FOOD SECURITY AND RELATED WELLNESS INDICATORS OF HEALTH SCIENCES STUDENTS IN CENTRAL SOUTH AFRICA DURING COVID-19: A PROGRAMME TO MITIGATE THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS

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Submitted in fulfilment of the requirements in respect of the PhD: Environmental Health in the Faculty of Health and Environmental Sciences at the Central University of Technology, Free State

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DECLARATION

I hereby declare that the work submitted here is the result of my own independent investigation. Where help was sought, it was acknowledged. I further declare that this work is submitted for the first time at this university/faculty towards a PhD degree in Environmental Health and that it has never been submitted to any other Higher Education institution for the purpose of obtaining a degree.

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SUMMARY

The negative impact of the COVID-19 pandemic resulting from isolated, confined, and extreme (ICE) environments brought about by strict lockdown restrictions has been widely documented, including its effects on Higher Education. Decreased physical activity, change in nutritional habits, weight gain, food insecurity, inadequate quality sleep, poor mental health and decreased academic performance are amongst manifestations of such impacts. In developing economies, the impact of the pandemic has been argued to be more pronounced as a result of limited resources and infrastructure. The aim of this study was to investigate possible changes in the nutritional health and related wellness indicators of students at a selected higher education institution in South Africa due to COVID-19 circumstances, and to propose a programme to the Higher Education portfolio that may mitigate negative impacts during future events resulting in ICE environments. Such future events may include political instability and conflicts, pandemics, climate change consequences, economic decline and the like.

A mixed method investigation was performed using both questionnaires and focus group discussions amongst final year students selected from four health science curricula at a prominent South African university of technology (UoT). The questionnaire and focus group discussions measured similar constructs and utilised existing, validated questionnaires, including Household Food Insecurity Access Scale, SA Demographic and Health Survey surveys, and questionnaires to assess adherence to diet and exercise advice, as well as Depression, Anxiety and Stress Scale of 21 Items. Data from questionnaires and focus group discussions were coded, analysed, and interpreted, whereafter a targeted and aligned mitigation programme was proposed for Higher Education institutions. To achieve the former, design thinking and project management processes were integrated towards a suitable and effective methodology to develop interventions and strategies for the challenges that emerged from the findings of the study. The adapted and integrated design process consists of six phases: (1) Initiation and planning, (2) Empathise, (3) Execute and define, (4) Ideate, (5) Prototype, (6) and Closure.

The results of the study showed that the majority of the participants *(n=148)* that completed the questionnaires were female (82%), while all focus group participants *(n=17)* were females, resulting from the sampling methodology applied. Questionnaire participants mainly resided in urban areas (76%) during the pandemic, while 36% had parents/guardians at home. Nutritional-related data indicated that food insecurity existed at varying levels amongst 84% of questionnaire participants. The main reason for food insecurity was financial constraints, and correlation statistics indicated participants from rural areas were more food insecure. Adequate water was available to participants during the pandemic, although the quality of the water may be questionable. Questionnaire participants' dietary intake changed, with mainly a decrease in sugary and salty snacks, although maintaining fruit, vegetables, and meat intake. Focus group participants indicated an increase in the intake of starchy food such as noodles and reverting to binge eating, primarily due to emotional stress. Dietary intake changes were also attributed to limited resources, e.g. funds and electricity. Only a few participants were aware (18%) or utilised (1%-4%) nutritional-related, as well as health and wellness support services that were offered at the institution during the pandemic. This observation suggests that respondents were unaware of the services offered by the institution.

Findings on related health and wellness indicators showed that most participants perceived their general health to have deteriorated, and they fell ill more often. Questionnaire participants reported considerable weight gain (33%) or slight weight gain (24%), as well as decreased physical activity with an increase of 11% in the no exercise category. Similarly, focus group participants indicated weight fluctuations, including weight gain, as well as more sedentary behaviour. The reasons for decreased activity included lack of motivation (17%) and inaccessible training facilities such as gymnasiums (24%). Both focus group and questionnaire participants' reported deterioration of mental health with the anxiety levels of questionnaire participants in the extreme category. Inferential statistics analysing the inter-relationships amongst tested variables indicated that a statistically significant relationship exists between food insecurity and poor mental health.

Utilising a mind map methodology, interventions and strategies were developed aimed at mitigating the challenges/impacts that emerged from the findings on nutritional and related health and wellness indicators of students. These interventions and strategies were classified into two categories: awareness and communication, and resources. In the awareness and communication category, improved communication of offered support services, awareness campaigns, developing skills and knowledge and evaluation of the student cohort as part of ensuring adequate capacity of support services, were suggested interventions. The resources category consisted of the following strategies: a wellness software application utilising Artificial Intelligence (AI), an adequate food aid programme with easy access, as well as wellness support that includes nutritional and fitness support. It was recommended that the proposed programme be implemented by Higher Education institutions in accordance with the Nadler-Tushman (N-T) model of congruence. The N-T model was selected due to its authority and proven effectiveness, as well as its simple and pragmatic approach to identify gaps and shortcomings. The model is also focused on a process of transformation – the latter being a priority within the current-day Higher Education sector and peripheral institutions in developing countries. The proposed programme is not a one-size-fits-all model, whereas institutions are advised to implement it into their specific contexts and ensure congruence between all the elements.

In conclusion, the study clearly showed that the ICE environment that resulted from the COVID-19 pandemic negatively impacted the students' nutritional status, especially food security. Moreover, these COVID-19 circumstances also had a significant impact on health and wellness indicators of students. A need was identified for a health and wellness programme at Higher Education institutions, including improved awareness, health and wellness training and support. As a result, a programme with strategies and interventions has been proposed to institutions that must reflect on their current support service structures to amend the strategies to suit their specific circumstances. Therefore, the proposed programme serves as point of departure for institutions wanting to ensure maintenance of student health and wellness, as well as academic performance during future ICE events. Ultimately, this study endeavoured to cast light on the impact of isolated, confined, and extreme environments

brought about by events currently rife on the international stage, and to suggest mediation strategies to cope in such environments, with a focus on Higher Education students.

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AFM	Alternative food movements
AI	Artificial intelligence
APP	Application
BMI	Body Mass Index
COVID-19	Coronavirus disease of 2019
CPUT	Cape Peninsula University of Technology
DASH	Dietary approaches to stop hypertension
DASS-21	Depression, Anxiety and Stress Scale of 21 Items
DCDT	Department of Communication and Digital Technologies
DHET	Department of Higher Education and Training
DOH	National Department of Health
DUT	Durban University of Technology
EUE	Extreme and unusual environment
FAO	Food and Agriculture Organization of the United Nations'
FI	Food insecurity
FWB	Food as well-being
HERA	Human Exploration Research Analog
HFIAS	Household Food Insecurity Access Scale
HFSSM	8-item Householde Food Security Survey Module
HH	Higher Health
HHS	Household Hunger Subscale
HPA	Hypothalamic–pituitary–adrenal
HRQoL	Health-related Quality of Life
HSREC	Health Science Research Ethics Committee
ICC	Isolated, controlled, and confined analogues
ICE	Isolated, confined, and extreme environments
IMF	International Monetary Fund
IT	Information Technology
MNO	Mobile network operators

NASA	National Aeronautics and Space Administration
NCCC	National Coronavirus Command Council
NICD	National Institute for Communicable Diseases
NIDS-CRAM	National Income Dynamics Study – Coronavirus Rapid Mobile Survey
NMU	Nelson Mandela University
NSFAS	National Student Financial Aid Scheme
N-T	Nadler-Tushman (model of congruence)
PMBOK	Project Management Body of Knowledge
PSET	Post-Schooling Education and Training
PTS	Post-traumatic stress
REPSSI	Regional Psychosocial Support Initiative
RU	Rhodes University
SADHS	SA Demographic and Health Survey
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SASCO	South African Students Congress
SES	Social-economic status
SOFI	The State of Food Security and Nutrition in the World
STATSSA	Statistics South Africa
TUT	Tshwane University of Technology
UCT	University of Cape Town
UFS	University of the Free State
UJ	University of Johannesburg
UKZN	University of KwaZulu-Natal
UL	University of Limpopo
UniS	University of Stellenbosch
UNIVEN	University of Venda
UP	University of Pretoria
USAf	Universities South Africa
UWC	University of Western Cape
WDP	Western dietary pattern

WHO	World Health Organization
Wi-Fi	Wireless fidelity
Wits	University of Witwatersrand
WTO	World Trade Organization

CHAPTER 1

Introduction

1.1. BACKGROUND

A large and growing body of literature has investigated human behaviour when experiencing isolated, confined, and extreme environments (ICE). Research in this domain is not a new phenomenon and the terminology regarding ICE has been conceptualised from as early as the 1900s (Suedfeld, 1987). In recent years, ICE studies are still in demand especially with the manned mission to Mars that the National Aeronautics and Space Administration (NASA) is planning for the early 2030s.

In addition to space missions, various other environments and situations share elements of ICE environments such as submarine travels, polar expeditions, war/military camps, prison, sea travels, desert missions and medical isolation units (Bartone, Krueger & Bartone, 2018; Suedfeld and Steel, 2000). Due to the diversity of these ICE environments, studies are usually multidisciplinary, where environmental research is integrated with disciplines from architecture to geriatrics (Bannova, 2014; Cohen-Mansfield, Hazan, Lerman & Shalom, 2016).

During the past century, much more information became available on ICE environments within the environmental psychology domain. Numerous authors have reported analyses of trends in ICE that demonstrated human adaptability and the negative impact of the environment on humans (Table 1.1). Most of these studies focused on the negative effect of ICE, while studies within the Positive Psychology paradigm are limited (Stuster, Bachelard & Suedfeld, 2000; Suedfeld, 2001). Table 1.1 provides an overview of the mentioned studies from popular authors within Environmental Psychology.

Table 1.1. Environmental Psychology research leaders from 1990 - 2023

Author	Environment researched	Factors mostly investigated
Bartone, PT (1995-2019)	War and space environments	Adaptability Conflict management Psychological hardiness Hardiness and cardiovascular health
Gushin, VI (1997-2013)	Space missions	Performance Personality traits Coping mechanisms Team interaction & communication
Kanas, N (1990-2005)		
Leon, GR (2003-2014)		
Manzey, D (1993-2013)		
Nicolas, M (1998-2002)	Chronic hypoxia in hypobaric chamber	Mood changes Mental health Personality traits
Palinkas, LA (1995-2021)	Arctic expeditions	Mental health Cultural differences Performance
Pulakos, ED (2004-2015)	Complex environments	Adaptability Performance
Rosnet, E (2000-2008)	Polar and isolated environments	Personality traits Self-image Performance Mixed gender Coping mechanisms
Stuster, J (1999 - 2021)	Space and polar expeditions	Personality traits Coping mechanisms Performance Team interactions & dynamics Temporal patterns
Steel, GD (1997-2013)		
Suedfeld, P (1991-2008)		
Sandal, GM (1991-2017)	Military, submarine, and space environments	Personality traits Coping mechanisms Crew tension and conflict management

Although most studies focus on the effect of ICE environments on the behaviour and psychological health of humans, it is inevitable that such environments also influence the physical

health of humans. In addition to the effect that poor mental wellness and stress may have on the physical body, other physical stressors may be induced by extreme environments (Suedfeld & Steel, 2000). Examples of negative effects of physical stressors include microgravity that decreases bone-density, extreme low temperatures that increase reactivation and shedding of latent viruses, as well as uncommon atmospheres (e.g. helium-oxygen mixtures) causing high-pitched voices, muscle loss and sleep disorders (D'Hulst, Jamart, Van Thienen, Hespel, Francaux & Deldicque, 2013; Suedfeld & Steel, 2000). Therefore, despite the attempt of capsules (e.g. space shuttle or submarine) to keep humans safe from the environment during certain ICE expeditions, the environment may still be detrimental.

ICE environments due to disasters and war are characterised by being sudden and in absence of a protective capsule (Suedfeld & Steel, 2000). Hence, humans in such ICE conditions are completely exposed to the environment. Although capsules are absent in these situations, some degree of physical remoteness or a restricted spatial range often exists. The world-wide coronavirus disease of 2019 (COVID-19) outbreak was a natural disaster that resulted in restricted spatial range regulations in most countries. These regulations aimed to limit movement of individuals in attempt to limit the spread of the virus (Stiegler & Bouchard, 2020).

In South Africa, the movement restriction regulations were initially strict and known as hard lockdown which was imposed for six-weeks. This hard lockdown entailed a complete halt of all economic and other activities except for life supporting businesses such as pharmacies and grocery stores. The main aim of these extreme restrictions was to enable the country to upgrade health care facilities while limiting the infection rate (South African Government, 2020).

The COVID-19 infection rate in South Africa was low in relation to other countries. This may not only be due to the lockdown, but some other possibilities include: the influence of the hotter climate and the higher number of youth in the country. In an attempt to retain the lower infection rate, the government ended the lockdown at a slow pace by means of five levels. In contrast with

the positive impact on infection rate, the impact of the lockdown on education was negative. Schools were closed completely, after which slow reopening was permitted. Similarly, all Higher Education institutions were completely closed during hard lockdown up until level five lockdown. After this time, final year students within the medical fraternity could return to the Higher Education institutions, to prevent a future lack of health care workers in the country. Health care workers are crucial in saving lives during pandemics such as COVID-19 (South African Government, 2020).

In addition to the effects of the COVID-19 virus itself on humans, the ICE environment that resulted from the pandemic also impacted lives. While less literature exists on COVID-19 restrictions and circumstances related to it, a considerable amount of literature has been published on other ICE environments. Therefore, it can be assumed that the COVID-19 ICE environment had a significant impact on the psychological and physical health of individuals who experienced it (Suedfeld & Steel, 2000).

In addition to an ICE environment, COVID-19 can also be classified as a stressful life event. Similar to literature relevant to ICE environments, evidence supports that there is an unambiguous relationship between stressful life events and the health (both psychological and physical) of individuals. This relationship is far from simple, and numerous variables play a role in the extent and number of resulting health problems. Some of these variables include health status, adaptability, predictability of the event and past experiences of the individual. Moreover, reaction to stressful events can also depend on the context, e.g. social support and personal resources available (Gardner, Ostrowski, Pino, Morrell & Kochevar, 1992). Therefore, these variables together with the stressful COVID-19 event were expected to have influenced the psychological and physical health of South African students.

In South Africa, the accessibility to Higher Education increased in recent years after the “Fees-Must-Fall” movement in 2015 (Mavunga, 2019). This movement led to free Higher Education for

students from poor and low-income families (Bitzer & De Jager, 2018). As a result, student diversity increased with the increased access at Higher Education institutions in South Africa. Consequently, with the increased diversity of students, the possible variables such as social support and personal resources, which play a role in stressful life events and health, may have also increased. Therefore, the predictability of the result of life events on health may have been influenced and thus increased the need for a study to determine the effects of COVID-19 at Higher Education institutions in South Africa.

Though students from low-income backgrounds have the privilege to attend Higher Education in South Africa, they may not have been so privileged during COVID-19. During the pandemic, a quality-of-life survey indicated that despite the South African government's endeavours to support communities with poor social and economic status, these communities remained vulnerable (Parker & Kadt, 2020). As a result, these communities, including their students, might have experienced a negative impact on their health by not being able to afford or obtain food, suffering from poor nutrition and being forced to limit their physical activity such as exercise, sports, and work. This negative impact on nutrition and health may be added to the anticipated stress and fear that resulted from COVID-19 circumstances (Stiegler & Bouchard, 2020).

Stress and fear were not only high amongst vulnerable communities during COVID-19 in South Africa, but also amongst health care workers across all sectors. Workers within health care daily face challenges and hazards due to the nature of the industry. However, COVID-19 brought about additional challenges, especially within the South African context. The World Health Organization conceded the increased challenges faced by health workers amidst COVID-19, internationally. Additionally, health workers nationally had to face challenges such as insufficient resources and limited staff resulting in increased pressure and workload. Research confirmed increased psychological concerns amongst health workers in South Africa during the COVID-19 pandemic (Subramaney, Kim, Chetty, Chetty, Jayrajh, Govender, Maharaj & Pak, 2020).

Considering the mentioned research on the possible effect of COVID-19 on the health of South African communities and health care workers, it can be anticipated that South African Health Sciences students may have experienced an intensified effect of the COVID-19 ICE circumstances on their health. Hence, this study sought to identify the effects of the ICE environment on these students' nutrition-related health and wellness, to assist relevant authorities to remedy and prevent identified problems in future. Although worldwide pandemics are not a common occurrence (Hickok, 2020), many researchers forecast more pandemics similar or worse than COVID-19 in future (Chan & Salzman, 2020). Moreover, as mentioned earlier, ICE environments are not the only result of the pandemic but may occur due to more common events such as campus evacuations during unrests and riots. Therefore, the need for research of this nature was essential to assist the Higher Education institutions with planning and implementing coping strategies and survival for future pandemics.

1.2. RATIONALE

ICE environments are not a new phenomenon and literature on the impact thereof does exist. Previous studies have, however, extensively reported on adaptability, performance, team dynamics and mental health under ICE environments (Bartone, Krueger & Bartone, 2018; Connaboy, Sinnott, LaGoy, Krajewski, Johnson, Pepping, Simpson, Bower & Alfano, 2020; Golden, Chang & Kozlowski, 2018; Landon, Douglas, Downs, Greene, Whitmire, Zwart & Roma, 2019; Suedfeld, 2001). Far too little attention has been paid to the holistic effect of such environments on health and wellness of the staff and students within such entities.

The worldwide COVID-19 pandemic broke out in November 2019, and limited literature was available on the ICE environment that may result from such a pandemic. In the World Health Organization's (WHO) COVID-19 situation report 182, the urgent need for research in this field was emphasised (WHO, 2020). In response to this urgency, various research projects have been conducted regarding COVID-19, while these were concerned with the treatment and prevention of COVID-19 (Bai, Yao, Wei, Tian, Jin, Chen & Wang, 2020; Zheng, Ma, Zhang & Xie, 2020). The

WHO acknowledged that COVID-19 resulted in increased social and economic stress. A recent study discussed the negative implications of COVID-19 circumstances on the mental health of especially vulnerable communities (Holmes & O'Connor, 2020).

Despite the considerable amount of literature published in relation to COVID-19, less consideration was given to the holistic impact of circumstances resulting from the COVID-19 pandemic on food security and related health and wellness indicators of students. Moreover, no literature could be obtained on the effect of COVID-19 on the nutritional health and wellness of students within the health sciences environment of South Africa. A need therefore existed for research to address possibilities to mitigate nutritional health and wellness consequences of vulnerable groups during pandemics and other conditions resulting in ICE environments. Discovery, evaluation, and refinement of mechanistically driven strategies and interventions to address food security, as well as related health and wellness aspects resulting from COVID-19 induced ICE environments were urgently required.

1.3. PROBLEM STATEMENT

Prior to the worldwide outbreak of COVID-19, exceptional events necessitated a selection of people to remain in ICE environments. These events were voluntary, and included, amongst others, space travel or simulations, polar expeditions, and military operations. During the COVID-19 pandemic, isolation was sudden, involuntary, and forced upon the community, as a desperate measure of governments to limit the viral spread and maintain public health.

Amongst this community were students with limited life experience who were concerned about their studies and future. Similarly, health workers at the frontline of defence against the COVID-19 pandemic, were facing tremendous fears while being overloaded with work. Health Sciences students fall in both these heavy hit categories. Personally, as a somatologist with a holistic view of well-being and an academic in a South African Higher Education institution, I could not help but wonder about the impact of the ICE environment resulting from COVID-19 on the nutrition,

health, and well-being of Health Science students. Therefore, at a practical level, this research was useful.

The scenario that the selected students found themselves in an environment as described above, could have resulted in so many stressful events. Some mild impacts that may result from stress include poor sleep quality, weight loss and muscle tension. Even more severe, life-threatening impacts can range from heart rate disturbances to severe mental disturbances. Similarly, poor nutrition may result in mild to serious impacts such as vitamin deficiencies, poor concentration, and performance, as well as other forms of malnutrition and related disorders. Therefore, if the possible impacts on nutritional health and wellness could be determined, a programme with preventative strategies and interventions can be developed to ensure optimal performance of Higher Education students when experiencing ICE environments. Moreover, should these findings be extrapolated to other institutions and communities, the broader South Africa can also benefit from such strategies and interventions.

1.4. RESEARCH QUESTIONS

The research study aimed to address the following four research questions:

i. To what extent did the ICE environment caused by COVID-19, have an influence on the food security and dietary intake of Health Sciences students at a selected higher education institution in South Africa?

ii. To what extent did the ICE environment caused by COVID-19, have an impact on the nutritional health and wellness of Health Sciences students at the selected institution?

iii. What associations and interrelationships exist amongst the tested variables that may indicate causality or effect?

iv. Based on information generated in this study, what future strategies and recommendations may be proposed to the Higher Education fraternity to limit the impact of probable future ICE events on student well-being and performance, not only in the Health Sciences but wider?

1.5. AIM

The main aim of this study was to conduct an in-depth assessment to inform the development of a programme with strategies and interventions that may contribute to improving the nutritional health and wellness of individuals at Higher Education institutions when experiencing events that lead to ICE environments.

1.6. OBJECTIVES

i. To provide a comprehensive, critical literature review of the possible influence of an ICE environment on nutritional-related health and wellness indicators within South Africa, as well as within the Higher Education environment.
ii. To describe regulatory and Higher Education responses to the COVID-19 predicament, at a national and regional level.
iii. To examine food security dimensions relating to the availability, access, and utilisation of food to illustrate stability of a student group's food security during COVID-19.
iv. To investigate the dietary intake, based on food frequency, to determine the quality of student diets during COVID-19.
v. To assess the nutritional-related health and wellness indicators including weight trajectories, physical fitness, and mental health, of the particular student cohort.
vi. To examine students' awareness and utilisation of offered institutional health and wellness support services.
vii. To investigate associations amongst the following measured variables: various demographic profiles, food security and mental health of the student cohort.
viii. To propose a programme with interventions and strategies to university structures to increase preparation and agility in similar ICE situations.

1.7. SCOPE OF RESEARCH

Food security and related health indicators were focused on to cover both physiological and psychological wellness. Inclusion of these two categories provide a more holistic view of

nutritional health and wellness of the particular students amidst COVID-19. Within the food security category, the following aspects were covered: food access, food consumption and preference, utilisation, and availability. Moreover, the nutrition-related health and wellness indicators included weight trajectories, physical activity, and mental health. A mixed method design was utilised to provide holistic findings on the effect of COVID-19 circumstances on nutritional health and wellness.

Selected students from a specific Higher Education institution in the Free State region were included in the research study. The sample focused on the specific institution's case to investigate the matter in more depth in relation to the university's location in the Central region of the Free State province, South Africa – which university is a prominent custodian of health/paramedical science courses including Biomedical Technology, Clinical Technology, Dental Assisting, Health Management, Radiography and Somatology. Health (paramedical) Sciences students have shown to be and are educated towards boasting traits related to compassion and care for patients. This, however, has been reported to also render them more aware of, and prone to the impacts of physical and mental trauma. Furthermore, students in these fields are often being looked up to by fellow students and society to provide support and to confide in, during situations of distress. The method of "over recruitment" was utilised to prevent possible non-participation or no-show of participants. Further considerations impacting the sampling protocol are alluded to in consequent sections.

1.8. ASSUMPTIONS

The following assumptions underpinned the research study:

- All students adhered to COVID-19 restrictions and regulations.
- Students were English literate as they were enrolled in English medium training courses.
- All students had access to online platforms as Higher Education institutions made these platforms available for online learning.

- Students were honest in their responses in questionnaire and focus group discussions. This was facilitated through ensuring considerable due diligence, ethical compliance and anonymity.

1.9. DEFINITIONS

In the context of the research study, it is important to take note of the described definitions and their application within this study.

Isolated, confined, and extreme environment (ICE)

The terminology: "isolated, confined environment" is often used by researchers when referring to capsule environments (Suedfeld & Steel, 2000) such as space shuttles or submarines. However, isolated, and confined environments also occur in absence of capsules under circumstances like prison or remote weather stations (Bartone *et al*., 2018). This classification often overlaps with the classification "extreme and unusual environment" (EUE) where "extreme" refers to physical parameters that are outside the ideal for human survival (e.g. extreme low temperatures or very high altitudes) and "unusual" indicates conditions that significantly deviate from the familiar environment of most humans (e.g. a natural disaster). In some instances, an environment may also be classified as an EUE temporarily, as in the case of a disaster. Often EUEs involve physical remoteness and lack of movement, which is then known as isolated, confined, and extreme environments (ICEss) (Suedfeld & Steel, 2000). This research study investigated such an ICE environment. Therefore, isolated, confined, and extreme environments within the context of this research study refers to the temporary circumstances resulting from the COVID-19 pandemic. Isolation and confinement stemmed from regulations of self-isolation, also referred to as "lockdown," that was enforced to contain the spread of the virus. This was the first world-wide pandemic since swine flu in 2009 and the similar severe Spanish flu of 1918. Therefore, the COVID-19 pandemic is classified as an unusual and extreme environment in the context of this research study.

COVID-19

The coronavirus disease (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus. COVID-19 resulted in a world-wide pandemic (WHO,2020). The virus spilled over to South Africa on 5 March 2020. In response to the pandemic, government and other authorities enforced restrictions and regulations to contain the spread and mitigate the negative impact of the coronavirus (Stiegler & Bouchard, 2020). In the context of the current study, reference to COVID-19 refers to the period when these various regulations were valid. Moreover, it refers not only to the virus itself, but rather to the ICE environment and/or circumstances that resulted due to the pandemic.

Food security

The World Food Summit's and the Food and Agriculture Organization of the United Nations' (FAO) definition of food security is utilised in context of this research study. The World Food Summit's (1996: 349) definition of food security is: "*Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".* Similarly, the Food and Agriculture Organization of the United Nations (FAO) define food security as an instance when all people, always, have physical, social, and economic access to sufficient, safe, and nutritious food meeting their dietary needs and food preferences (HLPE, 2020). This definition is widely accepted and underpins the multidimensional nature of food security. The specific definition refers to food security to be inclusive of food access, availability, food use and stability. This specific definition was decided upon as it has enabled policy responses focused on the promotion and recovery of livelihood options, as is the case with the aim of the output of the research study.

Health and wellness indicators

According to the World Health Organization (WHO) (1948), health can be defined as a state of complete physical, social, and mental well-being - therefore, not merely indicating the absence of disease. This definition was revised by WHO in 2021 and the amended definition of health is

"the extent to which an individual or group is able to realize aspirations and satisfy needs and to change or cope with the environment" (WHO, 2021: online). In relation to health, the term "wellness" refers to actions or choices that promote health promotion (WHO, 1998). Moreover, an indicator refers to a specific, observable, and measurable attribute that can be used to show changes or progress toward achieving a specific outcome. For this study health and wellness indicators refer to attributes of health status, specifically relating to physical and mental aspects of health.

Physical aspects of health and wellness

Physical health and wellness involve many aspects, including sleep and relaxation, proper nutrition, and physical activity. These aspects contribute to physical well-being, which is the ability to maintain a healthy quality of life with the ability to optimally perform daily activities without fatigue or physical stress (ANU, 2022). Physical aspects of the current study include physical activity/exercise and weight trajectories (originating from the proper nutrition aspect). Proper nutrition within the current study is referred to as food security and dietary intake and is not included under the term: Physical aspects of health and wellness.

Physical activity

Physical activity is defined by the WHO (2014: online) as: "any bodily movement produced by skeletal muscles that requires energy expenditure". Therefore, physical activity and exercise are related terms but not synonyms. Exercise is an organised physical activity that is done on a continuous basis to obtain physical fitness. In the current study physical activity relates to exercise and other activities that implicate bodily movement and performed as routine activities such as playing, walking, active transportation, house errands and recreational activities.

Weight trajectories

Weight trajectory within the context of the current study can be defined as the pattern or trend of a person's weight changes over time. It is utilised to assess whether an individual is gaining,

losing, or maintaining weight, and can provide insight into their overall health and wellness (Srivastava, Kushner & Apovian, 2022).

Mental health

Mental health refers to a state of mental well-being that supports the ability of coping with stress, recognise one's own abilities, learn and work optimal, and contribute to the community. Furthermore, mental health does not merely indicate the absence of mental disorders, but it exists on a complex continuum. Different people experience mental health differently, with varying degrees of difficulty with diverse social and clinical outcomes. Conditions relating to poor mental health can include conditions such as depression, stress, and anxiety, as well as mental disorders, psychosocial disabilities and mental states associated with impairment in functioning or risk of self-harm (WHO, 2022). In the context of the current study, mental health refers to non-clinical, self-reported emotional states of individuals that includes aspects related depression, anxiety, and stress.

Support services

Support services within the context of the study refers to student support services that were offered at Higher Education institutions, especially the institution involved in the study. Such student support refers to psychosocial assistance often referred to as wellness centres or wellness services (Linden, 2020). These services had to be augmented to cater for the students' increased and altered needs during COVID-19. The Wellness Centre of the Central University of Technology, Free State (CUT) provides services such as poverty relief, meal vouchers and counselling services to students (CUT, 2020).

1.10. CHAPTER LAYOUT

As accommodated in the relevant institutional postgraduate and research policies, the study follows a purposive-hybrid format combining a traditional chapter layout with article-based chapters that collectively form the thesis. Therefore, chapters 1-4 and 8 reflect on the

overarching research study, while chapters 5-7 reports on fragments of the study in article format. Chapter 1 provides an overview and introduction to the study followed by a methodology chapter (Chapter 2) that contains details on the methodology of the study. It is noteworthy that some repetition of information may occur amongst the methodology (Chapter 2) and subsequent article-based chapters (Chapter 5-7), seeing that methodologies may be alluded to in terms of overarching research methodology, with specialisations in terms of the chapter-specific components. However, the information is contextual only, and not linguistic. Chapters 3 contains a systemic literature review on ICE environments, followed by a narrative literature review in Chapter 4 on COVID-19 responses. Chapters 5 to 7 comprises three manuscripts in article format on the findings, including a proposed health and wellness intervention. Finally, Chapter 8 consists of summative remarks, conclusions, and overall recommendations, as well as future research suggestions based on the findings of this study. The chapter outline is as follows:

- **CHAPTER 1: Introduction**
- **CHAPTER 2: Methodology**
- **CHAPTER 3: The influence of isolated, confined and extreme environments (ICE) on nutritional and related health and wellness indicators: A systematised review** *[Systematised review of literature]*
- **CHAPTER 4: An exposé of regulatory and Higher Education strategies in response to the COVID-19 pandemic in SA** *[A narrative literature review of documents, policies, procedures and literature]*
- **CHAPTER 5: Food security and dietary intake of a cohort of South African students during the COVID-19 pandemic** *[Article 1 on questionnaire and focus group discussion findings]*
- **CHAPTER 6: An assessment of the impact of COVID-19 on nutrition related health and wellness indicators: a case investigation of South African Health Sciences students** [*Article 2 on questionnaire and focus group discussion findings]*

- **CHAPTER 7: Toward a health and wellness programme to ensure optimal student performance and well-being within ICE environments** *[Article 3 on strategies and interventions in response to overall findings]*
- **CHAPTER 8: Conclusions**

In conclusion, in this chapter the motivation for the study, including the problem statement, aims and objectives were argued and explained. Additionally, the layout of the thesis was presented. The methodology on the entire study will follow in Chapter 2, prior to the literature reviews which forms part of the methods of the study.

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CHAPTER 2

Methodology

2.1. INTRODUCTION

This chapter elaborates on the research design, layout and methods of the overarching study. Therefore, the chapter provides an overview of the methodology of the study in its entirety. The latter chapters of this dissertation, which are written in article format, include more specific and selected relevant methodology information per article. Some repetition may occur, while caution has been taken to limit repetition as far as possible.

2.2. RESEARCH PARADIGM

This research was not considered appropriate to resort fully under the positivist (postpositivist) nor the interpretivist (constructivist) paradigms. Therefore, the study was positioned within the pragmatic paradigm that provided a useful middle ground for both philosophical and methodological methods (Kaushik & Walsh, 2019). The pragmatic paradigm supports a relational epistemology, a non-singular reality ontology, a mixed methods methodology and a value-laden axiology (Creswell & Clark, 2011; Denscombe, 2017). Thus, this paradigm presented a practical, outcome-based method of investigation (Johnson & Onwuegbuzie, 2004) that focuses on real-life problems with emphasis on creating knowledge through joint actions (Creswell & Clark, 2011; Mertens, 2010). From this viewpoint, pragmatism was likely to offer paths for me as a researcher to explore and analyse the beliefs of Higher Education students within the Health Sciences environment.

2.3. RESEARCH DESIGN

This study employed a mixed method methodology as both qualitative and quantitative assessments were used to investigate nutritional health and wellness indicators. The complexity and multidisciplinary nature of the problem called for a mixed methods approach, covering facets ranging from environmental factors to changes in psychological and physiological health (De Vos, Strydom, Delport & Fouche, 2012; Johnson & Onwuegbuzie, 2004). A mixed method design had a two-fold benefit; firstly, to obtain a more comprehensive understanding of the inter-relationship of nutritional health and wellness, and the external environment. Secondly,

quantitative and qualitative methods were applied to benefit from the strengths of each of the methods and to ensure that the result of the study reflects reality. On the contrary, this mixed method study design may have resulted in a more complex, time-consuming study (Cassim, 2017). The data collection methods were conducted concurrently to limit some of the time constraints resulting from this research design.

A study design entirely based on quantitative research was not pursued, as it would have ignored the human factors such as the mental health of students. Such a design would have not considered that individuals may also experience certain emotions during exposure to events that lead to ICE environments. On the other hand, a solely qualitative design would have been based only on the perceptions of the participants, ignoring the physical changes such as weight gain that may occur when challenges with physiological health are experienced (Tashakkori & Teddlie, 2010). Therefore, a mixed method design was considered ideal to investigate the nutritional health and well-being indicators from a holistic perspective.

The mixed methods design provides a greater depth and breadth of information which is not possible utilising singular approaches in isolation (Lund, 2012). Moreover, the research relied on a case investigation to allow for an in-depth investigation within the limited time allocated to complete the project as part of a doctorate degree (Cassim, 2017). As a result of this case study approach, it might be more difficult to generalise the findings of the research study. To improve generalisation, a comprehensive across-case and within-case analysis was conducted during the research study (Polit & Beck, 2010). Furthermore, using a mixed methods research design would allow free interpretation of the findings without the imposed limitations of either qualitative or quantitative research designs (Tashakkori & Newman, 2010).

CASE INVESTIGATION on POPULATION of: Final year students from four Health Sciences Higher Education courses = Biomedical Technology, Clinical Technology, Radiography and Somatology

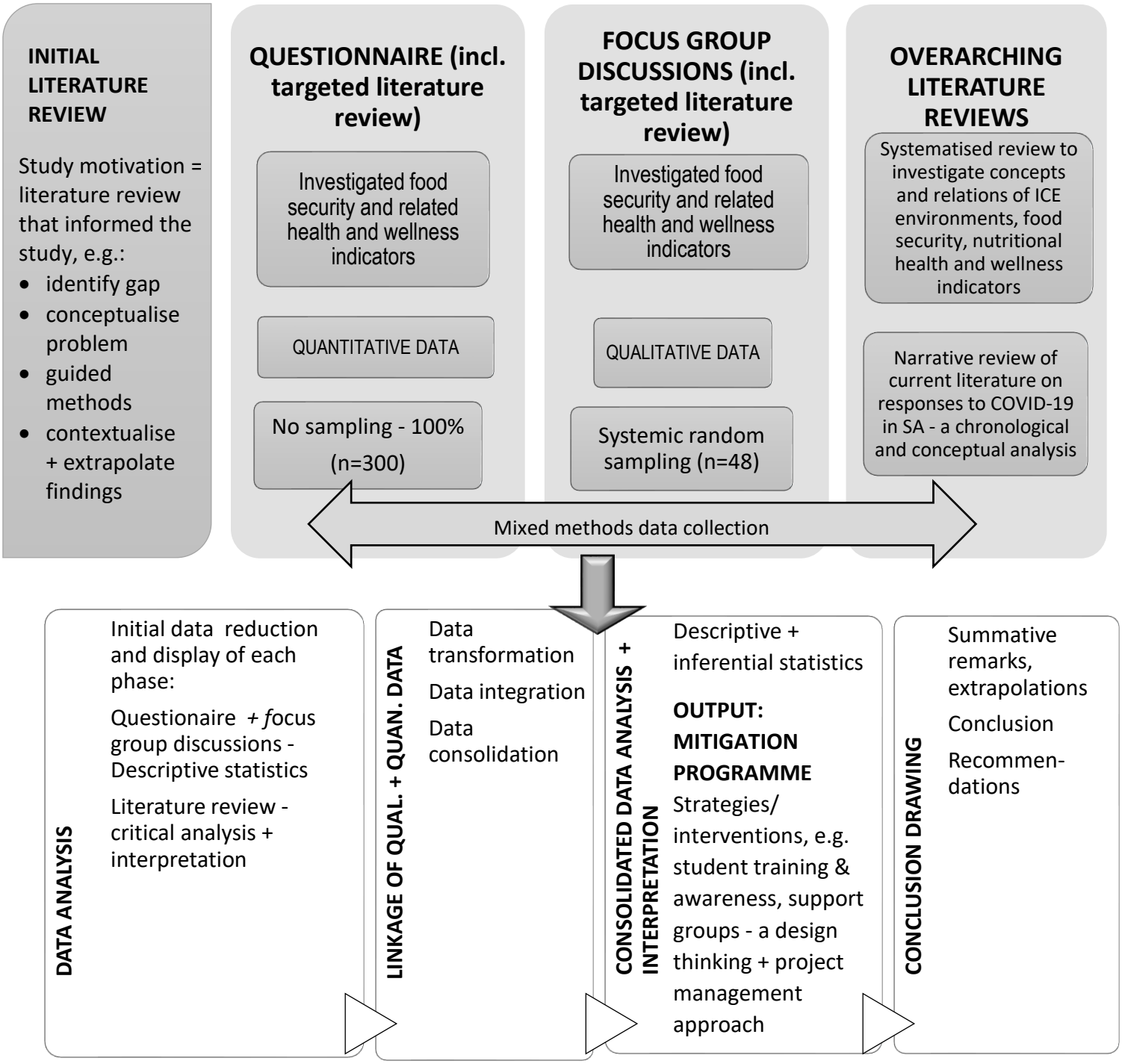

Figure 2.1. Study layout

The research study utilised an exploratory, mixed methods research design which consisted of three data collection methods (De Vos *et al.*, 2012; Tashakkori & Teddlie, 2010). This design (refer to Figure 2.1) was applied by utilising a questionnaire to collect quantitative data, as well as conducting focus group discussions and literature reviews to obtain qualitative data. All three the methods took place concurrently with an inductive drive. Henceforth, all analysed data were integrated to obtain a holistic answer to the research questions.

2.4. RESEARCH METHODS AND DATA COLLECTION TOOLS

In line with the research questions and the objectives stated, the methods used in the research study are detailed in the section below:

2.4.1. Literature reviews

Terre Blanche, Durrheim and Painter (2007) advocated that no research project can exist in isolation but must be built on the current body of knowledge. Therefore, literature was continuously reviewed throughout the course of this research study. The literature review served several purposes such as: identifying the theoretical framework and displaying the research paradigm; placing the research project into context, and conceptualising definitions; identifying gaps or pitfalls in previous research studies; refining and redefining the research question; as well as identifying methodologies and gaining insight into existing research tools (De Vos *et al.*, 2012; Terre Blanche *et al.*, 2007).

In this research study various types of literature reviews were conducted as described by Grant and Booth (2009). A motivation for the study based on literature was conducted prior to commencing with the actual study (Chapter 1). This motivation assessed the available research and assisted with selecting the study design. Thereafter, two literature reviews informed the study: a systematised review (Chapter 3) and a narrative review (Chapter 4). Lastly, targeted reviews were performed to provide background to the three article-based chapters (chapters 5-7) that reports on the results and discussion of the study.

2.4.1.1. Systematised review

According to Grant and Booth (2009,) systematised review includes elements of a systematic review process, while it is shorter than a systematic review. This type of review is typically conducted as part of postgraduate research studies. This type of review analyses literature to obtain insight into what is known from existing literature. The purpose of the conducted systematised review was to investigate various perspectives of isolated, confined, and extreme (ICE) environments, as well as perspectives of food security and nutritional health and wellness indicators. Furthermore, the possible effects of an ICE environment and COVID-19 on food security, and nutritional health and wellness indicators were explored. This systematised review is captured in Chapter 3.

2.4.1.2. Narrative review

A narrative review was performed on the recent and current literature related to the COVID-19 period in the South African context. This narrative review included both a chronological and conceptual analysis (Grant & Booth, 2009). The literature that was analysed included Higher Education and government policies, procedures, regulatory documents, as well as other sources. As a result, a narrative review in Chapter 4 was synthesised to provide the regulatory and Higher Education strategies in response to the COVID-19 pandemic in South Africa. Therefore, the review assisted to further contextualise the Higher Education environment that students found themselves in amidst COVID-19. The systematised and narrative reviews were conducted prior to the questionnaire's and focus group discussion's data collection to inform the questions and discussions of these two methodologies.

2.4.1.3. Targeted reviews

Targeted reviews were performed to provide specific and in-depth background to the articles/chapters that reported on the findings of the study. Aspects of both rapid and state-of-the-art reviews (Grant & Booth, 2009) were integrated to perform targeted reviews as captured in chapters 5-7. The targeted reviews related to the overarching literature of the systematised and narrative review (chapter 3 and 4), while centring on the specific aspects of each article-

based chapters. Therefore, the targeted reviews included a critical appraisal of the current and existing literature with an in-depth focus on the specific aspect/s of each chapter.

2.4.2. Questionnaire

Questionnaire research was deemed as a versatile methodology of collecting data in a social research study and ascertaining attitudes, opinions, and perceptions, thus making it ideal for this research study. This questionnaire method of data collection had the following advantages for the research study. The participants enjoyed a sense of freedom and confidentiality in completing the questionnaires, thus they felt safe to share information on sensitive issues such as mental health. Moreover, participants could complete the questionnaires at a convenient time, which was ideal to students who are loaded with responsibilities relating to their studies and workplace learning (De Vos *et al.*, 2012).

On the contrary, questionnaires might have also posed disadvantages to the research study. Self-administered questionnaires often result in a poor response rate (Jones, Baxter & Khanduja, 2013). The questionnaire links were sent out to three hundred students on their e-learning platform. The exclusion of selection would have resulted in a larger (100%) sample size to provide enough data despite poor response rate, while the distribution on the e-learning platform provided a familiar area to students to encourage response. Further disadvantages of questionnaires might have been that participants may not completely understand questions or answers are not correctly interpreted by researcher (Jones *et al.*, 2013). These disadvantages were overcome by conducting supplementary methods such as focus group discussions where explanatory information was shared. Additionally, a disadvantage of the questionnaire due to being online, might have been that students may not have had mobile data, or may have wanted to spend their mobile data on participation in the research study. Therefore, students were encouraged to complete the questionnaire while on campus to utilise the available campus wireless fidelity (Wi-Fi) by administering questionnaires during on-campus semesters, thus outside of recess periods.

Based on the literature study, a draft questionnaire was constructed as a tool to collect information. Apart from items to collect demographic data, the questionnaire consisted of several statements referring to food security and nutrition-related health and wellness, where respondents were required to indicate on a 5-point Likert scale their views on the level of change during COVID-19. This draft questionnaire was also quality assured by the statistician who checked for common errors such as double-barrelled, confusing, and leading questions, as well as testing for internal consistency by utilising Cronbach's Alpha values. The draft questionnaire was further quality assured by means of a pilot study (De Vos *et al.*, 2012). The final questionnaire was then made available for online completion, and the link was administered via the students' e-learning platform, to a large sample *(n=333)* of Health Sciences students.

2.4.3. Focus group discussions

To further explore the role of COVID-19 on the student cohort, focus group discussions were conducted to obtain detailed qualitative data. The focus group discussion method assisted to obtain information that the questionnaire method could not obtain and provide more detail to the questionnaire results (Tashakkori & Teddlie, 2010).

The perception of students regarding the effect of COVID-19 on food security and nutritional-related health and wellness indicators, was investigated by means of focus group discussions. A focus group discussion schedule contains probes and is used to guide discussions. The probes of focus group discussions were set-up in line with the questionnaire topics to obtain qualitative data on the quantitative data obtained from questionnaires. Therefore, similar to questionnaire items, the focus group discussion probes were based on the literature reviews. The following topics were identified as points of discussion: food security-related topics such as food consumption, buying patterns, preparations, food safety, availability. Additionally, nutritional-related health and wellness indicators such as general health, weight, physical and state of mind formed part of these discussions. Discussions as a method of data collection are meaningful when one wants to explore thoughts, feelings, and perceptions (De Vos *et al.,* 2012; Rossouw, 2003).

More specifically, group discussions in the form of focus group discussions are a popular method of collecting data in mixed method studies. Additionally, conducting focus group discussions amongst participants from separate groups (i.e. Health Sciences students from different fields of specialisation) result in more intersubjective information gained on the topic (De Vos *et al.,* 2012). Focus group discussions may not be beneficial to obtain sensitive information and participants may feel intimidated to share information in a group format. Therefore, the questionnaire phase was used to investigate more personal and/or sensitive issues not obtained by the focus group discussions.

A focus group discussion facilitator should possess basic knowledge of the subject at hand to further engage participants and improve the quality of resulting information (Krueger & Casey, 2000; Morgan, 1997; Stewart & Shamdasani, 2014; Terre Blanche *et al.,* 2007). Therefore, an experienced facilitator facilitated focus group discussions. Six focus group discussions, with eight participants each *(n=48)* were planned to be conducted. The number of participants recruited were aimed to fall within the suggested range of sample size for focus group discussions which is stated as six to eight participants. Systemic random sampling was utilised for the sampling of these participants from the questionnaire recruited participants, and over recruitment of 25% was done to prevent possible non-show of participants which is a disadvantage of this research method (Nyumba, Wilson, Derrick & Mukherjee, 2018). Participants for all six focus groups were recruited from all the four identified Health Sciences courses, namely: Biomedical Technology, Clinical Technology, Radiography and Somatology.

The questionnaire data collection was initiated prior to the focus group discussions, while some overlapping occurred. However, the data analysis of the focus group discussion and questionnaires was done concurrently. Overlapping of these methods were allowed to limit time, despite the higher number of methods included in the study. Prior to executing the questionnaire's and focus group discussion's data collection, pilot studies were conducted.

2.5. PILOT STUDIES

According to Teijlingen & Hundley (2001) and Terre Blanche *et al.* (2007) the purpose of a pilot study is to facilitate the refinement and optimisation of data collections tools. This includes minimising and rectifying possible misinterpretation of terminologies, and optimising time. In the current study, both the questionnaire and the focus group discussions were preceded by a pilot study.

The pilot study was conducted, prior to issuing the questionnaire to identify potential problems with the proposed research design and questions included in the questionnaire. Similarly, a second pilot study was conducted prior to the focus group discussion to verify the focus group discussion schedule. Both these pilot studies included a small sample size of six participants each, recruited by the same sampling techniques as proposed for the actual research study. These participants of the pilot studies were not allowed to participate in the study, as their opinions may have been contaminated following the pilot studies. Moreover, the results from the pilot studies were not included in the findings of this research study. The results of the pilot studies were merely used to amend and improve the data collection tools accordingly. Amendments included rephrasing questions/probes to be clearer of information requested, while no questions/probes were added nor removed from the questionnaire and focus group discussion schedule.

2.6. VALIDITY AND RELIABILITY OF THE DATA COLLECTION TOOLS

Validity and reliability are important concepts in the context of data collection tools. Validity refers to the extent to which a tool measures what it is supposed to measure. In other words, a tool is valid if it accurately captures the concept or construct it is intended to measure. Reliability, on the other hand, refers to the consistency and stability of the tool over time and across different contexts. A tool is reliable if it produces consistent results when used repeatedly under similar conditions. Both validity and reliability are crucial for ensuring that the data collected through a tool is trustworthy and can be used to draw accurate conclusions (Zohrabi, 2013).

The validity of the data collection tools was determined by 1) utilising existing mechanisms that have been tried and tested in the field. Therefore, data collection tools were a combination of four tried-and-tested data collection mechanisms. In addition to utilising existing mechanisms, 2) a reliability test by means of Cronbach alpha was performed on the Likert-scale questionnaire sections to further ensure validity (Laerd Statistics, 2019; Tavakol & Dennick, 2011).

The four existing data collection mechanisms that underpinned the data collection of the study are: the Household Food Insecurity Access Scale (HFIAS), the SA Demographic and Health survey (SADHS), a questionnaire to assess adherence to diet and exercise advice, as well as the Depression, Anxiety and Stress Scale of 21 Items (DASS-21). The data collection on food security was based on the HFIAS as described by Coates, Swindale and Bilinsky (2007). This scale is common to examine food security amongst diverse cultures and measures the access component of household food insecurity, although some insight is obtained on other components such as utilisation. The dietary intake data collection was based on the SADHS assessment (Department of Health, 2007). This tool is popular for dietary intake investigations in the context of South Africa and therefore an adapted, shortened version with merged items was included in the current study. Both the data collected on weight trajectories and physical fitness were based on a questionnaire to assess adherence to diet and exercise advice (Dubasi, Ranjan, Arora, Vikram, Dwivedi, Singh, Kaloiya & Shalimar, 2019). This questionnaire is aimed at collecting equivalent items as per the areas under investigation of the current study. Lastly, data collected on mental health was based on the DASS-21. This scale is designed to measure the emotional states of depression, anxiety, and stress of individuals (Lovibond & Lovibond, 1995).

To evaluate the internal consistency and reliability of the Likert scale sections of the questionnaire, a Cronbach's Alpha was calculated according to Tavakol and Dennick (2011). Cronbach's alpha provides an overall reliability coefficient for a set of variables (e.g., questions). Cronbach's alpha reliability coefficient normally ranges between 0 and 1. However, there is no

lower limit to the coefficient. The Likert scale's items have stronger internal consistency when Cronbach's alpha coefficient is close to 1.0. (Laerd Statistics, 2019). The Cronbach's alpha values for relevant data collection sections/areas were as follows: food security = 0.909, weight trajectories and physical fitness sections = 0.94, and the mental health section 0.949. Therefore, according to these values all the sections were internal consistent and reliable.

2.7. TRUSTWORTHINESS

According to Rossouw (2003) and De Vos *et al.* (2012) trustworthiness is the term referring to the truth value of the knowledge gathered during the research process. It is said that each phase of the research process can influence the trustworthiness of the findings. Thus, the following aspects were addressed to ensure trustworthiness of this research study: credibility, confirmability, transferability, reliability, and dependability.

Credibility relates to the degree to which the study results, as well as the methods to obtain them, can be trusted (Guba, 1981; Rossouw, 2003). Credibility is a challenge that pertains to qualitative research and necessitates careful application of methodological strategies to improve trustworthiness of findings (Noble & Smith, 2015). The following measures were included in this research study to improve credibility: sufficient involvement, triangulation (including confirmability), critical interview with peer members, and member checking.

The focus group facilitator who was acquainted with the Higher Education environment as well as focus group discussions ended the discussion sessions with member checking/validation (Guba, 1981). The research study incorporated triangulation by means of including multiple methods of data collection (questionnaires, focus group discussions and meta-analysis) and data from various sources (e.g. students from different specialisation fields and different years of study). The multiple methods used also assisted to ensure confirmability. Data triangulation assisted with more comprehensive and holistic findings. Additionally, critical interviews with peer group members took place in this study when the proposal was presented to a panel of experts

to provide input on the proposal. Moreover, continuous engagements with subject experts on the project, its methods and findings assisted to prevent bias in interpretation of findings (Noble & Smith, 2015).

Transferability refers to the possibility of transferring the findings into similar contexts and was addressed as described below. The context within which the research study took place, as well as the manner of implementation are described in detail to improve the possibility for transferability, as described by Rossouw (2003). Detailed record keeping with a clear decision trail was ensured, as well as consistent and transparent data analysis and interpretation (Noble & Smith, 2015). Moreover, a comprehensive literature review and random sampling were all incorporated in the research study to improve transferability and generalization of findings (Onwuegbuzie & Collins, 2007; Polit & Beck, 2010).

Reliability and dependability relate to the consistency of the research results. Rossouw (2003) advocates to ensure reliability, the type of questions and the manner of implementing the research study should fit the context in which the participants find themselves. The reliability was ensured by utilising existing data collections tools to underpin probes of the focus group discussion, as well as questionnaire items, as discussed previously. Dependability can be obtained by including step-by-step repetition, investigative audit, or triangulation (Rossouw, 2003). Triangulation took place in this study as previously mentioned, to address dependability.

2.8. DATA COLLECTION SETTING

Data were collected at a university of technology in the Free State, South Africa. The university has two campuses, a main campus in Bloemfontein and a smaller campus in Welkom. The university was established in 1981 and at the time of the study boasted more than 21 000 students. These students benefit from appropriate work-integrated learning that equips and prepares them for professional practice in addition to acquiring a qualification. The qualifications reside in four faculties—the Faculty of Health and Environmental Sciences, Faculty of Humanities,

Faculty of Engineering, Built Environment, and Information Technology (IT), and Faculty of Management Sciences. The university offers undergraduate certificates and diplomas in addition to advanced diplomas, postgraduate honours degrees, master's degrees, and doctoral degrees. This technological university in Africa should be viewed considering the university's desire to be socially relevant and to improve the socio-economic circumstances of the community it serves (CUT, 2022). Therefore, this institution was ideal to perform this study amongst students who have been exposed to their work environment in the paramedical sciences and who studies at an institution who aims at improving socio-economic circumstances.

2.9. SELECTION OF PARTICIPANTS

The participants for both the questionnaire and focus group discussions were from the same sample, while no selection was performed for the questionnaire, and the entire population was recruited for this method. The target population was from four different specialisation fields, but with similar characteristics, within the Health Sciences (Onwuegbuzie & Collins, 2007). These groups comprised of the following bachelors and honours degree courses in Health Sciences at this university: Clinical Technology, Biomedical Technology, Radiography and Somatology. The inclusion criteria of the target population who were recruited as participants were as follows: participants from the four Health Sciences training courses listed as health workers, as well as participants in their final years of study during 2021, as these students are more familiar with their future industry.

Students in their final two (third and fourth) years of study within the Health Sciences were the target population. These students were decided upon due to the health industries' role during COVID-19. The health industry was at the forefront during the COVID-19 pandemic, while being vulnerable to be infected and experiencing an unprecedented workload in burdened health facilities, and with no end in sight. The lives of students from the four health courses, could have been influenced at various levels, like their studies as well as their workplace learning. The focus group discussions' selection of participants was based on systematic random sampling.

Systematic sampling was performed by utilising class lists to select students. These class lists were obtained from the institution's online teaching platform and included only email addresses as contact details.

Both these sampling methods are suggested for mixed methods research studies (Onwuegbuzie & Collins, 2007). Random sampling would prevent bias while improving transferability and generalisation of the findings of the study. A disadvantage of these sampling methods is that it may become a complicated process. Therefore, in an attempt to improve the practicality, as well as the confidentiality, a gatekeeper recruitment method was employed.

Participants were recruited through gatekeepers (Terre Blanche *et al.,* 2007) to obtain contact details of students which were not readily available. Gatekeepers were purposively recruited at the specific Higher Education institution. Gatekeepers consisted of employees within the various departments, including the Clinical Technology, Biomedical Technology, Radiography and Somatology courses. Gatekeepers requested participation, based on goodwill, from participants while ensuring that volunteering participants met the inclusion and exclusion criteria.

The possible participants, in this case the registered, third- and fourth-year students in Health Sciences, consisted of 333 students *(n=333)*. All these students were selected for participation in the questionnaire of the study, with an expected response rate of 50% to add up to a total of approximately 150 completed questionnaires. A large sample size is ideal for questionnaires known for a low response rate. On the contrary, the sample size for the focus group discussions was much less as suggested sufficient for exploratory research by Onwuegbuzie and Collins (2007).

Six focus group discussions were conducted. A total of 10 participants (Onwuegbuzie & Collins, 2007) were recruited and invited to each focus group discussion *(n=50).* The focus groups were

executed online to address social distancing regulations in place during planning of the research study.

2.10. DATA COLLECTION

2.10.1. Literature reviews

As stated earlier, mainly three types of literature reviews were included in this research study (Grant and Booth, 2009). Two overarching literature reviews informed the study: a systematised review (Chapter 3) and a narrative review (Chapter 4). Additionally, targeted reviews provide background to the three article-based chapters (chapters 5-7) of the study. While the literature searches were similar in nature, differences existed in the time utilised to perform the literature search, purpose/scope of each and synthesis of the collected data/literature.

The following search engines were mainly utilised in the literature searches: Google Scholar, iSEEK, ERIC, YIPPY, ScienceDirect, refseek and ProQuest. Language search limits were applied and publications not in English were excluded. Date range of sources were limited, as far as possible, to be published after 2018. The literature search for the overarching two literature reviews were executed between 2020 and 2023, while the targeted literature searches were conducted during 2022 and 2023.

The systematised review had an overarching scope and investigated literature on the effects of ICE environments on food security and health and wellness indicators. The review was performed according to the principles prescribed by Grant and Booth (2009) and conducted in a systemic manner to perform as comprehensive a review as possible within the time limit of the study. The analysed literature was synthesised into the Chapter 3 systematised literature review.

The narrative review also had an overarching scope but investigated the response of regulatory and Higher Education entities within South Africa during the COVID-19 pandemic. A wide range of related concepts were searched at various levels of comprehensiveness. The literature was

analysed to obtain the chronological order of responses to the COVID-19 pandemic, and this analysed data are synthesised into a narrative literature review in Chapter 4.

The targeted reviews were performed over a shorter period with a narrower scope and investigating the most recent literature on the relevant concepts of each article. Therefore, these targeted reviews included literature searches based on rapid and state-of-the-art literature review methods (Grant & Booth, 2009). The literature searched included less literature sources, but critical analysis of the literature was executed. The targeted reviews were synthesised by connecting with the overarching two literature chapters, while concentrating on the specific, current literature relevant to each article chapter (chapters 5-7).

2.10.2. Questionnaire

The study's participants completed a questionnaire to establish their views on the impact of the COVID-19 circumstances on their nutrition and related health and wellness. Questionnaires were in an electronic format and created utilising the QuestionPro online survey software. Invitations were e-mailed to recruited participants via the online platform of the designated institution. Information letters (Appendix A), consent forms (Appendix B) and an electronic link were sent to participants with the invitation. An agreement preceded the questionnaire and participants were not able to access or complete the questionnaire if they did not agree to participate in the research study. Participants were allowed two months for completion of the questionnaires. Participants were reminded twice of the questionnaire during this period, via the e-learning platform. Reminders were aimed at increasing response rate to obtain optimum data.

Additionally, as many measures as possible were included to raise the response rate, as low-response rate is a major disadvantage of survey research (De Vos *et al.,* 2012). Measures that were incorporated included not performing a selection process (100% of sample), sending questionnaire invitations outside of major holiday periods and including an information letter with the invitations to inform participants in advance about the research study.

2.10.3. Focus group discussions

A focus group discussion schedule was compiled to guide discussions (De Vos *et al.*, 2012). Literature and data from questionnaires informed the probes of this schedule (De Vos *et al.*, 2012). The probes were aimed at exploring the views of participants on the impact of COVID-19 on their food security and nutrition related health and well-being. Moreover, suggestions on how possible negative impacts could have been prevented or limited by Higher Education institutions. The discussion schedule was adapted after the completion of the pilot study (De Vos *et al.*, 2012). A disadvantage of focus group discussion is that a skilful facilitator is needed to ensure that the correct, as well as adequate amount of information is collected (Denscombe, 2017). The use of a focus group discussion schedule and the pilot study thereof assisted in obtaining adequate information during the focus group discussion. Moreover, the focus group facilitator had training and experience in conducting focus group discussions. The focus groups were executed online to deal with social distancing regulations in place during planning of the research study. The focus group discussions were conducted at various time slots to encourage participants to join at a convenient time.

Similar to the questionnaire invitations, focus group invitations were e-mailed to recruited participants using the online platform of the designated institution. Invitation emails included an information letter (Appendix A), a consent form (Appendix B) and an electronic link to a Microsoft Teams meeting. Prior to the focus group discussions, participants had to provide written consent and were not allowed to participate in focus group discussions if they did not agree to participate in the research study.

It is essential to create a conducive environment and to put participants at ease during focus group discussions. Therefore, online focus group discussions commenced with a brief introduction and instructions (incl. consent), as well as information on the purpose of the study. At this point, the actual discussion was initiated by the facilitator according to the discussion schedule (De Vos *et al.*, 2012). The focus group discussions were conducted in English, as it was

assumed participants are English literate (language of current training course). The information retrieved from the focus group discussions were captured in the form of field notes, as well as recordings with captions generated by the Microsoft Teams application. The focus group discussion recordings and captions were then integrated and converted into transcripts to add fullness to information captured in the field notes (De Vos *et al.,* 2012). The facilitator ended the discussions by briefly summarising the main points of view, seeking verification, and expressing gratitude to the groups.

Despite over recruitment of 25% and other measures to improve participation in focus group discussions, the attendance rate of focus groups were poor. A total of seventeen students participated in the six focus groups as follows: three participants in discussion one, two participants in each of the discussion number two, three, four and six, and six participants in discussion five. Possible reasons for the poor participation rate were students experiencing issues with mobile data, connectivity issues or loadshedding resulting in no electricity for certain periods of time. However, despite the participants being few, discussions were vigorous and rich qualitative data were obtained.

Literature concludes that when averaging the sequential and randomised order of focus groups, two to three focus groups are adequate for data saturation and can capture up to 80% of themes. This 80% will include the most predominant themes. Moreover, three to six focus group discussions will be sufficient to capture 90% of the themes. These themes and saturation are evident when focus group discussions on a homogenous study population using a semi-structured discussion schedule (Guest, Bunce & Johnson, 2016). In the current study, thematic saturation was reached already with focus group 2, after which no new themes were identified. Focus group 1 included 76% of the total number of identified themes. Furthermore, focus group 2 included 61%, focus group 3 included 76%, focus group 4 included 64% and focus group 5 and 6 included 60% of identified themes.

2.11. CODING AND STATISTICAL ANALYSIS

The study was based on a mixed method design utilising quantitative and qualitative data. The analysis was performed using the guidelines reported by Onwuegbuzie and Collins (2011). This data analysis involved the use of both quantitative and qualitative analysis techniques within the same framework, which would be iteratively applied (representing analytical decisions that occur repetitively, in a back-and-forth manner during the study). The mixed analysis served a dual purpose of complementarity and expansion, where the data from the focus group discussions and literature reviews provided elaborative detail and contextualised the data from the questionnaire. A basic parallel mixed analysis was implemented where the different data analysis techniques were performed parallel (in isolation) until the data interpretation was completed. A four-step process of mixed analysis (Vogl, 2018) was applied and included parallel data analysis, linkage of qualitative and quantitative data, further data analysis of consolidated data and finally, data interpretation.

The data from the questionnaires and focus group discussion were analysed in parallel by means of descriptive statistics. The quantitative data from questionnaires were captured electronically in a grid format in Microsoft Excel (De Vos *et al.,* 2012). Captured quantitative data were evaluated to obtain frequencies and percentages with assistance of a statistician. The frequencies and percentages were then interpreted against the scales of the existing data collection mechanisms (HFIAS, SADHS, questionnaire to assess adherence to diet and exercise advice and DASS-21) that underpinned the questionnaire (Coates *et al.*, 2007; Department of Health, 2007; Dubasi *et al*., 2019; Lovibond & Lovibond, 1995). Furthermore, the frequencies and percentage were utilised to display findings in tables and graphs as found in later chapters. Similarly, qualitative data from focus group discussions were first analysed in isolation.

The qualitative data from focus group discussions in the form of recordings and field notes were transcribed in an electronic format in Microsoft Word. A moderator reviewed field notes and

recording data against transcripts to confirm validity of transcriptions. The transcriptions from the focus group discussions were prioritised, categorised, and summarised prior to thematic analysis as described by Maguire and Delahunt (2017); Braun & Clarke (2006); and Morgan (1997). ATLAS.ti9 software was utilised to assist with the manual thematic analysis. This analysis consisted of a three-coding framework that included two stages of coding and content analysis to assist with quantitative information. Ethnographic analysis was the last stage and would obtain qualitative information. As a result, the context specific themes that emerged from the qualitative data, collectively with the information from the literature review, were utilised to provide descriptions and meaning to the questionnaire data.

The analysed data from questionnaires and focus group discussions provided descriptive insight into in participants' food security and nutritional value as a result of COVID-19 circumstances. Data from the isolated, parallel analysis were then transformed to be integrated and consolidated into one set of consolidated data. Further analysis was performed on consolidated data by means of descriptive and interferential statistics. This analysis was based on explorative data analysis that included more graphical analysis, association and significance testing.

Data from the institutional and other published sources were obtained by means of literature searches. Data from these sources were summarised and captured in the format of literature reviews as discussed in section 2.10.1. The purpose of these literature reviews was to explore the influence of ICE environments on health and wellness and the relations with such environments with COVID-19 circumstances, as well as to contextualise the Higher Education environment that students found themselves in amidst COVID-19.

Finally, the results of the experimental work and literature reviews were synthesised to identify and describe strategies and interventions in the format of a health and wellness programme for Higher Education institutions. An integrated design thinking and project management approach was utilised to obtain effective and sustainable strategies/interventions such as knowledge and

skills development, food relief and other support service initiatives. The aim of this programme was to create awareness and assist to maintain students' health and wellness during similar, future ICE situations at the specific and extrapolated to other Higher Education institutions.

2.12. ETHICAL CONSIDERATIONS

In any study it is important to pay attention to issues pertaining to the integrity of the study. This includes matters pertaining to research ethics. Ethical aspects were addressed in the current study as explained below.

2.12.1. Ethical clearance

Ethical clearance was obtained from the University of the Free State's Health Science Research Ethics Committee (HSREC) before the research study commenced (refer to appendix E).

2.12.2. Financial implications to the participants

No participant was financially remunerated nor charged to participate in the research study.

2.12.3. Withdrawal criteria

Participants participated voluntarily in the research study and had the right to withdraw at any stage of the study with no negative result to them, irrespective of the reason/s for withdrawal.

2.12.4. Participant information and informed consent

Each participant in all the phases of the research study was informed about the following aspects regarding the study: the purpose, financial implications, the right to withdraw, and expectations. This information was included in an information sheet that was explained. Together with the information sheet, each participant was also expected to provide informed consent. Participants received an electronic consent form in the form of an agreement prior to opening the links to the online questionnaire and focus group discussions.

2.12.5. Confidentiality

The confidentiality of the research study enjoyed high importance. Although the participants who participated in the focus group discussions were known to the facilitator and each other, identities were protected by utilisation of pseudonyms and omitting any information from field notes and transcriptions that could make them identifiable. Participants were requested to keep video cameras off during discussions and encouraged to use pseudonyms.

Survey questionnaires were unmarked to ensure that participation in the survey is confidential (De Vos *et al.*, 2012). Once the participant completed the questionnaire and submitted it via the electronic questionnaire platform, the completed questionnaire received an automated number to ensure no linking to the participants' e-mail address or name. Participants were instructed to not add names or the names of employers/institutions to any part of the questionnaire. In the case where a participant requested findings of the study, their identity was kept confidential, and communication destroyed.

The identity of participants in focus group discussions were kept confidential. No person or employers/institutions were identified or identifiable in the study. No participant's identification was made known to any person without the consent of such a participant. Recordings and transcripts were kept in a locked filing system in the case of hard copies and electronic files were password protected. Once the suggested five-year store period has elapsed the documents - both electronic and hard copies - will be destroyed. Similarly, e-mail correspondence will be deleted.

To conclude, a mixed methods study was performed with three data collection methodologies as described in this chapter. These methodologies include a questionnaire, focus group discussions and various literature reviews. The systematised literature review is captured in the following chapter.

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CHAPTER 3

The influence of isolated, confined and extreme environments (ICE) on nutritional and related health and wellness indicators: a systematised review

3.1. INTRODUCTION

In the period after the first quarter of 2020, when most of the world had gone into lockdown because of the COVID-19 pandemic, researchers have been probing the consequences of this historical event in detail. Investigations ranged from the nature of the pathogen and the pathophysiology thereof, as well as the physiological, emotional, psychological, and social implications of the measures taken to contain the pandemic.

The focus of this systematised literature review was to explore the possible impact of COVID-19 resulting circumstances (both hard lockdown and other levels thereof) on food security, food consumption and preferences, as well as on nutritional health and wellness indicators. The unprecedented constraints imposed on the public to contain the virus included limited social interaction, impacting on the financial situation of students, as well as the physical and psychological environment in ways that are usually only seen in extreme circumstances such as confinement and quarantine. Almost overnight, students found themselves isolated and forced to adopt atypical lifestyles often in inhospitable settings whether their own homes or elsewhere, such as in student accommodation facilities (Özden & Parlar Kiliç, 2021). Moreover, as the students, or their support system, were unable to generate an income, their money and food situation, which at the best of times is precarious, was suddenly dire. The resulting consequences on students' nutritional health and wellness were the subject of the current study.

While it is vital to collect reliable data about a phenomenon for effective future planning, the lived experience of those affected by an event and those investigating the event, is rooted in a particular context. The consequences of the pandemic and the measures taken to contain it, were the outcomes of decisions and structures of which society found itself in. The review therefore also explored underlying assumptions of the paradigmatic matrix that determine the food economy, education, as well as health and wellness models.

The systematised review as described by Grant and Booth (2009) was used as methodology in the consequent chapter, providing the impact that the circumstances that arouse from COVID-19 had on the food security and associated health and wellness indicators of general citizens as well as on student populations. The review was structured as follows: 1) an overview of concepts related to food and health, wellness and well-being, 2) an overview of food security, physical health and mental well-being among students in both the international and South African Higher Education landscape, 3) the influence of COVID-19 on health and wellness behaviour particularly related to food consumption, weight management, physical fitness and mental health as collected from the literature published internationally and in South Africa in particular.

3.2. FOOD AND THE WEB OF LIFE

There is an African proverb proclaiming that you cannot work for food when there is no food for work. Food, in this case, would be any substance ingested to stay alive. Humans eat, however, not only to stay alive, but to meet physiological, mental, and psychological needs for energy, tissue building and repair, regulation, and protection of the body. The nutrients in food (proteins, carbohydrates and fibre, fat, vitamins, minerals, phytochemicals, and water) are used in the body to ensure survival. Furthermore, healthy nutrients also have therapeutic effects that support and restore physiological and mental health by aiding the immune system and lowering the risk of developing conditions such as diabetes and cardiovascular disease (GBD 2017 Risk Factor Collaborators, 2018; Ohlhorst, Russel, Bier, Klurfeld, Li, Mein, Milner, Ross, Stover & Konopka, 2013; Salanta, 2020). Therefore, nutrition also played a fundamental role in the prevention of, and recovery from, COVID-19 infections during the pandemic (Clemente-Suárez, Ramos-Campo, Mielgo-Ayuso, Dalamitros, Nikolaidis, Hormeño-Holgado & Tornero-Aguilera, 2021). According to the WHO (n.d.), nutrition is a key component of humans' health and development. Nutrition underpins longevity and quality of life based on the interconnectedness among nutrients, foods, and dietary patterns (Chae, Ju, Shin, Jang, & Park, 2018; Spencer, Korosi, Layé, Shukitt-Hale & Barrientos, 2017; Tapsell, Neale, Satija, & Hu, 2016; Vajdi & Farhangi, 2020).

3.2.1. Nutrition and quality of life

The view that nutrition underpins longevity and quality of life is supported by a review of thirteen studies (four longitudinal, and nine cross-sectional), with over 43 000 subjects, identifying two dietary patterns associated with improved health-related quality of life (HRQoL) (Vajdi & Farhangi, 2020). These studies linking nutrition and HRQoL, explored two types of interactions (Itani, Rosa & El Ghoch, 2021). The first was a bi-directional interaction, i.e. good and healthy nutrition improves HRQoL and *vice versa*. The second was a synchronic interaction where nutrition and HRQoL result in an added effect such as a therapeutic outcome (improving a medical or psychological condition). Diets that result in this improved health-related quality of life are usually referred to as healthy diets.

A healthy diet can be defined as the ever-shifting perceptions of the role played by different foods, food groups, essential nutrients and dietary patterns in health and disease (Cena & Calder, 2020). Different types of healthy diets, whether considered traditional or created by design, share common elements and in most cases correspond with the WHO's Global Action Plan for the Prevention and Control of Noncommunicable Diseases. The WHO defines a healthy diet as:

> *one in which macronutrients are consumed in appropriate proportions to support energetic and physiologic needs without excess intake while also providing sufficient micronutrients and hydration to meet the physiologic needs of the body* (Cena & Calder, 2020:2).

Additionally, the importance of macronutrients and micronutrients can be summarised as follows: Cellular processes needed for daily living are dependent on the energy supplied by macronutrients (i.e. carbohydrates, proteins, and fats) while comparatively small amounts of micronutrients (i.e. vitamins and minerals) support normal growth, development, metabolism, and physiologic functioning (Cena & Calder, 2020). The mentioned health outcomes, as well as the nutrient metabolism are not the same for everyone and are influenced by certain factors.

Researchers distinguish between two sets of factors that influence nutrient metabolism and health outcomes. Firstly, intrinsic factors such as sex, age, and genetic factors, and secondly, extrinsic factors that relate to the food consumed, xenobiotics such as food additives, environmental pollutants, pesticides, synthetic polymers, carcinogens, drugs, and antioxidants and the environment itself (Chena, Michalak, & Agellon, 2018). In this case, when using the term environment, it refers to natural influences such as the light/dark photoperiod of the day-night cycles which sets the endogenous circadian rhythm that is intricately linked to the regulation of metabolic activity. The time of day that food is consumed, is as significant as what is consumed and can affect health (Manoogian, Chaix, & Panda, 2019). Therefore, an individual's gene-environment interrelationship also has strong effects on nutrient metabolism and subsequently on health and risk behavioural outcomes (Liu, Tuvblad, Raine, & Baker, 2013). An example would be the way an unfavourable environment, including a high-stress situation, reduces the body's ability to sense and respond to metabolic challenges causing long-term consequences for nutrient and energy metabolism. The result can be the onset of metabolic disorders such as coronary heart disease and Alzheimer's disease (Bergmann, Gyntelberg & Faber, 2014; Cena & Calder, 2020; Kuo, Bratzke, Oakley, Kuo, Wang & Brown, 2019; Rabasa & Dickson, 2016). Conventional advice for preventing such metabolic disorders that includes a low-fat diet and regular exercise, might thus not be enough to achieve the best outcome. Additionally, the effect of psychosocial stress should also be considered (Kuo *et al.,* 2019). In view of the above, an integrated approach should be taken to obtain optimum results related to health outcomes.

With the emphasis on taking an integrated approach to food consumption, appraisals of what constitutes a healthy diet have increasingly been shifting from the contribution of specific dietary nutrients to health outcomes, to analysing dietary patterns and the diversity of food consumed (Chena, Michalak & Agellon, 2018; Echouffo-Tcheugui & Ahima, 2019; English, Ard, Bailey, Bates, Bazzano, Boushey, Brown, Butera, Callahan, de Jesus, Mattes, Mayer-Davis, Novotny, Obbagy, Rahavi, Sabate, Snetselaar, Stoody, Van Horn, Venkatramanan & Heymsfield, 2021; GBD 2017 Risk Factor Collaborators, 2018; Schulz, Oluwagbemigun & Nöthlings, 2021; Tapsell, Neale, Satija

& Hu, 2016). A dietary pattern in this sense refers to the combined effects of the quantities, assortment, or combinations of different nutrients in foods and beverages as well as the frequency of consumption (English *et al.,* 2021; Tapsell, Neale, Satija & Hu, 2016). Unlike the approach that emphasises nutrient analysis, studying dietary patterns looks at interactions among nutrients and food components (English *et al.,* 2021). Therefore, designing guidelines emphasise eating patterns and food combinations, as well as taking into consideration aspects such as interactions across foods. The concept of dietary patterns is more user-friendly as "people eat foods, not individual nutrients" (Echouffo-Tcheugui & Ahima, 2019).

Traditional dietary patterns consider the amounts of a type of food a person consumes, for example vegetables, legumes, fruits, nuts, whole grains, cereals, or non-refined grains, fish, animal products, dairy products, and unsaturated vegetable oils. Dietary patterns offer a "meaningful and interpretable database on foods and food groups" and according to English *et al.*, 2020: 8), their review ascertained that:

> *"Multiple food choices can be made toward a healthy diet that promotes beneficial outcomes. Dietary pattern approaches are advantageous because they place an emphasis on the combination of foods and beverages that meet total energy needs and are associated with health, instead of the selection of specific nutrients or foods alone, which may be more difficult for consumers to translate into a total diet"* (English *et al.,* 2021: 8).

Three well-known dietary patterns are the Mediterranean diet, the Western dietary pattern (WDP) and Dietary Approaches to Stop Hypertension (DASH). These have shown evidence of being associated with reduced disease risk (Tapsell, Neale, Satija & Hu, 2016). However, other dietary patterns exist that may be associated with increased disease risk. Studies reporting the nutritional composition of dietary patterns have identified patterns that contain high levels of sugar, sodium, and dietary saturated fat to be associated with increased disease risk (Tapsell, Neale, Satija & Hu, 2016). A study conducted in four African countries, namely Nigeria, Tanzania,

South Africa, and Uganda, distinguished two main dietary patterns, namely a mixed diet pattern and a processed diet pattern with the latter being linked to overweight and obesity (Holmes, Dalal, Sewram, Diamond, Adebamowo, Ajayi, Adebamowo, Chiwanga, Njelekela, Laurence, Volmink, Bajunirwe, Nankya-Mutyoba, Guwatudde, Reid, Willett, Adami & Fung, 2018). As evident, dietary patterns are complex and numerous factors are involved in the dietary intake of individuals.

3.3. FACTORS INFLUENCING DIETARY PATTERNS

Understanding and managing the reasons for deleterious dietary patterns require assessments of a variety of contextual factors such as nutrition transition (Pradeilles, Rousham & Griffiths, 2016) and food choices that rely on the developments in food processing, production, and supply (Tapsell, Neale, Satija & Hu, 2016), as well as food variety and availability (Labadarios, Steyn & Nel, 2011).

3.3.1. Nutrition transition

The nutrition transition phenomenon is of particular interest when studying food choices in South Africa (Sproesser, Ruby, Arbit, Akotia, Dos Santos, Bhangaokar, Furumitsu, Hu, Imada, Kaptan, Kaufer-Horwitz, Menon, Fischler, Rozin, Harald, Schupp & Renner, 2019). Nutrition transition is a global phenomenon influenced by several variables, including economic factors and income (Memela, 2017). Nutrition transition is defined as modifications to the eating habits of individuals, families, groups of people, or whole populations when social, political, economic circumstances and the food environment change. The transition may be a gradual transition or dramatic as with the transformation after the 1994 democratic elections in South Africa (Ronquest-Ross, Vink & Sigge, 2015). Nutrition transition relates to a shift from more traditional diets to highly refined diets with high fat, salt, and sugar (especially sugar-sweetened beverage) consumption, while being low in fibre and micronutrients. This shift is more common in societies marked by industrialisation and urbanisation, and other demographic and epidemiologic changes (Nnyepi, Gwisai, Lekgoa & Seru, 2015). This shift also links with an increased prevalence of

resultant nutrition-related noncommunicable diseases. Authors of a study conducted in Uganda distinguished four dietary typologies in a transitioning food environment based on whether the participants were from rural or urban areas, whether dietary patterns reflected traditional or modern diets, and the environmental impact. Three of the four categories are 1) 'urban, low-impact, early-stage transitioners', 2) 'urban, medium-impact, mid-stage transitioners' and 3) 'rural, low-impact, early-stage transitioners' leaning towards transitioning dietary patterns. In contrast, the fourth, 'rural, low-impact, traditionalists' represents the traditional eating practices (Auma, Pradeilles, Blake, Musoke & Holdsworth, 2020). In addition to the influence of social, political, and economic circumstances on dietary patterns, eating habits and personal choices of individuals also influence food intake.

3.3.2. Food choice

Food choice refers to the way people "consider, acquire, prepare, store, distribute, and consume foods and beverages" (Blake, Frongillo, Warren, Constantinides, Rampalli & Bhandari, 2021). Food choices are primarily determined by the food system that the individual finds themselves in (Blake *et al.,* 2021). Such a system encompasses the cultivation and breeding of food stuffs and related industries, food production, transport, processing and manufacturing, retailing, and consumption of food. A food system considers food impacts on environment, health, and society (Von Braun, Afsana, Fresco, Hassan & Torero, 2021).

3.3.2.1. Food systems

The dominant food system globally strives to align food production and food consumption to ensure food safety, security and sustainability using a top-down, neoliberal approach. The focus is on food as a commodity and its contribution to the growth of the economy managed through policies, 'programmatic priorities', data gathering, modelling and analysis (Fukuda-Parr, 2018; Sodano, 2012; Vivero-Pol, 2017; Von Braun *et al.*, 2021). This model is the consequence of post-World War II industrialisation and intensification of agricultural and food production worldwide to fulfil the demand for food and more food choices in a world with more people, urbanised

communities, and increased future demands by merely continuing to increase production and consumption (Gladek, Roemers, Muños, Kennedy, Fraser & Hirsh, 2017). Critics consider this food system "at the centre of a nexus of global problems, stretching from poverty to environmental degradation" and the "preservation of ecosystems and the future well-being of the human population are all centrally dependent on a structural transformation of the food system towards a sustainable and resilient state" (Gladek *et al.,* 2017: 4). The neoliberal ideology is held responsible for dismantling traditional agriculture and culture-specific diets and flooding markets with cheaper ultra-processed (junk) foods at a "high cost to the detriment of the health and wellbeing of society" (Nestle, 2019: online). The ideology manifests as a tension between governments wanting to supply healthy food and their own objectives of economic growth in a free market environment (Thow, Greenberg, Friel, Du Toit & Sanders , 2018). However, there is consensus in some areas that the current structure is unsustainable. In addition to food systems, eating behaviour plays a vital role in food choices and dietary patterns.

3.3.2.2. Eating behaviour

Kabir, Miah and Islam (2018) and others define eating behaviour as normal behaviour related to eating habits, selecting foods that are eaten, culinary preparations and quantities of intake. On the contrary, deleterious eating behaviours lead to weight gain, obesity, malnutrition, low energy levels and eating disorders. Such eating behaviours include under- or overeating, restricting certain foods, skipping meals, consuming ultra-processed food, excessive snacking, and ordering take-away meals (Smaira, Mazzolani, Esteves, André, Amarante, Castanho, de Campos, Benatti, Pinto, Roschel, Gualano & Nicoletti, 2021.). Eating behaviour includes food preferences, food choices, food purchasing, food preparation and eating routine. Eating behaviour and decisions become habitual responses and daily routines. However, these behaviours are influenced by the individual's thoughts, feelings, and reasons for eating as well as their circumstances (who they eat with, what is available, where they are, cooking and storing facilities). Therefore, it is highly changeable as confirmed by research, e.g. the case of Higher Education students demonstrating changes to their dietary patterns (Deliens, Clarys, De Bourdeaudhuij & Deforche, 2014; Kabir,

Miah & Islam, 2018; Smaira *et al.,* 2021). In addition to the individual's related influences on eating behaviours, circumstantial influences include, amongst others, more environmental factors such as consumer culture.

Over the last thirty years, however, and under the influence of the neoliberal consumer culture and the messaging from marketing industry, media and social media, wellness has to some extent taken on a more pleasure-seeking quality. Rather than behaviours that support a person to live a meaningful life, being well has become a commodity and an end (Kruger, 2019; Wahl, Villinger, König, Ziesemer, Schupp & Renner, 2017). Foucault labels it "biopower" over the individual who "voluntarily control themselves by self-imposing conformity to cultural norms through self-surveillance and self-disciplinary practices, especially those of the body such as the self-regulation of hygiene, health, and sexuality" (Pylypa, 1998: 22). The accent is on the individual determined to live a good life and maximise their personal potential, but rather than pursuing a higher purpose, achieving health and wellness has become the goal (Kruger, 2019). Health and wellness can be promoted by curating a lifestyle that exhibits self-care through pursuing physical fitness, striving to manage stress, acquiring appropriate accessories, achieving work-life balance, and demonstrating environmental sensitivity (Callaghan, Lösch, Pione & Teichner, 2021).

Developing nutritional knowledge is one of the most obvious ways in which food industry's marketing channels promote wellness to the consumer (McMahon, Williams & Tapsell, 2010). This is not a strategy without merit, as the choice between good eating habits and poor eating habits can have long term health consequences and increase wellbeing (Hernadez, Bamwesigye & Horak, 2016). However, achieving this basic human need for quality and affordable food takes on different meanings for different groups depending on economic, social, cultural, and political factors. The alternative food movements (AFM) serve as an example. AFMs have emerged as desire to counteract the industrialised food production systems developed since World War II (Grauerholz & Owens, 2015). Food movements can take on various forms depending on the factors that support the groups' dissatisfaction with the status quo. For communities from the

Global North, primarily entrenched in the neoliberal paradigm it manifests as a "growing desire for more personal connections between consumers and producers, and between producers and their products" (Grauerholz & Owens, 2015: 566). These consumers choose local, healthy, and organic foods, support fair trade, and adopt vegan and vegetarian lifestyles. However, people do not only change eating behaviours as part of a quest for personal health and well-being. Other reasons for searching for AFMs, particularly in the Global South, include finding collective ways of food production, distribution, preparation, and consumption to counteract the class inequalities between the rural poor across the globe and promote small-scale, family-owned operations (Grauerholz & Owens, 2015; Motta, 2021). Hence, food choice is the result of a complex interrelationship among individual preferences based on personal circumstances as well as broader social, economic, and political factors (Chen & Antonelli, 2020). Much research has been done on the factors influencing eating behaviour and some researchers have proposed conceptual models of food choice.

3.3.2.3. Food choice models

Researchers are of the opinion that it is vital to be aware of how people make food choices (what, how, why) in the specific food environments to enable and encourage individuals to follow sustainable healthy diets (Blake *et al.*, 2021; Chen & Antonelli, 2020). The science of food choice is stated as a multidisciplinary effort including nutritional sciences, psychology, sensory sciences, marketing, sociology, agricultural economics, and behavioural economics. Four questions are identified to steer a dynamic model of food choice that is essential for effective policy and programme development to achieve sustainable healthy diets for all (Blake *et al.,* 2021). These four questions can be stated as follows: 1) How and why do people eat what they eat? 2) What do people eat from the options available and accessible in their environment? 3) How do they interact with the social and physical environments to obtain, prepare, distribute, and consume food? 4) Why do people decide to acquire, prepare, distribute, and consume foods in the manner they do? These questions probe the *what* and the *why* of people's food choices, but to answer the *why* (explanatory) requires ample data on the *what* (descriptive) and *how* (explanatory).

Considering these questions and various answers on food choices, a variety of food choice models exist (Chen & Antonelli, 2020; Rozin, 2015; Shepherd & Raats, 2006).

Several scholars attempt to construct conceptual models of food choice that integrate the different views on food choice and determining factors thereof. This review provides a brief overview of such models by Chen and Antonelli (2020); European Food Information Council (EUFIC) (2006) and Marcone, Madan and Grodzinski (2020).

The model of Chen and Antonelli (2020) focused on influential factors related to foods, individual differences, and society. According to this conceptual model the following factors determine general food choice: food-internal factors (sensory and perceptual features), food-external factors (information, social environment, physical environment), personal-state factors (biological features and physiological needs, psychological components, habits and experiences), cognitive factors (knowledge and skills, attitude, liking and preference, anticipated consequences, and personal identity), as well as sociocultural factors (culture, economic variables, political elements).

The EUFIC states that food choice factors vary according to life stages and the power of factors also varies amongs individuals or groups. Therefore it is suggested that interventions focus at specific groups of the population, considering the more specific food choice influencing factors. However, EUFIC (2006) identifies six major determinants of food choice besides physiological or nutritional needs: 1) biological determinants such as hunger, appetite, and taste; 2) economic determinants such as cost, income, and availability; 3) physical determinants such as access, education, skills (e.g. cooking) and time; and 4) social determinants such as culture, family, peers and meal patterns' 5) psychological determinants such as mood, stress and guilt; and 6) attitudes, beliefs and knowledge about food.

Marcone, Madan and Grodzinski (2020) focused on sociological and environmental factors that influence eating behaviour. Eating and purchasing behaviours are personal and complex expressions of an individual's thoughts, beliefs, family life (or lack of it), social life, physical environment, cultural aspects, religious prescriptions, trends, influence of media, marketing, and policies (Marcone, Madan & Grodzinski, 2020). The framework proposes a personal ecological framework to guide research into the link between people, their eating habits, and their environments. This personal ecological framework can be divided into four major groups: (1) personal determining factors (characteristics and behavioural factors that influence food selection, physiological state, food preferences, nutritional knowledge, perceptions of healthy eating and psychological factors), (2) state of the economic ecosystem (food availability, variation and price, food security, personal income, and employment), (3) social environment (proximal relationships, culture and social media); and (4) the ecological environment that the individual inhabits (infrastructures that affect food availability, e.g. food outlets such as shops, supermarkets, restaurants where they live, work, study, and socialise). Increasingly researchers are also factoring in the environmental impact of food production and eating by considering the balance between healthy, nutrient-adequate dietary patterns and environmental boundaries for food production (Helander, Bruckner, Leipold, Petit-Boix & Bringezu, 2021; Rossa-Roccor, Richardson, Murphy & Gadermann, 2021).

Overall, all three models propose that food choice is influenced by multiple factors, including environmental circumstances such as economic state and food access, biological need and physycological factors, including moods. However, the specific factors are categoriseed differently, i.e. internal and external factors, and their relative importance differ slightly between the models. While knowledge on food choices is essential for interventions to modify food choice and transition towards a sustainable healthy diet, it is not that straightforward. As EUFIC stated, food choice is complex, and interventions necessitate a broader approach considering various influencing factors. For example, on a personal level individuals may experience nutrition transition as one of personal choice, as aspirational, as part of a socially upwardly mobile

trajectory or general globalisation trends (Leach, Nisbett, Cabral, Harris, Hossain & Thompson, 2020; Vivero-Pol, 2017). However, the political-economic power of the dominant food system must, considering the vulnerabilities exposed by the COVID-19 pandemic, be interrogated (Figueroa-Helland, Thomas & Pérez Aguilera, 2018; Leach *et al.,* 2020; Motta, 2021). Any study of a group's food consumption, purchases and preferences will therefore be remiss if it only deals with the nutrient value of food items and the food industry environment. Therefore, a broader approach should be taken that considers the context surrounding people's relationship with food as channelled by the dominant food system. Such a relationship is dynamic, multi-layered, and complex, intertwined with personal, political, and economic pressures that bear down on the individual and the community (Reedy, Subar, George & Krebs-Smith, 2018). As Leach and team (2020: 11) explain:

> *The politics of food consumption and eating are not reducible to contestations over nutrients and dietary recommendations, or even to material political economy, but are intimately entwined with questions of meaning, values, beliefs, and identity – what might broadly be termed 'food cultures'.*

3.4. NUTRITIONAL-RELATED HEALTH AND WELLNESS INDICATORS

A particular objective of this study was to assess the nutritional-related health and wellness indicators (including weight, physical fitness, and mental health) during the COVID-19 pandemic. Therefore, it is necessary to explain terminology relevant to health and its components, as well as wellness, including the relation of food promoting wellness.

3.4.1. Health

The term 'health' is traditionally explained by the 1948 WHO definition as "a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity" (WHO, 1948: online). The more recent definition of health, as amended by WHO in 2021, refers to the ability of an individual or group to realise goals, meet needs, and adapt to or cope with the

environment (WHO, 2021a). In relation to health, the term 'wellness' refers to the description of health-promoting actions or choices that are practical and serves as a "resource which permits people to lead an individually, socially and economically productive life" (WHO, 1998: online). Whereas health is a resource for everyday life, wellness is the descriptive word for the action taken to replenish that resource by adopting good habits that prevent disease and injury such as exercise, weight management, eating a healthy diet, adequate hydration, sleeping, and hygiene (Callaghan, Lösch, Pione & Teichner, 2021; Kirkland, 2014). Two of the three components of health, namely physical health and mental well-being, as defined by the WHO (1948), were investigated in this study. Therefore, it is imperative to provide an overview of these two components of health.

3.4.2. Physical health

Physical health or well-being refers to possessing optimal quality of life and the ability to perform daily activities. Although many aspects are involved in physical health, e.g. sleep and relaxation, proper nutrition, and physical activity (ANU, 2022), the current study only focused on certain aspects such as weight management and physical activity/exercise.

Weight management is an important part of physical health since it directly influences the risk of acquiring chronic diseases including diabetes, hypertension, and cardiovascular disease. Maintaining a healthy weight through a balanced diet and regular physical activity can lower the risk of certain diseases while improving overall health. Overweight and obesity are recognised by the WHO as abnormal or excessive fat accumulations that may affect health. In 2016, more than 1.9 billion adults worldwide were overweight, with over 650 million obese. Moreover, in most of the world's countries overweight and obesity conditions lead to more deaths than underweight (WHO, 2021b). Therefore, weight management is significant in sustaining good health.

According to research, a combination of healthy eating habits and physical activity can help a person to maintain his/her weight effectively. A study published in the Journal of the Academy

of Nutrition and Dietetics discovered that people who follow a Mediterranean-style diet and exercise regularly had a lower body mass index (BMI) and a lower risk of obesity-related disorders (Schwingshackl, Missbach, König & Hoffmann, 2018).

Body mass index (BMI) is a measurement of body fat based on height and weight. BMI is calculated by dividing weight in kilograms by the square of height in meters. Thus, the formula for calculating BMI is as follows: BMI = weight (kg) / height² (m^2). Calculating BMI is useful to assess body fat, but it has some limitations. For example, it does not consider the distribution of body fat, which can affect health outcomes. Despite the limitations, BMI remains a widely used measure of body fat due to its simplicity and ease of use. BMI can be utilised as an initial screening tool, as in the current study, to identify individuals who may be at risk of obesity-related diseases. However, BMI should not be utilised as a diagnostic tool, but should rather be combined with other assessments such as body fat percentage, abdominal adiposity, and waist circumference (WHO, 2008).

Similar to BMI, waist circumference is also a tool to screen for risk of developing various obesity-related conditions. A high waist circumference indicates excess abdominal fat, which is a major risk factor for these conditions like metabolic syndrome and diabetes (NIDDK, n.d.). According to the WHO, a waist circumference of more than 94 cm in men and 80 cm in women signifies an increased risk of developing health problems. However, these values may vary depending on ethnicity and other factors (WHO, 2008). Therefore, weight management is an essential part of maintaining physical health and various manners can assist with weight management, including monitoring dietary intake and increasing physical activity (NIDDK, n.d.).

Physical activity does not only play a part in weight management but is also a vital component of physical health (WHO, 2022). Evidence exists that lifelong exercise is associated with improved quality of life and longer lifespan with delayed onset of chronic diseases. This is due to the link of physical activity to numerous health benefits, including reduced risk of chronic diseases such as

heart disease, stroke, and diabetes (Ruegsegger & Booth, 2018). Moreover, physical activity is found to improve mental health, reduce anxiety and depression as well as improve cognitive function (Zschucke, Gaudlitz & Ströhle, 2013). Therefore, physical activity does not only promote physical health, but also positively influence other aspects of physical health such as maintaining a healthy body weight, as well as maintaining mental health (Ruegsegger & Booth, 2018).

The WHO (2022) recommends that adults engage in at least 150 minutes of moderate-intensity aerobic physical activity per week to maintain good health, although physical activity recommendations may vary based on individual needs, health status and fitness level. Individuals with chronic health conditions or disabilities may require modified physical activity recommendations to ensure safety while promoting health. Therefore, healthcare provider or fitness instructor guidance is suggested for such individuals before initiating an exercise programme (WHO, 2022).

Physical activity does not only refer to physical exercise but can include various activities. Such activities can include traditional forms of exercise such as running, cycling, or weightlifting, as well as leisurely activities such as walking, gardening, or dancing. Additionally, many workplaces, schools and universities offer opportunities for physical activity, such as fitness classes or sports leagues (WHO, 2022).

3.4.3. Mental wellbeing

Similar to physical activity, mental health is an essential aspect of overall health and well-being. Mental health refers to the ability to cope with stress and challenges, optimally function, make meaningful contributions to society and to live a quality life. Conversely, poor mental health can lead to a range of mental health disorders, including anxiety, depression, bipolar disorder, schizophrenia, and others (Felman & Tee-Melegrito, 2022).

Mental health does not merely refer to the absence of a mental illness but is a complex, multifaceted concept that is influenced by numerous factors including genetics, environment, lifestyle, and social factors. As a result, those who lived in poverty, have a family history, experienced social isolation or trauma have an increased risk of developing mental health problems (WHO, 2019). According to the WHO (2019), mental health disorders are a leading cause of disability worldwide and are associated with significant economic and social costs.

However, despite the high prevalence and impact of mental health disorders, various barriers exist that hinders access to mental health services. These barriers include stigma and discrimination, lack of awareness and understanding of mental health issues, inadequate funding for mental health services, and limited availability of mental health professionals (Tirintica, Andjelkovic, & Sota, 2018). To address these challenges, it is essential to promote mental health awareness and education, reduce stigma and discrimination, increase funding for mental health services, and improve access to evidence-based treatments (WHO, 2019).

3.4.4. Wellness and well-being

Even though the terms wellness and well-being are often used as synonyms by the media and marketing industry, there is a qualitative difference. If wellness refers to adopting good and healthy habits, well-being can be viewed as the overarching outcome that individuals want to achieve by adopting these habits. In other words, well-being describes a quality life in which the person finds meaning, purpose, contentment in the vein of Aristotle's *eudaimonia* (Kruger, 2019). Well-being also refers to a life in which there exists equilibrium between an individual's resources across eight dimensions of life (physical, mental, emotional, social, purpose, occupational, financial, and environmental) and the challenges that occur in life (Dodge, Daly, Huyton & Sanders, 2012; Kruger, 2019). According to Dodge, Daly, Huyton and Sanders (2012: 229):

> *…stable wellbeing is when individuals have the psychological, social, and physical resources they need to meet a particular psychological, social and/or physical challenge.*

When individuals have more challenges than resources, the see-saw dips, along with their wellbeing, and vice-versa.

In addition to staying alive and healthy, food nourishes *emotional and psychological well-being. As* Block and team (2011: 11) *stated, "(n)o one sits down to eat a plate of nutrients*. *Rather*, *when we sit down for a meal*, *we are seeking physical as well as emotional and psychological nourishment*." According to novelist Virginia Woolf (Woolf, 1929: 13), *"(o)ne cannot think well, love well, sleep well, if one has not dined well"*. Therefore, food nourishes the body, psyche, and social relationships. The integrated notion of dietary patterns (food preference, purchasing and consumption) is in line with the current understanding of well-being in the literature. As merely using statistical indicators for education, poverty, inequality and employment to measure people's objective well-being does not provide a full picture of people's QoL (Western & Tomaszewski, 2016), so does quantifying nutrient ratios consumed not tell their story with food.

A shift from "food as health" to "food as well-being (FWB)" is suggested to encourage a paradigm shift to an integrated, positive approach to understanding food as a key contributor to individual and societal well-being (Block *et al.*, 2011). This shift is in line with the new WHO definition of health and wellbeing (WHO, 2021a). Moreover, the shift will alter the view of a dietary pattern from a rules- and restriction-based model to an expanded view that encompasses positive psychological, physical, emotional, and social relationship with food at individual and societal levels. Clearly such a model would also consider environmental, cultural, and legal factors related to food attitudes and behaviours. The FWB model is based on five domains: food socialisation, food literacy, food marketing, food availability, and food policy. Hence, to establish whether the dietary and consumption patterns of a person or group (as in this current study) contribute to their health and wellness, such investigation would also require consideration of additional factors, besides good habits, which might influence their eating habits.

3.5. STUDENTS' FOOD SECURITY AN RELATED HEALTH AND WELLNESS

The current research study investigated food security and dietary intake, physical health, and mental well-being amongst students within the Higher Education landscape. This investigation aimed at collecting data pertaining to the period during the COVID-19 pandemic, while data were not obtained preceding the pandemic. In the absence of baseline data for comparison, it is essential to review literature on the Higher Education landscape prior to COVID-19. Both the international and national Higher Education landscapes will be covered, with specific reference to students' food security, physical health, and mental well-being.

3.5.1. The international Higher Education landscape

With Higher Education increasingly being moulded in the market-oriented political-economic ideology all over the world, including the Global South, food insecurity and poor mental health, but also the lack of adequate housing and other basic needs, have become the norm for students everywhere (Kigotho, 2018; Kromydas, 2017; Schraedley, Jenkins, Irelan & Umana, 2021; Troiani & Dutson, 2021). Moreover, neoliberalism has adjusted society's role allocations related to who is responsible for looking after the welfare of whom (Kruger, 2019). The neoliberal system considers the individual a self-directed and self-reliant being who aspire to be independent from the state and responsible for themselves. The "traditional markers of neoliberalism" rooted in Western-style liberalism are cited as privatisation, competition, deregulation, choice, non-interventionist economics, and minimal government involvement (Schraedley, Jenkins, Irelan & Umana, 2021). As a result, spending on public, health, social and educational services has been cut and often such state functions have been taken over by non-state agencies such as private companies and non-governmental organisations (Kruger, 2019).

However, rather than advancing students' or anyone else's well-being, the free-market system has left them to navigate divergent expectations. The message is that to share in the neoliberal 'good life' requires one to be economically productive. The assured way to achieve such a 'good life' is to enrol for a Higher Education qualification that will result in a better-paying and more

secure occupation (Burrows, Whatnall, Patterson & Hutchesson, 2017). The proviso is, as the "future driver of society" (Hames & Lewis, 2021), students do it on their own and with little support from the state. Furthermore, whatever support students receive from the private sector comes at market-related prices. The result is large student loans, no guarantee of a job after graduating and meek living conditions with food insecurity during studies.

This neoliberal invasion on Higher Education has affected students in both high- and low-income countries, but according to Schraedley *et al.* (2021: 10), it has had "disproportionately negative consequences for historically underserved populations (e.g. racial/ethnic minorities, low-income students, and first-generation college students)". These populations experience a lack of adequate housing, poverty, relentless rises in living costs, university fees as well as food insecurity (Bruening, Argo, Payne-Sturges, & Laska, 2017; Dickenson, 2021; Dominguez-Whitehead, 2017; Hames & Lewis, 2021; Maynard, Meyer, Perlman & Kirkpatrick, 2018).

Food insecurity among students in lower- and middle-income countries world-wide has been described as a public health concern long before the pandemic forced them into lockdown (Cady, 2016; Cheong, 2021; Hattangadi, Vogel, Carroll & Côté, 2019; Fortin, Harvey & Swearingen White, 2021; Gallegos, Ramsey, & Ong, 2013; Mukigi, Thornton, Binion, Brown, Church, Cook, Henry, Hopkinson, Masucci, Pruett, Rogers, Singleton, Vichi-Miller, Wofford & Brown, 2018; Ngumbi, 2019; Payne-Sturges, Tjaden, Caldeira, Vincent & Arria, 2018; Van den Berg, Abera, Nel & Walsh, 2013). The rate of students at risk of food insecurity in high-income countries like Australia and the US ranges from between 12% to 46.5% of the population (Ukegbu, Nwofia, Ndudiri, Uwakwe & Uwaegbute, 2019). Furthermore, studies show that food insecurity is as much as three times higher in US colleges and universities than in US families (Cheong, 2021). In middle- and low-income countries, which make up most of the world's population, especially in Africa south of the Sahara and south and west Asia, food insecurity can reach 60%. More specifically, in South Africa rates of between 11% and 38.3% has been reported (Devereux, 2021).

As far back as 2011 student food insecurity was referred to as the university's skeleton in the cupboard and a threat to physical and psychological health and to academic achievement (Hughes, Serebryanikova, Donaldson & Leveritt, 2011). Although food is considered essential to early childhood education and good cognitive and physical development of children, less is known about the food acquisition struggles of Higher Education students and the consequences of this (Dominguez-Whitehead, 2017). Furthermore, with the socio-economic repercussions of the pandemic, the problem has been exacerbated. Already in 2020 and 2021 news reports (Alderman, 2021; City University of London, 2020; Laban, Jackson, Maynard & Loring, 2020); and research studies on the effect of COVID-19 on the food security of students all over the world, started appearing - the US (Chewe Sabi, Kolanisi, Siwela, & Naidoo, 2020; Dickenson, 2021; Mialki, House, Mathews & Shelnutt, 2021;), Brazil (Santana, Milagres, Silva dos Santos, Brazil, Lima & Pereir, 2021), Malaysia (Mohd Jamil, Sulaiman, Adznam & Badari, 2020), Australia (Shi, Davies & Allman-Farinelli, 2021; Murray, Peterson, Primo, Elliott, Otlowski, Auckland & Kent, 2020), Venezuela (Hernández & Camardiel, 2021), France (Alderman, 2021), Iran (Zolfaghari, Bayat, Izadi, Askari & Piran, 2021), Italy (Wagner, Kaneli & Masango, 2021; Zahan & Bonadonna, 2021).

Food insecurity (FI) is defined as "limited or uncertain availability of nutritionally adequate and safe food or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Payne-Sturges, Tjaden, Caldeira, Vincent & Arria, 2018: 2). This insecurity is the result of financial and personal factors, having only restricted access, not having adequate life skills such as effectively buying food and preparing meals as well as managing a budget (Mukigi & Brown, 2018; Ranjit, Macias & Hoel, 2020; Ukegbu, Nwofia, Ndudiri, Uwakwe & Uwaegbute, 2019). Food insecurity can manifest as running out of food, not having money to buy good-quality food or any food at all, as well as being anxious about having enough money to buy food (Mukigi & Brown, 2018).

Additionally, the concept of food security is defined by the Food and Agriculture Organization of the United Nations (FAO) as an instance when all people, always, have physical, social, and economic access to sufficient, safe, and nutritious food meeting their dietary needs and food preferences (HLPE, 2020). This definition includes the six dimensions of food security: availability, access, utilisation, stability, agency, and sustainability (HLPE, 2020). Food security can be classified as: individuals with food security to have consistent access to adequate food. Mildly food-insecure people experience anxiety over food sufficiency; however, they manage to provide for themselves. Moderately food insecure people have inferior quality, less variety and choice but still manage to take in enough food, while severe food insecurity is suggested by intermittent eating patterns and reduced food intake (El Zein, Shelnutt, Colby, Vilaro, Zhou, Greene, Olfert, Riggsbee, Morrell & Mathews, 2019).

Authors (Freudenberg, Goldrick-Rab & Poppendieck, 2019) state five trends that explain the increase in food insecurity among US college students: firstly, more students are currently facing financial challenges; secondly, the price of Higher Education as well as living expenses have increased; thirdly, the number of students from low-income households has increased and state support decreased; and fourthly, students find it more difficult to supplement their income by working in a market rife with joblessness. Finally, educational institutions' resources do not offer adequate support for students (Ordway , 2019). The lack of food assistance programme as well as student's ineligibility for food assistance are major causes of food insecurity (Ukegbu, Nwofia, Ndudiri, Uwakwe & Uwaegbute, 2019).

Furthermore, a Canadian study describes university students as a particularly vulnerable group (Hughes, Serebryanikova, Donaldson & Leveritt, 2011) while Mukigi *et al.* (2018: 1) term students as "emerging adults that encounter life-changing experiences as they transition to life away from home" - a stressful event that may cause anxiety and depression. In turn this leads to poor dietary choices and unhealthy eating patterns including overeating, binge eating, meal restriction and possibly eating disorders (Mukigi *et al*., 2018; Ukegbu, Nwofia, Ndudiri, Uwakwe & Uwaegbute,

2019). This becomes a dangerous circle as experiencing food insecurity again exacerbates this stressful situation (Meza, Altman, Martinez & Leung, 2019; Shi, Davies & Allman-Farinelli, 2021).

Additionally, such vulnerability amongst students also impacts other aspects of their health and well-being, and literature indicates that college students in many countries have an increased risk for serious health issues, substance abuse and problems resulting from anxiety and depression (Varghese, Norman & Thavaraj, 2015). These factors are a concern that Higher Education should address, especially since the factors relate to reduced academic achievement, decreased motivation, and increased risk of dropout (Pascoe, Hetrick & Parker, 2020). While mild levels of stress have a positive impact on students' performance, continuous levels of high stress may lead to physical health issues, e.g. headaches, anxiety, depression, poor sleep quality, self-harm, and substance abuse as well as poor learning capacity and decreased academic performance (Kai-Wen, 2009; Pascoe *et al.*, 2020; Varghese *et al.*, 2015). Evidence indicates that numerous factors lead to increased levels of stress amongst students, including academic-related stress, such as pressure to achieve high marks and concerns about receiving poor grades (Pascoe *et al.*, 2020). Other factors that play a role in the stress levels of students are social media, financial difficulties, relationship issues and lack of coping mechanisms (Kai-Wen, 2009). Coping mechanisms that can help students cope with stress and anxiety include talking to others, counselling, leisure activities and physical activities (Pierceall & Keim, 2007).

Similar to stress, physical inactivity is also a major concern for students and may be a contributing factor to the elevated levels of poor mental health among students globally. Literature indicated that in 2012, 31% of individuals worldwide were physically inactive, with proportions ranging from 17% in southeast Asia to about 43% in the Americas and the eastern Mediterranean (Hallal, Andersen, Bull, Guthold, Haskell & Ekelund, 2012). Additionally, a study conducted by Goje, Salmiah, Ahmad Azuhairi and Jusof (2014) showed associations between physical inactivity and gender (female), low income, low self-efficacy, and poor mental health. Furthermore, the WHO's (2002) stated physical inactivity amongst the ten leading causes of death. Physical activity has

numerous health benefits ranging from increased cardiovascular health with protection against hypertension, as well as weight control and reduction. Conversely, a lack of physical activity may result in poor sleep quality and lack of cognitive ability, all of which will in turn negatively impact students' academic performance (Donnelly, Hillman, Castelli, Etnier, Lee, Tomporowski, Lambourne & Szabo-Reed, 2016).

Research has indicated that physical activities decline consistently during adolescent years, especially whilst students are involved in Higher Education studies. During this time, healthy lifestyle practices often decrease together with the practice of moderate to vigorous physical activity (Goje *et al.,* 2014). Therefore, it is essential to continuously monitor physical activity levels and develop policies and programmes to increase activity levels and to reduce the occurrence of non-communicable diseases (Hallal *et al.*, 2012). It is suggested that such policies and programmes should include counselling on mental health and physical activity awareness among students (Goje *et al.*, 2014).

To address these mental and physical well-being issues, various initiatives have been launched and exist around the world. These include programmes at Higher Education institutions such as mentorship programmes, counselling, and support services, as well as less formal initiatives, including social activities, sports, and yoga, to help students cope with stress and anxiety (Kai-Wen, 2009; Pierceall & Keim, 2007; Rose, Godfrey & Rose, 2015). Governments often develop health policies and delivery systems with the aim of improving the health and wellness of citizens (Edelman & Kudzma, 2022). However, despite these endeavours of Higher Education and governments, the literature still indicated that students' physical and mental well-being is not optimal, and that more needs to be done to ensure that students perform optimally and have quality of life.

With the food security and related health and wellness indicators of international students provided, the focus will move to Higher Education circumstances locally. Therefore, an overview

will be provided on the South African students' experiences regarding food security, physical health, and mental well-being in the period prior to COVID-19.

3.5.2. Higher Education within the South African context

Hames and Lewis (2021) pointed out that South African universities, as others globally, are increasingly investigating the student hunger phenomenon while also setting up food access programmes. Examples are the "Stop Hunger Now" initiative at the University of Johannesburg, the University of the Free State's "No Student Hungry" Programme, the launch of a farmer's market at the University of the Witwatersrand, and Stellenbosch University's food security task team (Banda, 2021; Mafolo, 2020; Satgar & Cherry, 2018). Several colloquia on the subject have been held in the last five years. In 2018 the Socio-Economic Rights Project of the Dullah Omar Institute hosted the *National Colloquium on Access to Food for Students in South African Tertiary Institutions* (Mafolo, 2020*;* Socio-Economic Rights Project, Dullah Omar Institute, 2018). From this initiative a booklet was developed to assist students, administrators, and policymakers to help realise the right to food of students in tertiary education in South Africa (Adeniyi & Durojaye, 2020). Food insecurity as one of the ways that exclude people from Higher Education opportunities in the unequal education system also featured in the #Fees-Must-Fall movement and students' protests calling for the decolonisation of Higher Education institutions (Costandius, Blackie, Nell, Malgas, Alexander, Setati & Mckay*,* 2018; Dominguez-Whitehead, 2017).

A number of academic research and media investigations into food insecurity among students have been launched exploring the relationship between hunger and academic progression, food politics on campuses and the weaknesses in the food-security models, students' coping strategies such as steering clear of fast-food outlets, pooling food, sharing meal preparation schedules, eating fewer meals and going home for meals, lifestyle habits of healthcare students (Hames & Lewis, 2021; Rudolph, Kroll, Muchesa, Manderson, Berry & Richard*,* 2018; Tremblay, 2019; Van den Berg & Raubenheimer, 2015; Van den Berg, Abera, Nel & Walsh, 2013; Wagner, Kaneli & Masango, 2021; Wegerif & Adeniyi, 2019).

The article by Hames and Lewis (2021) on the topic of the food politics on campuses and the weaknesses in the food-security models underpinning it, offers an insightful theory about its preoccupation with locating the cause of hunger with the individual Their article focuses on the symptoms of the problem and do not address the structural causes of hunger. Rather than confronting the histories and socio-economic circumstances that create hunger, food security paradigms concentrate on reforming the symptoms of these legacies (Hames & Lewis, 2021). They explain that this approach has its roots in neoliberal hegemony and its instruments namely the International Monetary Fund (IMF), the World Bank, and the World Trade Organization (WTO). Rather than a bottom-up approach to ensure that every person has food to eat, the emphasis is on top-down food security controlled through economic policies, including trade liberalisation, privatisation, deregulation of national industry and the opening of markets (Hames & Lewis, 2021). As such these authors stated that the "hungry university student is in many ways a negation of neoliberal mythmaking" which in turn is the go-to explanation of food-related social challenges for policy makers and researchers alike (Hames & Lewis, 2021: online).

3.5.3. Students' lived experience of hunger

The worry about food is an added stressor for students who are already juggling academic demands with financial and housing pressures, living independent from their families, and settling into a new environment, a relentless process of survival (Hughes, Serebryanikova, Donaldson & Leveritt, 2011; Raskind, Haardorfer & Berg, 2019). Several studies into general and student food insecurity indicate association with decreased psychosocial health, including high stress levels, anxiety, and depression (Raskind, Haardorfer & Berg, 2019; Rudolph *et al.*, 2018; Sabi, Kolanisi, Siwela, & Naidoo, 2019). A study by Meza, Altman, Martinez, and Leung (2019) highlights several psychosocial effects of food insecurity narrated by students themselves, i.e. not wanting to disappoint their family, resenting students who are better off, struggling to develop meaningful social relationships, feeling despondent, unhappy, and frustrated with the university for the lack of support.

Furthermore, the effects of food insecurity on psychosocial health impede students' academic performance and contribute to high attrition levels (Raskind, Haardorfer & Berg, 2019; Sabi, 2019; Van den Berg & Raubenheimer, 2015). The flipside has also been shown with several studies directly linking a good diet quality with higher academic achievement both for Higher Education students' and scholars (Burrows, Goldman, Pursey & Lim, 2017; Raskind, Haardorfer & Berg, 2019; Reuter, Forster & Brister, 2020; Sabi, Kolanisi, Siwela & Naidoo, 2019; Weaver, Vaughn, Hendricks, McPherson-Myer, Willis & Rescigno, 2020; Whatnall, Patterson, Burrows & Hutchesson, 2019). In their 2017 paper, Burrows, Whatnall, Patterson and Hutchesson (2017) explain that such observations are aligned with what is known about the function and regular intake of micro- and macro nutritional components including folate, iron, and omega 3, as well as energy-rich foods in brain development and functioning. Nutritional components, however, also interconnect with other factors that influence academic achievement such as social-economic status (SES), health behaviours and health issues (Burrows, Whatnall, Patterson & Hutchesson, 2017). Studies on aspects affecting academic performance relating to gender, SES, behaviour, and lifestyle choices, sleeping patterns, exercise frequency, alcohol and drug use, smoking and stress management (Caso, Miriam, Rosa, & Mark, 2020; Peltzer & Pengpid, 2017) have been undertaken.

Evidence indicates that academic achievement is not only affected by the mentioned factors in isolation but also by the interaction among all or some of these factors. For example, lower academic achievement relates to lower SES and poor diet quality while binge drinking is associated with a sedentary lifestyle (Correa-Burrows, Burrows, Blanco, Reyes & Gahagan, 2016; Dinger, Brittain, O'Mara, Peterson, Hall, Hadley & Sharp, 2018). A sample of 16-year-olds studied indicates a link between excessive consumption of energy-dense, low-fibre, high-fat foods and reduced academic performance. Moreover, a study by Caso *et al.* (2020) gauge the relationship between stress and unhealthy eating among undergraduate students and how nationality affected food consumption and choices. Results indicated that students tended to turn to

unhealthy food, while academic stress reduced junk food consumption among students. Several other studies have also investigated the link between eating patterns and academic achievement and stress (Deliens, Clarys, De Bourdeaudhuij & Deforche, 2014).

If food insecurity is universities' skeleton in the cupboard (Hughes, Serebryanikova, Donaldson & Leveritt, 2011), it is also a 'shameful secret' among students, enough to prevent them from registering for food support programmes (Sabi, Kolanisi, Siwela & Naidoo, 2019; Van den Berg & Raubenheimer, 2015). Students experience embarrassment to accept 'hand-outs' and fear stigmatization and stereotyping for being poor or 'disadvantaged' (Sabi, Kolanisi, Siwela & Naidoo, 2019).

Related factors that are frequently mentioned by researchers when discussing food insecurity and psychosocial effects thereof among students, are one, the normalisation of the "starving student" narrative and secondly, perceived lack of deservingness. Students, the community, and policy makers seem to have assimilated the notion that it is part of growing up to struggle and survive on poor-quality fast food while studying at a Higher Education institution. This notion is an indication of the severity of the problem (City University of London, 2020; Crutchfield, Carpena, McCloyn, & Maguire, 2020; Maynard, Meyer, Perlman & Kirkpatrick, 2018). Professor Greta Defeyter, Director of UK's *Healthy Living Lab*, expresses astonishment at the number of universities globally that have instituted food banks and food pantries to support hungry students (City University of London, 2020). She argues that perpetuating the idea that food insecurity is part of a typical student's life, and that this issue should challenge perceptions and encourage society to confront the actual problems of poverty and student inequality (City University of London, 2020; Defeyter, Stretesky, Long, Furey, Reynolds, Dodds, Porteous, Mann, Stretesky, Kemp and Fox, 2020).

Another perception among students is the tendency to minimise the magnitude of their food insecurity predicament (Maynard, Meyer, Perlman & Kirkpatrick, 2018: 137), expressed as not

deserving assistance or not considering themselves as “someone that should be using that resource” - this despite studies showing that students’ financial need often intersects with first generation and students from racial/ethnic minority status (Payne-Sturges, Tjaden, Caldeira, Vincent & Arria, 2018).

3.5.4. The effect of COVID-19 on students

In March 2020, the first imported case of COVID-19 was reported in South Africa. Soon after this, one of the measures taken by South Africa to contain the spread of COVID-19 was to introduce a hard lockdown isolating residents in their homes and shutting down the economy (with a few exceptions) and education institutions until May of that year (Arndt, Davies, Gabriel, Harris, Makrelov, Robinson, Levy, Simbanegavi, van Seventer & Anderson, 2020; Posela & Casale, 2021; Stieglera & Bouchard, 2020).

In a country with the extreme levels of poverty and joblessness as recorded in South Africa, the lockdown aggravated the poverty and food insecurity situations of families (Devereux, 2021; Patrick, Khalema, Abiolu, Ijatuyi & Abiolu, 2021). Also, the promised state support took at least a month to materialise. People were given a few days to prepare and make their way to wherever they chose to spend the lockdown. Approximately one in six adults (or between five and six million people aged 18 years and older) had moved from where they had been living (Posela & Casale, 2021). The same time limit (a few days) applied to deciding for food supplies to see them through the lockdown. South Africans’ preparedness for the lockdown fluctuated by age, race, locale, and other socio-economic factors (Sifunda, Mokhele, Manyaapelo, Dukhi, Sewpaul, Parker, Naidoo, Jooste, Ramlagan, Gaida, Mabaso, Zuma & Reddy, 2021).

Higher Education students in South Africa, already a particularly vulnerable group because of issues around money, accommodation and food insecurity and subsequent protests and university closures, were hit hard by the lockdown restrictions (Landa, Zhou & Marongwe, 2021). The pandemic had “left no living and learning space in the South African universities unaffected,”

and its influence on students was profound (Kanyumba & Shabangu, 2021: 103). Students were required to vacate residences and switch to remote and online learning. Despite some universities making available resources and financial assistance to help pay for transport to go home and storing belongings, it still led to a wide scale upheaval for students who vacated their on-campus and off-campus living spaces as well as those who opted to not move home or in with family (Kanyumba & Shabangu, 2021; Makgahlela, Mothiba, Mokwena & Mphekgwana , 2021; Shoba, 2020; Van Aardt & Sibanda, 2021).

Campus closure also resulted in ceasing of campus sport activities, which resulted in decreased physical activity amongst students. This inactivity was exacerbated with government regulations that limited movements and access to the gym facilities, controlled movements which further restricts outdoor and open space physical exercises. Reduced physical activities, restricted access to entertainment, loneliness, and weight gain increases health risk factors such as obesity, hypertension, cardiorespiratory and mental health disorders among others (Mbunge, 2020).

A research study investigated the influence of COVID-19-related experiences on the emotional and mental health of South African university students three months into the pandemic. Results indicated that students' mental health decreased mainly due to serious discomfort during the lockdown, difficulty adjusting academically and feeling socially isolated. The younger female students and students residing in informal settlements experienced more emotional difficulties. Additional factors that influenced the emotional and mental health of students during COVID-19 were social, academic, spiritual, and physical well-being and positive coping strategies (Visser & Law-van Wyk, 2021).

3.6. IMPACT OF ISOLATION DUE TO COVID-19 REGULATIONS

The COVID-19 pandemic was the greatest international biopsychosocial emergency the world has faced for a century, and the lockdown and forced social distancing as a measure to contain the pandemic must have been the largest isolation experiment in history (Choukér & Stahn, 2020).

The jury is still out on what the long-term effect of these measures will be on human physiology (brain, neuro-humoral mechanisms, the immune-response) and psychology (behaviour and affect) (Brooks, Webster, Smith, Woodland, Wessely, Greenberg & Rubin, 2020; Choukér & Stahn, 2020). As early as February 2020 a review published in *The Lancet* warns about balancing the possible benefits of "mandatory mass quarantine" need to the potential "psychological costs" (Brooks *et al.,* 2020: 917). The authors indicate that adverse psychological effects may range from being an unpleasant experience, boredom to more severe conditions such as uncertainty, loneliness, and anger to post-traumatic stress (PTS) symptoms and even suicide symptoms (Brooks *et al.,* 2020). Moreover, reduced sensory stimulation and sensory monotony is added to the list (Choukér & Stahn, 2020). While considering these adverse effects of the unprepared isolation of COVID-19, studies on the results of more prepared isolation situations may be useful to investigate for comparisons.

One source of information that can be mined is the model that explores human behaviour in ICE environments related to adaptation, dealing with uncertainty, monotony, unfamiliar threats, and remoteness (Bartone, Krueger & Barton, 2018; Smith & Barrett, 2020). The concept is usually applied to situations such as polar expeditions, submarine and dessert missions, space exploration, war and military camps, prisons, long haul sea travels, medical isolation units and research undertakings into capsule habitats (Bartone, Krueger & Barton, 2018; Choukér & Stahn, 2020; Offord, 2020; Suedfeld & Steel, 2000; Tortello, Folgueira, Nicolas, Cuiuli, Cairoli, Crippa, Barbarito, Abulafia, Golombek, Vigo & Plano, 2020).

Several studies sponsored by the international space agencies and starting in the 1990s, have been collecting information by way of isolated, controlled, and confined analogues (ICC) from campaigns in Norway, Germany, Russia, the United States, and China. The duration of these confinement experiments ranged from a few to 240 days. Based on what was learnt from the early, shorter experiments, the Mars500 study was designed and became the longest isolation experiment in history. In 2011, a diverse group of six crewmembers were isolated for 520 days in

preparation for the mission. Research by the space agencies into ICE continue in different environments including underwater habitats, on islands in Hawaii and at the NASA Human Exploration Research Analog (HERA) facility at Johnson Space Centre (Choukér & Stahn, 2020; Cromwell, Huff, Simons & Patel, 2021; Pagel & Choukèr, 2016). The data and anecdotal evidence available about the human physiological and psychological response and health risks associated with protracted confinement, relates to these (Choukér & Stahn, 2020). The question arises whether these types of undertakings can be considered analogues to the social isolation and confinement measures during COVID-19.

Choukér and Stahn (2020) argue that the effects of psychological and environmental stressors that affect space travellers, overwintering crews and volunteers participating in research on isolation and confinement, also apply to people exposed to chronic emotional and physical stress caused by the COVID-19 pandemic. According to these two authors "(t)he parallels between social distancing and isolation and confinement and spaceflight analogues offer opportunities for shared learnings between these settings" (Choukér & Stahn, 2020: 5). Moreover, these authors explain that social isolation and confinement have neurological and psychological effects which translate into immunological weaknesses.

Matthews and Tye (2019: 5) describe social interaction as an innate need for human beings, central to our survival and well-being. As such, they state, "evolutionarily conserved neural systems underlie the maintenance of social connections: alerting the individual to their absence and coordinating effector mechanisms to restore social contact" to regulate social homeostasis (Matthews & Tye, 2019: 5). Rodent studies have indicated that this system is integrated with other physiological systems and functions to support the individual adjust to the vulnerabilities of isolation and to re-establish social connection (Matthews & Tye, 2019). However, both too much (overcrowding) and too little (isolation) social contact can be experienced as physiologically and psychologically stressful and generate adaptive and/or pathological responses to re-establish social homeostasis (Lee, Chen & Tye, 2021).

Physical isolation does not automatically lead to deleterious behaviour and health issues (Choukér & Stahn, 2020). Studies among space explorers in isolation and confinement indicate that many factors influence their experience such as personality, coping strategies, psychological and social support, crew dynamics, and mission duration. It is also important to distinguish between social isolation and perceived social isolation. Merely being away from other people is not a sufficient condition to increase physical and mental health risks. However, experiencing high levels of perceived social isolation and social disconnectedness have negative consequences for psychological well-being (Clair, Gordon, Kroon & Reilly, 2021). Choukér and Stahn (2020: 4) state that a "common denominator of perceived social isolation is that it translates to physiological stress responses via the sympathetic nervous system and the hypothalamic–pituitary–adrenal (HPA) axis". These responses lead to neuroendocrine changes with damaging mental and physical health effects including increased blood pressure, inactivity, motor decline, shortened lifespan and increased rates of cancer (Arzate-Mejía, Lottenbach, Schindler, Jawaid, & Mansuy, 2020; Lee, Chen & Tye, 2021).

Relating to how the human brain and cognition is affected by isolation, studies highlight dementia, depression, anxiety, loneliness, reduced immediate and delayed recall, as well as higher odds of mental health problems (Lee, Chen & Tye, 2021; Offord, 2020). An overview of the influence of protracted isolation on brain mechanisms that regulate social behaviour in humans indicate that it can lead to changes in gene expression in the brain and affect mental health (Arzate-Mejía *et al.*, 2020). Proper behaviour in response to environmental conditions and signals is critical for development, reproduction, and survival, but when social interactions are upset by an event like the COVID-19 lockdown and social isolation, it can have lifelong consequences for mental well-being. Adverse psychological effects include anxiety, panic, anger, PTS symptoms, digestive problems, obsessive-compulsive symptoms, insomnia, and depressive symptoms, all set off by the duration of the lockdown, infection fears, aggravation, inadequate supplies, inadequate information, monetary loss, and stigma (Brooks *et al.,* 2020; Pietrabissa & Simpson, 2020).

Furthermore, negative behaviours related to social isolation, mentioned in the literature, are boredom (Özden & Parlar Kiliç, 2021), lack of motivation (Weinstein & Nguyen, 2020), inactivity (Seetan, Al-Zubi, Rubbai, Athamneh & Radaideh, 2021), sleeping patterns and quality (Banerjee & Rai, 2020; Benham, 2021; O'Regan, Jackson, Young, & Rosenzweig, 2021), increased stress levels and suicidal behaviour, altered relationships and perceptions of empathy levels among people (Saladino, Algeri & Auriemma, 2020), lockdown, loneliness and social disconnection, increased and altered use of digital technology to counteract it (Ochnik, Rogowska, Kuśnierz, Jakubiak, Schütz, Held, Arzenšek, Benatov, Berger, Korchagina, Pavlova, Blažková, Aslan, Çınar & Cuero-Acosta, 2021; Shah, Nogueras, Van Woerden & Kiparoglou, 2020). In addition, there are several studies on the relationship between depression, anxiety, anger, and eating during isolation (Nguyen-Rodriguez, Chou, Unger & Spruijt-Metz, 2008). Inappropriate strategies to deal with negative feelings also increase food intake (Evers, Marijn Stok & de Ridder, 2010). Complex emotions and distress lead to emotional eating, unhealthy nutrition and weight gain (Koenders & van Strien, 2011).

3.6.1. Did COVID-19 result in an ICE environment?

Although the knowledge about the effect of isolation on human health and well-being gained from researching ICE environments, is valuable, the question is whether it contributes to answering the research questions in this study, namely to what extent the isolation aspect of the COVID-19 containment measures influenced the food security, dietary intake and related health and well-being of Health Science students at a certain Higher Education institution in the Free State province of South Africa.

Several dissimilarities between ICE environments described in the literature and social distancing elicited by the pandemic, can be identified. Firstly, it is not the same to be told to be isolated at home and to voluntarily participate in explorations and military missions. Secondly, it is a particular type of person who seeks out risky, high stakes and physically taxing adventures as opposed to all people forced to isolate. According to an operational psychologist for astronauts

at a US space centre, James Picano, dealing with isolation (such as lockdown and social distancing) for the public, unlike for astronauts who choose to and then meticulously train to, may be difficult (Owens, 2020). Higher Education explains that the first step in counteracting the negative effects of social isolation is the selection process. In referring to space missions, the way that people deal with isolation and confinement depends on several factors including individual issues such as personality, coping strategies, psychological support, crew dynamics, and mission duration. Only then does training start to prepare for the mission (Choukér & Stahn, 2020). Furthermore, these space missions, like trips to ICE environments, are usually planned years in advance and in minute detail by operational and financial backers, members of the team and expert support teams. These missions also have a definite start and end point. On the contrary, the COVID-19 isolation was responded to by Owens (2020: online) as follows: "That's not the case for the rest of us and makes the situation we face much harder to adapt to". The severity and duration of the pandemic's lockdown took most people by surprise. No proper planning was possible, logistical arrangements were made hurriedly in a climate of uncertainty and a lack of comprehensive support from the state. This is supported by the findings of a survey conducted in March/April 2020 that looked into South Africans' perceptions and preparedness for the first lockdown and self-isolation phase considering the widely diverse social contexts (Sifunda *et al.,* 2021).

Furthermore, added to the list of distinctions is the logistical, managerial, and financial support services at the disposal of organised missions and which are lacking for individual citizens, operational and financial backers, members of the team and expert support teams. This is particularly pronounced when considering accommodation and food safety. When planning to go on a voyage to sea, to Antarctica or to space, daily food rations are prepared and made ready for maximum nutritional value for each meal. During lockdown most people were thrown into the situation with no real planning nor financial support.

Lastly, the most pertinent point of difference for this study is the contrast between explorers having their meals and other needs sorted and knowing that when embarking on this trip there is no need for money. On the contrary, during the pandemic the opposite was true with uncertainty across all facets of well-being felt by students who experienced the lock down. The mentioned maintaining and monitoring of food and nutrition, as part of general health of crew members are key to the success of space missions (Douglas, Zwart & Smith, 2020; Smith, Zwart, Block, Rice & Davis-Street, 2005).

Therefore, food system inadequacies are the major cause of deaths and space mission failures. Examples of such inadequacies include a deficiency of one or more nutrients, insufficient caloric supply and under-consumption, inadequate preservation, or even nutrient toxicities (Douglas, Zwart & Smith, 2020). Food systems for space missions should distinguish between meeting minimal nutritional requirements and optimising systems to promote health and performance. The systems must also counteract negative effects of space voyages on the human body such as loss of body mass, muscle and bone, oxidative damage and radiation exposure and insufficient dietary intake (Smith, Rice, Dlouhy & Zwart, 2013). Factors that guarantee the success of a space food system include food safety, food system stability and reliability of ingredients and equipment; palatability to encourage sufficient consumption to support "health, performance, and morale" (Douglas, Zwart & Smith, 2020:2243); fitness for purpose, e.g. mitigating loss of body mass in extreme environments; sufficient variety to prevent menu and flavour fatigue and to accommodate crew members' taste (Bugos, 2021; Douglas, Zwart & Smith, 2020). Beyond the physiological functions of nutrient intake, as on earth, food and eating also play a psychosocial role (Smith, Rice, Dlouhy & Zwart, 2013). Also critical to a successful mission is resource minimisation, meaning *"all resources used (e.g., mass, volume, crew time, water, power, equipment) and all waste products created (e.g., wastewater, packaging, volatiles, biological waste) by a food system are weighed against the amount and variety of acceptable, nutritious food available for astronauts"* (Douglas, Zwart, & Smith, 2020: 2244). The last factor is easy and efficient modes of food preparation.

> *To develop the optimal space food system depends on a great deal research, expert knowledge, experience of catering in ICE environments dating back to before 1961 when Soviet cosmonaut Yuri Gagarin became the first human to consume a meal in space combined with the resources to develop the life-saving menu* (Betz, 2020: online).

Like space missions, the same food system matters apply to explorers and over-wintering crews in Arctic regions and the proposed space holidays to the Moon and Mars (Obrist, Tu, Yao & Velasco, 2019). As Russian journalist, Yekaterina Sinelschikova describes it, *"(a) trip to the North Pole is pretty much like a trip to space... but with 5 tons of weird food!"* (Sinelschikova, 2020: online). Yet, despite the differences between the isolation faced by astronauts, explorers and other adventurers and the lived experience of the general populace during COVID-19, the knowledge gained from studies done by the former about the physiological, psychological, and social effects of being cut-off from others and related to eating behaviour, is invaluable.

3.6.2. Eating behaviour, physical activity and mental health in isolation

One of the consequences of the COVID-19 regulations, like lockdown, related to this study is the way it altered eating patterns and behaviour (Coulthard, Sharps, Cunliffe & van den Tol, 2021; Dragun, Veček, Marendić, Pribisalić, Đivić, Cenna, Polašek & Kolčić, 2021; Ingram, Maciejewski & Hand, 2021). Research further suggests there are major sleep problems and psychological disorders (e.g. stress, anxiety, depression) associated with the reduction of movement and activities, as well as the reduced social interaction that occurred as a result of COVID-19 regulations (Chtourou, Trabelsi, H'mida, Boukhris, Glenn, Brach, Bentlage, Bott, Shephard, Ammar & Bragazzi, 2020). According to Garber *et al*. (2011), exercise improves physical and mental health and/or fitness in most persons irrespective of their training habits, therefore highlighting the need for individuals to stay physically active during quarantine or social isolation. Furthermore, research on the effect of social isolation from young to old indicated that younger citizens (18-40 years old) were more at risk for sedentary habits and lower quality food intake (Brito, Lima, Mascarenhas, Mota & Leite, 2021).

Several reviews on the impact of the pandemic-motivated social isolation on eating patterns have been published (Alamri, 2021; Ammar, Brach, Trabelsi, Chtourou, Boukhris & Masmoudi, 2020; Bakaloudi, Jeyakumar, Jayawardena & Chourdakis, 2021; Bennett, Young, Butler & Coe, 2021; Di Renzo, Gualtieri, Cinelli, Bigioni, Soldati, Attinà, Bianco, Caparello, Camodeca, Carrano, Ferraro, Giannattasio, Leggeri, Rampello, Lo Presti, Tarsitano & De Lorenzo, 2020). One such publication is a survey of 12 studies done in 2019 and 2020 with 20 789 participants from Italy, Spain, Poland, China, India, US, and South Africa (Matsuo, Tureck, Lima, Hinnig & Vasconcelos, 2021). On the whole people seem to have maintained their usual diet with some healthy and other not-so-healthy modifications. However, the results of the ECLB-COVID-19 International Online Survey indicate that it had altered "physical activity and eating behaviours in a health compromising direction" (Ammar *et al.,* 2020: 10).

Eating behaviour is influenced by social context (Higgs & Thomas, 2016). Due to only supermarkets being allowed to be open, food availability and choice during COVID-19 were limited, mealtimes were modified and food and purchasing goals and motivations changed (Oliver, 2020; Snuggs & McGregor, 2021). Although worldwide, social isolation and loneliness were common before the COVID-19 pandemic, the compulsory social distancing directives resulted in most people having minimal human contact for some time. Even when confined in the same space as other people, many still experienced severe feelings of disconnection, although the social distancing and isolation during the compulsory COVID-19 lockdown did not always mean eating alone. It also exerted pressure on people who were forced to spend the time with families and groups who shared the same space for a protracted time yet did not have the same eating patterns and dietary preferences (Özden & Parlar Kiliç, 2021)

While some families thrived during lockdown for having shared meals and relaxing mealtimes thanks to home-schooling from remote working, others' dietary patterns and eating behaviour were affected deleteriously and they experienced loneliness (Woolley, Fishbach & Wang, 2020). Examples would be inadequate cooking skills, a lack of motivation to cook, solo eating, food

insecurity and the use of information and communications technology. The nutritional intake of people who live and eat alone has been linked to a higher risk of lifestyle conditions such as diabetes and cardiovascular conditions (Hanna & Collins, 2015). A study on solo eaters using ICT devices (such as cellular phones, personal computers, television sets) while eating indicated that these gadgets can influence the way the person experiences and consumes the food (Lemke & Schifferstein, 2021). ICT devices can distract eaters to be unaware of what and how much they are eating and can also offset boredom and loneliness. The complexity of eating behaviours is confirmed by a study conducted at Cambridge, US, indicating that people forced to isolate crave social interactions similarly to the way in which a hungry person craves food (Tomova, Wang, Thompson, Matthews, Takahashi, Tye & Saxe, 2020).

Similar to solo eaters, living alone and preparing one's own meals influence nutritional intake. Preparing one's own meals rather than resorting to ready-made food counts as one of the factors contributing to healthy eating pattern modifications, as it leads to consuming more fruit and vegetables, and experimenting with new recipes or food types (Alamri, 2021; Palmer, Bschaden & Stroebele-Benschop, 2021). More resulting unfavourable eating patterns in a review of ten studies conducted between March and May 2020 indicate increase or decrease in the frequency of meals and snacks, choosing fast food, sugary foods and drinks, processed meat and raised alcohol consumption (Da Mota Santana, Milagres, Silva dos Santos, Marinho Brazil, Rocha Lima & Pereira, 2021; Keenan, Christiansen, Owen & Hardman, 2021 ; Matsuo *et al.*, 2021; Naicker, Palmer, Makanjana & Nzama, 2021).

The impact of COVID-19 on eating habits of students specifically aligns with studies of the broader population showing both adoption of healthy and disordered eating (Amatori, Zeppa, Preti Gervasi, Gobbi, Ferrini, Rocchi, Baldari, Perroni, Piccoli, Stocchi, Sestili & Sisti, 2020; Bosi Bağcı, Kanadıkırık, Somyürek, Gerçek, Tanrıkulu, Öntaş & Uzun, 2021; Browning, Larson, Sharaievska, Rigolon, McAnirlin, Mullenbach, Cloutier, Vu, Thomsen, Reigner, Metcalf, D'Antonio, Helbich, Bratman & Alvarez, 2021; Luciano, Cenacchi, Vegro & Pavei, 2021).

3.7. CONCLUSION

If the aim of collecting data on students' eating and health and lifestyle behaviour during COVID-19 is to prepare for similar future events, it is prudent to take a broad view of ways to establish sustainable and affordable interventions. The problem of student food insecurity and poor mental health while exacerbated by the pandemic, has had a long history related to structural inequalities in the socio-economic fabric globally and in South Africa. Assessing how current support services relating to health and wellness (such as food programmes and counselling services) on Higher Education campuses attempted to assist would be useful, as would students' narratives on awareness and utilisation of such services. More than being participants or even co-investigators, setting students up to be the designers of such interventions would go a long way to integrate aspects of our world that have been separated and left sapped long before the pandemic struck (Ahmed, Ilieva, Clarke & Wong, 2021; Paganini, Ben-Zeev, Bokolo, Buthelezi, Nyaba & Swanby, 2021).

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CHAPTER 4

An exposé of regulatory and Higher Education strategies in response to the COVID-19 pandemic in SA

4.1. INTRODUCTION

The current chapter responds to the second objective of the research study: to analyse and compare regulatory and Higher Education responses to the COVID-19 predicament, at a national, and regional level. Therefore, this chapter serves to provide the context in which data were collected from a cohort of Health Sciences students. The methodology of the current chapter is a literature reviews synthesised as a narrative review as described by Grant and Booth (2009). More specifically, this chapter provides a narrative review of circumstances that formed part of the ICE environment that students experienced, and which resulted from the response of Higher Education institutions and South African regulatory bodies to COVID-19.

When the first case of COVID-19 in South Africa was reported on 5 March 2020, it set in motion a time of uncertainty and an amplified need to be agile and inventive for all, including the Higher Education sector. By the end of that month, the government had declared a national state of disaster with associated measures to protect citizens against the virus, including social distancing, quarantine, self-isolation, testing, and an immediate travel ban. Moreover, the government announced an immediate closing of educational institutions (Staunton, Swanepoel, & Labuschaigne, 2020). The National Coronavirus Command Council (NCCC) was formed to take the lead in containing the spread and to assuage the negative impact of the coronavirus. The containment strategy was structured around the five-level COVID-19 alert system to determine the severity of the lockdown regulations. The alert system was guided by the following criteria: the level of infections and rate of transmission, the capacity of health facilities, the extent of the implementation of public health interventions, and the economic and social impact of continued restrictions (South African Government, 2020).

These measures to protect against COVID-19 not only had a substantial impact on the workings of the state and on the economy but also on the lives of the citizens, including the approximately 2.5 million post-schooling education and training system (PSET) students and staff (DHET, 2020). The 26 public universities, like other Higher Education institutions, had to make swift decisions

and devise creative contingency plans with limited information at their disposal, in a situation that was completely unprecedented (De Klerk, Krull, & Maleswena, 2021). Higher Education institutions then had to effectively communicate these plans to their stakeholders (students, staff, and parents) using internal communication channels, the media, and social media (UniS, 2020b).

4.2. RESPONDING TO THE NATIONAL RESPONSE TO THE COVID-19 PANDEMIC

Immediately after the South African President declared a national state of disaster on 15 March 2020, universities started preparing short- and medium-term strategies to manage the consequences of the pandemic and the strict lockdown regulations. Simultaneously the South African Students Congress (SASCO) initiated an online petition demanding the immediate postponement of classes. SASCO president, Bamanye Matiwane, urged the suspension of academic programmes in all PSET declaring that "(f)ailing to do so, students will be forced to defend themselves by closing these institutions themselves" (Hendricks & Chirume, 2020).

However, threats were unnecessary as the first steps taken by most institutions were to suspend all academic activities, to implement early recess and to reschedule academic programmes accordingly (Van Schalkwyk, 2020). By the end of the next day, 16 March 2020, the universities of Cape Town (UCT), Witwatersrand (Wits), Stellenbosch (UniS), Johannesburg (UJ), KwaZulu-Natal (UKZN), Pretoria (UP) and Nelson Mandela University (NMU) had announced the suspension of all contact classes (Dell, 2020; Hendricks & Chirume, 2020; Pijoos, 2020). The other universities followed in short succession.

Student and staff codes of conduct for the immediate future were announced, including curtailing non-essential local travel for study and official purposes, 14-day self-quarantine for staff and students who had travelled abroad in the three weeks prior to the lockdown, maintaining social distance and to meet, if possible, only when essential (Pijoos, 2020; Van Schalkwyk, 2020). Access to the campuses became strictly monitored and entry and exit

screening protocols mandatory (Van Schalkwyk, 2020). All other COVID-19 precautions were adhered to, including handwashing and sanitisation protocols, wearing appropriate face masks, and social distancing. UJ announced that it had deactivated its biometric scanners at all entrances to avoid contamination and provided hand sanitising equipment to curb the risk of infections (Pijoos, 2020).

One of the more contentious measures was the call for students to vacate residences and leased accommodation, in most cases within 72 hours (Hendricks & Chirume, 2020; UCT, 2020a). Regarding a return date, students were informed that the situation would be assessed at the end of March 2020.

As student residences are primarily communal living spaces, this was considered an essential measure to mitigate the risk of large-scale exposure to and the spread of COVID-19 (Pijoos, 2020; UKZN, 2020). This angered students for a variety of reasons, including them considering the campus a safer space than home (Mbijekana, 2021; Paterson 2021). A Northwest University student, Buhle (Mbijekana, 2021), in an article published later in the year in University World News, related how leaving the campus affected her. She desperately wanted to be with her family who live in South Africa's Eastern Cape Province some eight hundred kilometres away. Yet, neither she nor her mother had the means to pay for a trip home. Also, she knew that mobile signal strength in the rural areas would be inadequate for online learning. She opted to stay with a family friend in the greater-Johannesburg area. "When I left my residence in Potchefstroom, I only took my laptop and some clothes, and packed them in my backpack because I thought I would be back after the Easter holidays, which is what most of us thought would be happening" (Mbijekana, 2021). However, this was not the case.

4.3. SENDING STUDENTS HOME

By the end of April 2020, when the NCCC on COVID-19 announced that the country was to move to alert level 4, some regulations were relaxed. Yet, that did not improve the situation of Higher

Education students. The university's council decided to not resume contact learning for the 2020 higher education academic year (Cele, 2020). This situation continued until the country moved to alert level 3 in June 2020.

In the meantime, to assist vacating students finding it difficult to return home, Higher Education institutions started to put support systems in place. However, as Luescher, Schreiber, Moja, Mandew, Wahl and Ayele (2020: vi) pointed out, despite most governments proclaiming "one-size fits-all" directives to all universities, on the ground, the student affairs practitioners had to contend with (the students') diverse local realities, including long and arduous journeys to rural areas. Students who were not able to take all their belongings home received storage space that was made available; financial support was arranged for the ones who could not afford the transport fees; and transport (buses) was provided for out-of-towners (UCT, 2020b; UCT, 2020a; UKZN, 2020). The Department of Higher Education and Training (DHET) also undertook to ensure payment of allowances for all students receiving financial aid. Students, and in particular international students, who were unable to return home were given permission to remain in the residences (Wits, 2020a).

Despite the universities expressing their willingness to assist students, the student bodies and student leaders were dissatisfied, and some even called on students to "occupy" the residences in protest (Macupe, 2020a). However, after meetings with university Management, this idea was scrapped and the student leadership began to encourage students who preferred to, and who could afford it, to evacuate the residences. The ones that were unable to meet the expenses or who opted not to leave, were advised to contact their wardens or student housing advisory body to decide whether they could stay (Hendricks & Chirume, 2020; Farber, 2020).

4.4. KEEPING STUDENTS SAFE AND STUDYING

On 20 March 2020 a webinar was held with 500 participants from Higher Health (HH) (a national agency that develops and implements health, wellness, and psychosocial services in Higher

Education institutions), the National Department of Health (DOH), the National Institute for Communicable Diseases (NICD) and PSET management, staff and health care workers to discuss the COVID-19 outbreak. A partnership was formed among HH, NICD and DOH together with Universities South Africa (USAf) (a representative body of South Africa's public universities) to develop capacity, inform, advise, guide and train on COVID-19. This included all PSET healthcare workers and support staff from campus clinics, campus health and wellness coordinators and others (DHET, 2020; Van Schalkwyk, 2020). Four days later, on 24 March 2020 the DHET established a COVID-19 team comprising USAf, HH and other role players to coordinate the sector's response to the pandemic (DHET, 2020). One of the team's tasks was to compile a survey on the information technology (IT) capability and ability to offer on-line learning of Higher Education institutions. The team was also responsible for developing strategies to ensure research and business continuity, ensuring uninterrupted funding to students to sustain themselves and to afford learning material at that "time of general hardship and uncertainty" (National Student Financial Aid Scheme, 2020).

Between March and April 2020, the National Student Financial Aid Scheme (NSFAS) processed 150 000 of the 614 986 students from PSET institutions across the country (National Student Financial Aid Scheme, 2020). Early in April 2020 in a media statement, the organisation indicated that it had paid about R4.9 billion as upfront payments to institutions allowing eligible students to register. By 17 April 2020 NSFAS had paid over 7.2 billion Rand in total (some 20% of the total DHET grant) for tuition and allowances to Public Higher education institutions and qualifying students (National Student Financial Aid Scheme, 2020).

During a joint virtual meeting of the Parliamentary Portfolio Committee on Higher Education, Science and Technology with representatives of the selected Committee on Education, Technology, Sports, Arts and Culture held on 11 May 2020, NSFAS administrator, Dr Carolissen, described the COVID-19 pandemic as a time of "unparalleled challenges" which had compelled NSFAS to do away with paying via intermediaries and the voucher system and to rather make

payments directly to students (Maputi, 2020). In this meeting future Higher Education institution budget cuts because of COVID-19 were anticipated.

4.5. TURNING TO REMOTE LEARNING TO SALVAGE THE ACADEMIC YEAR

Meanwhile, Higher Education institutions were frantically implementing online learning systems to salvage the academic year. According to Luescher *et al.* (2020), the only option under the circumstances was the following:

> *"(T)his switch to remote teaching laid bare the enormity of the digital divide on the African continent in its starkest and most iniquitous form as students in far-flung remote rural areas were unable to get access to academic programmes."*

In the weeks to come most universities in South Africa started aiding to facilitate remote learning including providing students with laptops, other learning devices and data (Luescher, *et al.,* 2020; Mungadze, 2020a; Macupe, 2020b; Seleka, 2020). Some universities' students were expected to return the laptops at the end of the academic year, while others made it available on a loan-to-buy basis with the cost of the device to be added to the students' fee account (UWC, 2020; Van Schalkwyk, 2020). The University of Free State (UFS) required a monthly payment for rental of such devices (Samuels, 2020b).

By June 2020 Higher Education, Science and Technology Minister, Dr Blade Nzimande, announced that just under 50 000 laptops will be distributed to NSFAS-funded students at colleges and universities. The first 22 000 was expected to arrive in the country by the end of the month (Chetty, 2020; Samuels, 2020a). An open tender procurement process was devised. The Minister explained that to adhere to national treasury's procedures when spending such a huge amount of taxpayers' money, there might be a delay in supplying the laptops (Samuels, 2020a). Higher Education urged students, staff, and parents to be patient.

However, three months later NSFAS students were still not connected, leaving some students unable to continue their studies remotely. The open tender process announced in May 2020 has been cancelled due to corruption and graft allegations and a new process commenced, as NSFAS administrator Dr Randall Carolissen explained to parliament's Portfolio Committee on Higher Education, Science and Technology (Mungadze, 2020b). The new tender process was published by 4 September (Mungadze, 2020b; Ndaba, 2020; Van Schalkwyk, 2020). In November 2020 NSFAS announced that students would only receive their laptops the next year (2021) because of delays in the tender process (Sunday World, 2020). Higher Education, Science and Technology Minister, Dr Blade Nzimande expressed his regret. In January 2021, the laptop delivery date was set for March 2021. Again, the Minister expressed his regret. By this time universities equipped to do so, such as UCT, UJ, Wits, UFS and UP had provided laptops to their students with different arrangements to pay (Macupe, 2021).

To remove one of the key obstacles to effective remote learning, namely high data costs, the DHET and the Department of Communication and Digital Technologies (DCDT) negotiated with mobile network operators (MNOs). The upshot was that zero-rated websites were introduced that allowed students to access university websites, online services and some online study resources and avoiding any data costs (Van Schalkwyk, 2020). By June 2020 the total number of PSET institutions submitted for zero-ratings stood at 586 including the 26 universities. Although access to institutional websites was free, some of the embedded content including YouTube and videos may have been charged for, as indicated by Minister Nzimande (SAnews.gov.za, 2020).

In an article that reflected on the South African public university sector and the pandemic (Van Schalkwyk, 2020), an overview was provided of the financial implications that the operational and fiscal governors, the university councils, had to navigate. For example, the DHET was instructed by the National Treasury to reduce its budget by 20% (19 billion Rand). After negotiations the parties settled on a final reduction of 8% (9 billion Rand), from 116 857 billion Rand to 107 000 billion Rand. Money also had to be reallocated to accommodate reprioritised

expenditure for COVID-19-related activities, including student support and distribution of learning devices and data (Cele, 2020; Mafolo, 2020a). Most affected by the cuts were the expenditure on infrastructure grants and operational subsidies (Mafolo, 2020a; Van Schalkwyk, 2020). On 14 July 2020 the Deputy Director-General for universities again assured the Parliamentary Portfolio Committee on Higher Education, Science, and Technology that the number of funded students supported by NSFAS would not be affected by the budget cuts (Van Schalkwyk, 2020). Simultaneously, Minister Nzimande announced the allocation of an extra 4,1 billion Rand for additional student financial aid due the extension of the academic year (Van Schalkwyk, 2020).

4.6. WELCOMING BACK SOME STUDENTS ON CAMPUS

During the month of May 2020 there was an easing of the hard lockdown restrictions (Alert Level 4) with universities re-introducing face-to-face teaching for final year students in Health Sciences programmes requiring clinical training, which started with medicine students. Dentistry, nursing, and veterinary science followed suit (Van Schalkwyk, 2020).

In June 2020, the government announced Alert Level 3 which allowed for the reopening of universities. This process extended over approximately a month as different institutions announced different opening dates and staggered dates (Ngqakamba, 2020a; Van der Merwe, 2020). A maximum of 33% of the national student body was allowed to return to campus and residences on conditions of strictly adhering to COVID-19 health and safety protocols, including daily screening (Mafolo, 2020b). Preference was given to medical students and others doing clinical training, final year students and postgraduate students who required access to laboratories and technical equipment. Universities were also permitted to accept students in need to return to residences due to difficult home circumstances affecting their learning (Kanyumbai & Shabangu, 2021; Mafolo, 2020b). Conditions for staying in residences included strictly adhering to social distancing and sanitation protocols. For example, no visitors were permitted, and no gatherings were allowed (Kanyumbai & Shabangu, 2021).

The process of screening students and staff daily was eased by HH who developed a digital COVID-19 screening and mapping tool called Health Check for smartphones and laptops. The app made results available within 90 seconds of doing the test and classified the person into low-risk, medium-risk, or high-risk category. Those who tested negative received a barcode generated by the app, as proof of having done the test while the information of individuals classified as moderate and high risk, were included in national tracking and tracing process (Mafolo, 2020b). Volunteers from each residence were organised into COVID-19 response teams to oversee the daily screening and managed the students who showed symptoms. Other suggestions from HH included starting every lecture, tutorial and practical by establishing whether anyone present showed COVID-19 symptoms and setting up volunteer-manned screening stations on campus. By the beginning of July 2020, 20 universities had accepted back students with another six, including Sefako Makgatho University, University of Fort Hare, Mangosuthu University of Technology, Walter Sisulu University, Tshwane University of Technology, and the University of the Free State (UFS) allowing students to return at the end of August 2020 (Ngqakamba, 2020a).

In August 2020 the official lockdown was further relaxed when Alert Level 2 was announced. This permitted Higher Education institutions to reintegrate students to a level of 66%, including first-year students (Van Schalkwyk, 2020). International students outside the country's borders, however, had to wait for Alert Level 1 before they could return. Some universities such as UP maintained only online learning, while others allowed students to return to university residences as an act to ensure social justice (Ngqakamba, 2020b; Van Schalkwyk, 2020).

As the lockdown was eased to Alert Level 1 on 20 September 2020, all students were allowed to return (Department of Higher Education, Science, and Innovation, 2020; De Klerk, 2020). Universities were allowed 50% occupancy of their rooms and up to a maximum of 250 people indoors at a time. Higher Education institutions, however, encouraged students to continue their studies at home, if possible (Wits, 2020b; UP, 2020a). Guidelines related to extending deadlines for tuition and accommodation fees for the 2020 academic year for institutions, private

accommodation providers, NSFAS and fee-paying students were gazetted in October 2020 (Ngqakamba, 2020a). The Higher Education institution authorities continued to sound caution and adherence to COVID-19 protocols. However, despite these safety measures, by 22 September 2020, 1 979 cases of COVID-19 had been identified, including 1 215 staff members and 764 students (De Klerk, 2020). Of these, fifty-three people had died because of the virus infection - 44 staff members and nine students (Department of Higher Education, Science and Technology, 2020).

Come 2021, two things become clear: firstly, that COVID-19 still posed a threat and secondly, that universities would still not be able to institute face-to-face learning - at least not during the first quarter or first semester to allow adequate attention to be given to the new first-year students and introducing them to remote learning (Monama, 2021). Professor Ahmed Bawa from USAf stated that, although most institutions had opted to have first-year students on campus, it was to give them access to computers and not for face-to-face learning. UCT spokesperson Elijah Mohlola referred to "physically distanced learning" and added that “we have seen how difficult it was for many of our students to learn remotely for various reasons, including their social conditions” (Monama, 2021: online). To keep them safe, students were not required to share rooms in residences and strict adherence to COVID-19 regulations were enforced (Monama, 2021). It was also reported that the NSFAS first-year intake was restricted to 20 000 to prevent taxing the organisations needlessly.

As time went on, it became clear that the 2022 academic year would see students back on campus, but with strict and controversial directives. While many were against it, others considered mandatory vaccination of staff and students at universities as the only way to ensure their safe return to learning institutions (Sibanda, 2021a). In July 2021 the DHET announced a formal COVID-19 vaccination programme for staff in the PSET to be conducted under the guidance of HH (South African Government, 2021b). By October 2021 universities including UCT, UniS and UFS proposed vaccine mandates for students and staff (Sibanda, 2021b). Soon after that

Rhodes University (RU) followed suit (Mahomed, King & Mogashoa, 2021). This opened a debate on the rights of the individual versus the state, and rights related to health and safety as well as of religion (Mahomed, King & Mogashoa, 2021). By January 2022 UJ and the University of Western Cape (UWC) had also announced that they would not allow unvaccinated staff and students on their campuses. In reaction the SA Union of Students (SAUS), although in favour of voluntary vaccination, threatened to protest enforcement. It urged the Parliament's Portfolio Committee on Higher Education to intervene "in this matter before it gets ugly" (Macupe, 2022: online). This highly emotional and contentious issue (Mahomed, King & Mogashoa, 2021) required a balance between the rights of individuals who chose not to be vaccinated or disclose their vaccination status, and the universities' obligation to ensure a safe working and learning environment.

4.7. EXTENDING A HELPING HAND TO STUDENTS AND THE BROADER COMMUNITY

As part of their support strategies, several universities instituted COVID-19 relief funds to lend a hand to the NSFAS and DHET efforts. In May 2020 the Cape Peninsula University of Technology (CPUT) announced that their relief fund would help supply equipment such as laptops, data, special equipment, and e-books for the students to help them complete the academic year (Mlamla, 2020).

The Central University of Technology, Free State (CUT) in Bloemfontein's relief fund provided financial assistance, equipment, medical products, and services aimed at assisting vulnerable community members and CUT students (CUT, 2020). Until then the university's contributions to COVID-19 relief included financial or in-kind aid, for example, personal care products, food items, CUT-branded COVID-19 masks, and hand sanitizers. It also supplied tablets to students not receiving NSFAS support, who were not bursary recipients, did not receive postgraduate funding and were not being helped by the institution's official poverty alleviation programme within its Wellness Centre. This university also reached out to the community with food parcels for vulnerable community members, non-profit organisations, as well as CUT students and staff to

the value of R428 000. By September 2020, CUT announced in a paid article in the Sunday Times that its relief fund had received about R600 000 from outside donors and was able to support 371 students (Sunday Times, 2020).

By May 2020, the UniS had identified 800 students requiring assistance with remote learning (Mafolo, 2020b) and had supplied 1 500 laptops on loan, while a survey conducted by UCT (UCT 2020; Sonday, 2020) showed that most students had access to computers and plans were put in place to help the ones without. However, UCT's Black Academic Caucus criticized this survey for "not interrogat(ing) deeper issues surrounding students' circumstances such as quiet learning space, infrastructure, and other essential resources necessary for online learning" (Mafolo, 2020b: online). Unequal access to online technologies was speculated to be only one of many disparities that handicapped students (Mafolo, 2020b).

4.8. EXPANDING SUPPORT FOR STUDENTS' PSYCHOLOGICAL WELL-BEING

Throughout, the psychosocial well-being of the students remained a priority for Higher Education institutions as well as for students (Van Aardt & Sibanda, 2021) and not without reason. Even prior to the pandemic, students worldwide have been considered a vulnerable population due to high incidences of anxiety, depression, substance abuse, attempted suicide, suicide and other mental ailments. The fact that South Africa's rate of about one in four students battling psychopathological issues or receiving psychotherapy, and being significantly higher than the norm, was particularly concerning (Govender, Reddy & Bhagwan, 2021; Olawale, Mutongoza, Adu, & Omodan, 2021). In general, women, people with alternative sexual orientations and students with disabilities tend to be most vulnerable (Govender, Reddy & Bhagwan, 2021). During the pandemic, having to continue their learning in an unfamiliar mode with a taxing socio economic context of poverty, personal, familial, and communal challenges, as well as infrastructure deficiencies, put additional strain on people's mental health (Luescher, *et al.*, 2020). A study of student's returning to their residences at different campuses across the country revealed that this group also exhibited high stress levels because of isolation, mastering remote

learning, adhering to hygiene and sanitation regulations, boredom, a lack of resources and personal protective equipment (e.g. masks) and inadequate connectivity (Kanyumbai & Shabangu, 2021).

The sudden upheaval in students' academic and personal lives combined with social distancing, isolation, financial worries and in many cases inadequate technical support from universities left students (particularly marginalised students) rudderless and anxious. Additionally, authorities and health professionals were left concerned for students' mental health (Govender, Reddy & Bhagwan, 2021; Hernández & Sancho-Gil, 2021; Luescher, *et al.,* 2020). Mbijekana's (2021: online) description of her emotional state while living with family friends in an area with inadequate connection and having to go to the local clinic every day to access the university's student portal is evident from the following:

> *I was always crying to my mother because I never had free time. I had so many deadlines and so much stress that I lost a lot of weight during lockdown. I had sleepless nights while trying to meet deadlines, and struggled with mobile signal every day … I lost so much weight due to stress and unhealthy sleeping habits. I thought about dropping out every day, but I couldn't because I did not want to disappoint my mother. My mental health was unstable, I was suicidal and not motivated at all. I just did what I could. I lost interest in school, the course I was doing and everything.*

Moreover, for many students from problematic home lives, the university was a safe space and the residences their homes (Cloete, 2020). When told to vacate and go home, some students did not have homes to go to. The study by Govender, Reddy and Bhagwan (2021) also highlighted the disconnect students experienced being away from campus and its resources. Students felt isolated and disoriented from a lack of structure in their lives. Furthermore, students also missed the personal contact with staff and their peers (Govender, Reddy & Bhagwan, 2021; Visser & Law-van Wyk, 2021). In the communal context of South Africa and in particularly at the rural

universities, the university environment has traditionally strengthened social ties and satisfied the universal need to belong to a community (Olawale, Mutongoza, Adu, & Omodan, 2021). The changes to learning and personal lives of students resulting from policies and regulations to curb the COVID-19 pandemic, the lack of resources and dearth of psychosocial wellness programmes at these institutions altered rural university life, thus, significantly impacting on their psychosocial well-being (Olawale *et al.*, 2021). However, one of the most profound effects of the pandemic was the fast-tracking of digital transformation of Higher Education forcing universities to develop virtual communities (Kanyumbai & Shabangu, 2021).

In an attempt to address the issue of student well-being early in the lockdown, the DHET agency HH, introduced a dedicated and toll-free student mental health support service. This service was available 24/7 and was run by a team of psychologists, social workers and counsellors from the South African Depression and Anxiety Group (Higher Health, 2020). Higher Education institutions also expanded their psychosocial support services and resources (Moja, 2021). Worldwide, during the lockdown periods, most universities declared their students' support services as essential services providing primarily counselling, academic support, and health-related services (Schreiber *et al.*, 2021). Interestingly, in Africa, student accommodation and related catering and retail services were less frequently declared essential than elsewhere in the world, while academic support featured slightly more (Schreiber *et al.*, 2021). However, most universities were new to online tutoring and mentoring and did not have online systems of support in place. This was speculated to be jeopardising academic careers (Cloete, 2020).

Student support, including psychosocial assistance which had existed at all universities prior to the pandemic to a more or lesser extent, were run as wellness centres or wellness services (Linden, 2020) managed by the human resources departments (University of Fort Hare, n.d.). This had to be augmented to cater for the students' increased and altered needs. For example, the Wellness Centre of the Central University of Technology, Free State (CUT), according to the university's website, assisted 334 students with poverty relief, meal vouchers, and postgraduate

support to the value of R521 104 during the first five months of 2020. Additionally, the centre offered online counselling services to students (CUT, 2020).

Other innovative ways to support students' well-being and psychosocial health introduced during lockdown included the use of the institutions' websites and social media to disseminate information. An example is the University of Limpopo (UL) who published an interview with clinical psychologists on building mental resilience in the fight against COVID-19 (Maake, 2021). The UFS put the student counselling unit's Facebook page to use linking students with qualified psychologists and creating a safe and confidential space for informal chats and individual online sessions on navigating the pandemic and related stress and fear (Linden, 2020). The UniS's centre for student counselling and development also provided services virtually and telephonically and offered an online support series (#supportUS) on the student affairs' Facebook and Instagram platforms. In April 2020 alone, these UniS centre's posts had reached 61 591 people on Facebook with 15 443 post engagements (UniS, 2020a). A grant by an overseas philanthropic non-profit organisation financed additional academic and psychosocial support for students who were vulnerable and at risk (Seleka, 2020); (UniS - Phambili, 2020).

Another innovative project was the one launched at UP involving the concept of "flocking" (UP, 2020b). Although this project is usually run for the youth by the Regional Psychosocial Support Initiative (REPSSI), it was made available for students under the guidance of the Director of the UP's Resilience Study Centre, Liesel Ebersöhn. She explained that 'flocking' relates to behaviours typical of the Ubuntu philosophy, namely building strong social structures and sharing social resources to encourage connectedness and face challenges collectively (UP, 2020b).

As mentioned earlier, HH (the national agency that develops and implements health, wellness, and psychosocial services in Higher Education) was tasked to advise on, and train PSET healthcare workers and support staff in relation to COVID-19. The HH developed guidelines for managing and responding to mental health and substance abuse in relation to the pandemic (Higher Health,

2020). The document suggested that Higher Education institutions with student counselling and support units in place, should put these to use in dealing with the COVID-19 pandemic and mental health response to it. To support the efforts of the institutions with inadequate resources, HH hired clinical and counselling psychologists to provide mental health support to students and staff. The guidelines emphasised that Higher Education institutions should encourage students to follow a healthy lifestyle, introduce a routine to their day, do physical as well as relaxation/meditation exercises and stay in contact with their social network within the parameters of social distancing regulations. The guidelines also dealt with more delicate topics such as relationships and sex.

4.9. TACKLING STUDENT FOOD INSECURITY

Notwithstanding diligence in the HH mental health support guidelines, the document did not mention the term 'eating habits' at all. The word 'food' appeared only once, and in relation to the lack thereof causing students' stress. This is both surprising and confounding considering the long history of student food insecurity and the constant voicing of the problem even before the pandemic (Luescher, *et al.*, 2020; Mafolo, 2020c).

One of the organisations that has long fought the battle to alleviate student food insecurity, the Dullah Omar Institute, based at the UWC, in partnership with the Centre of Excellence in Food Security, organised two webinars in September and October 2020. The aim of the webinars was to explore the topic of COVID-19 and student hunger (Centre of Excellence in Food Security, 2020; Mafolo, 2020c). Participants highlighted that although feeding projects existed on campuses, such as UJ's Stop Hunger Now project, little data and no overarching plan or legislative framework existed to address students' food insecurity (Mafolo, 2020c). Furthermore, Higher Education institutions were under no legal obligation to relieve student hunger (Mthethwa, 2021) - this despite research showing that the already prominent levels of student hunger in South Africa compared to other parts of the world, had been amplified by COVID-19 (Macharia, 2021; Mafolo, 2020c).

Still, several universities did incorporate feeding programmes in their COVID-19 student support initiatives. These were mostly supported by private donors and alumni on an ad-hoc basis (Patrick, 2021). Examples were: UCT (food vouchers), Tshwane University of Technology (TUT) and UKZN (free meals at the cafeteria), Wits (food programme, food gardens, daily meal project and a food bank) and Durban University of Technology (DUT) (a food drive organised by second-year food and nutrition students) (Mthethwa, 2021; Peters, 2021; Wits, n.d.). On noting a significant increase in students needing more than psychosocial services, the Counselling Unit of UFH organised a food and clothing drive. This was in addition to the existing food parcels provided to unfunded students (Linden, 2020). According to a spokesperson for NWU's student support services, applications for food packs, also from NSFAS students who had not received their funding timeously, had almost doubled by March 2021 (Mthethwa, 2021). During a Western Cape legislature's ad hoc committee meeting on Covid-19 in 2021, CPUT's Professor Mellet Moll indicted that during recess periods the student feeding schemes were not effective (Payne, 2021). These food-insecurity-related interventions were introduced to plug holes and retard the acceleration of a problem stemming from long before the COVID-19 pandemic.

4.10. CONCLUSION

Broadly speaking, the South African government's initial attempts at slowing down the spread of the COVID-19 pandemic in March 2020, was quick and decisive. The lag of three months before the first COVID-19 case was diagnosed in this country, gave the authorities leeway to learn from the experiences of the differing responses in Asia, Europe, and the USA (Staunton, Swanepoel, & Labuschaigne, 2020). Whereas at the outset the public tended to have faith in the South African government's response to the pandemic, over time the trust waned to where, by the end of 2021, distrust and suspicion had surfaced manifesting as non-obedience (Wasserman & Madrid-Morales, 2021). This defiant attitude also revolved around the vaccination drive. Criticism of the government's response to the corona virus included it declaring a state of emergency, seemingly devaluing certain human rights under the Bill of Rights "with the exception of those non-derogable human rights expressly contained within Section 37(5), which includes the rights to

dignity, life, and a fair trial". The country's already struggling national economy was further strained as a result of some controversial decisions such as the tobacco and alcohol ban; criminalising non-compliance; not adequately collaborating with civil and scientific role players; jeopardising healthcare systems heaving under high incidences of HIV-Aids, TB, lifestyle diseases and comorbidities as well as crime casualties (Staunton, Swanepoel, & Labuschaigne, 2020).

However, the one refrain that was most heard from the media, socio-political commentators, and researchers, was that the national strategy and the hard lockdown had not adequately taken cognisance of the citizens' socio-economic realities (Staunton, Swanepoel, & Labuschaigne, 2020). The pandemic itself has not triggered socio-economic hardships but has amplified the historic and present-day inequalities of a deeply fractured society. This was also evident in the consequences that followed the Higher Education sector's response to COVID-19 (Staunton, Swanepoel, & Labuschaigne, 2020; Paterson, 2021).

In their assessment of the leadership responses to the pandemic at two Higher Education institutions, Kele & Mzeleni (2021) asserted that South African universities had demonstrated the ability and willingness to adjust and innovate towards becoming a social justice-oriented university guided by the ethos of Ubuntu and pursuing equitable access to Higher Education. Universities had taken into consideration the overall well-being of vulnerable students including their needs for food, transport, laptops, data and flexible learning and teaching programmes. Yet, the authors observe "the process of social justice is full of contradictions" as illustrated by several paradoxes (Kele & Mzeleni, 2021: 1). An example was requiring students to vacate residences for their own safety, yet forcing them into unsafe, inadequate learning spaces. Another example was supplying laptops and data to facilitate remote learning without a guarantee of reliable power and connectivity.

Schreiber, Luescher, Perozzi, & Bardill Moscaritolo (2021: vi) pointed out that it is the student assistance services at universities that should get credit for:

> *responding to and mitigating the impact of Covid-19 on the learning and development context, by supporting the change to virtual learning, providing digital access and support for online learning competencies, maintaining safe spaces on campuses conducive to learning and development, reaching out to rural students and supporting poor students, offering personal, academic, and social counselling and health care, and responding swiftly and innovatively to the various needs of students and the institution.*

SASCO, they argued, held an influential position as mediator in the dynamic interplay of the students and the four systemic-contextual factors that affect their learning. These four factors need to be integrated to effectively support a student, as they actively and simultaneously shape the environment and each other (Schreiber *et al.*, 2021).

The consequences of the Higher Education institutions' responses to the pandemic illustrated the importance of the interplay among the personal, social, institutional, and macro systems as illustrated in UKZN political science student, Thobani Zikalala's, less than charitable, comments during an online seminar held in June 2020. He accused Higher Education institutions of prioritising business over learning and being out of touch with the lived experience of students (USAf, 2020). Zikalala considered the online learning strategy as favouring "a privileged cohort of students" and not considering poorer areas where internet connectivity is inadequate:

> *My home is where eight of us share a two-roomed structure. When you say you are moving the classroom into that space, what are you saying about my academic career? You're saying I must study in the space where, while in a Zoom class, I must rush outside to go and collect water... This is the reality of the South African student -- especially the poor, black majority (Universities South Africa (USAf), 2020: online).*

Many of the errors and oversights attributed to the Higher Education institutions in their handling of the pandemic resulted from factors outside the institutions' sphere of influence and were the upshot of broader societal problems and macro-infrastructure challenges (Luescher *et al.,* 2020). Another factor that thwarted students was the deep-rooted culture of corruption in the country (Friedman, 2020). This was evident in the NSFAS laptop-tender debacle (Ndaba, 2020).

However, Schreiber *et al.* (2021: v) stated that the results of their survey generated from 781 responses of student affairs practitioners worldwide, of which 118 were from the African continent, indicated that "African universities provided much more frequently than elsewhere in the world". Being cognisant of poor students and those in remote areas being the worst affected, and often found themselves in social community environments that have "toxic social norms" rendering a home environment unconducive to learning, they provided "direct and targeted" support. This kind of support stretched beyond facilitating online learning and is "in line with the social justice mandate of universities" (Schreiber *et al.,* 2021: vi; Luescher *et al.,* 2020).

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CHAPTER 5

Food security and dietary intake of a cohort of South African students during the COVID-19 pandemic

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ABSTRACT

Introduction and aim: Food insecurity among students was a global concern, even before the onset of the COVID-19 pandemic. During the pandemic containment measures had a negative impact on economies, which in turn negatively impacted the food security of citizens. The paper investigated the food security and dietary intake of a cohort of South African students, as well as the awareness and utilisation of institutional support services related to nutrition.

Methods: A mixed method study was performed with questionnaires and focus group discussions amongst final year students from four Health Sciences courses at a university of technology. The focus group discussions built on the data that was obtained from the questionnaires to provide a richer context of the situation.

Results: Most (82%) of the questionnaire participants *(n=148)* and all the focus group participants *(n=17)* were females. Participants were mainly living in urban areas (76%) during the pandemic and only 36% had parents/guardians at home. Food insecurity existed at varying levels, with more participants from rural areas classified as food insecure. Findings indicated that 16% of questionnaire participants were food secure during the pandemic, 54% experienced mild food-insecurity, 28% experienced moderate food insecurity and 2% experienced severe food insecurity with intermittent eating patterns and reduced food intake. The main reason for food insecurity was financial restraints. Adequate water was available to participants during the pandemic. Results on dietary intake obtained with the questionnaire and focus group discussions were different, with no clear reason. In the questionnaire, participants reported that their dietary intake changed during the pandemic, with a decrease in sugary and salty snacks, and maintenance of starch, fruit, vegetables, and meat intake. In contrast, results from focus group discussions indicated an increase in the intake of starchy food such as noodles and binge eating that was ascribed to being emotionally unwell during the pandemic. Changes to intake were attributed to limited availability of food and limited resources, e.g. money and electricity. Few participants were aware (18%) or utilised (1%) relevant support services that were offered at the institution during the pandemic.

Conclusion: The ICE environment that resulted from the COVID-19 pandemic negatively impacted on the students' nutritional status, especially food security. Institutions should increase awareness and efficacy of relevant support services in an attempt to maintain food security and nutritional status during future ICE events.

Keywords: COVID-19, Higher Education, ICE environment, Health Sciences students, food security, nutritional status

5.1. BACKGROUND

In December 2019, a novel coronavirus (SARS-Cov2) emerged which led to a global pandemic of acute respiratory syndrome in humans (COVID-19). The pandemic led to widespread challenges and suffering, due to amongst others isolated, confined, and extreme (ICE) environments likened to situations brought about by space travel and polar expeditions (Suedfeld & Steel, 2000). The COVID-triggered ICE environments resulted from the extreme regulations enforced to limit the spread of the virus. Such regulations included social distancing, movement restrictions, travel bans, as well as temporary closure of education institutions and non-essential businesses. The period of these strict restrictions was also referred to as 'lockdown' (Devereux, Béné & Hoddinott, 2020; Staunton, Swanepoel & Labuschaigne, 2020).

In South Africa, the government initially imposed an abrupt, "hard" lockdown with strict regulations for a period of six weeks. This hard lockdown demanded a complete halt of all economic and other activities except for essential services (life supporting businesses). The main aim of the extreme restrictions during hard lockdown was to enable the country to upgrade health care facilities while limiting the infection rate. Once the medical facilities were in place and infection rates decreased, the government eased the lockdown regulations by means of a five-level COVID-19 alert system (South African Government, 2020).

The mentioned regulations had a substantial impact on the workings of the state and the economy. However, on a more individual level it impacted the lives of the citizens with sudden unprepared lifestyle changes, increased anxiety, and lack of income (Di Renzo, Gualtieri, Cinelli, Bigioni, Soldati, Attinà, Bianco, Caparello, Camodeca, Carrano, Ferraro, Giannattasio, Leggeri, Rampello, Lo Presti, Tarsitano & De Lorenzo, 2020). In developing countries such as South Africa, the pandemic exacerbated an already burdened country where meeting the basic needs of the underprivileged population was a challenge, even before the pandemic occurred (Workie, Mackolil, Nyika & Ramadas, 2020). Moreover, early research during the pandemic indicated that the COVID-19 containment measures already had a negative impact on economies globally, which negatively impacted the food security of citizens (Anelich, Lues, Farber & Parreira, 2020; Devereux, Béné & Hoddinott, 2020).

The results of international studies investigating food security early during COVID-19 indicated an increase in food insecurity and a change in dietary intake, especially in rural and low-income households (Anelich, Lues, Farber & Parreira, 2020; Movahed, Fard, Gholamrezai &Pakravan-Charvadeh, 2022). During the pandemic many reported that food insecurity manifested as running out of food, not having money to buy good-quality food or any food at all, as well as being anxious about having enough money to buy food (Mukigi & Brown, 2018).

Food security is present “when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life” (HLPE, 2020: online). According to the FAO, food security includes the six dimensions: availability, access, utilisation, stability, agency, and sustainability (HLPE, 2020). The six dimensions can be briefly explained as follows: (1) Availability refers to having a quantity and quality of food sufficient to satisfy the dietary needs of individuals. (2) The access dimension includes economic, social, and physical access meaning that everyone (including vulnerable groups) obtains sufficient food without compromising other basic needs. (3) Utilisation entails meeting physiological needs with a sufficient diet, safe water, sanitation, and health care to

maintain nutritional well-being. (4) Stability refers to the ability to maintain food security despite events like sudden shocks (e.g., an economic or health crisis such as COVID-19) or cyclical events (e.g. seasonal food insecurity). (5) Agency entails the capacity of individuals or groups to act independently on choices like food intake, food production, processing, and distribution, as well as engagement in policy processes relevant to food systems. (6) Lastly, sustainability means food system practices should contribute to long-term regeneration of natural, social, and economic systems, to ensure that the food needs of the present generations are met without compromising the needs of future generations (HLPE, 2020). Food security dimensions of individuals and groups can be measured by using a number of metrics, such as self-reporting surveys (Coates, Swindale & Bilinsky, 2007; Marques, Reichenheim, De Moraes, Antunes & Salles-Costa, 2015). It should be noted that different metrics measure different aspects of food security. As result, the findings from the different metrics cannot be compared with each other (Vand den Berg & Walsh, 2023).

Metrics that have been used by previous studies to examine food insecurity and hunger amongst South African students include: a single-item measure, an 8-item Household Food Security Survey Module (HFSSM), household hunger subscale (HHS) and the Household Food Insecurity Access Scale (HFIAS) (Kassier & Veldman, 2013; Rudolph, Kroll, Muchesa, Manderson, Berry & Richard, 2018; Van den Berg & Raubenheimer, 2015; Wagner, Kaneli & Masango, 2021).

HFIAS is a popular tool to examine food security access amongst diverse cultures and is often utilised within the context of South Africa amongst individuals from different age groups (Coates, 2004; Coates, Swindale & Bilinsky, 2007; FANTA, 2004). According to the HFIAS, food security categorised as food secure, mildly food insecure, moderately food insecure, and severely food insecure. The categories can be summarised as follows: food secure individuals are those who have consistent access to adequate food. Mildly food insecure individuals experience anxiety over food sufficiency. Moderately food insecure people have inferior quality, less variety and choice but still have a sufficient food intake, while severely food insecure refers to irregular eating patterns and reduced food intake.

This paper utilised the HFIAS food insecurity scale to enhance the understanding of the pandemic's impact on food security of individuals and groups left vulnerable by COVID-19 (Devereux, Béné & Hoddinott, 2020). The current paper investigated the food security and dietary intake of a cohort of South African students as a vulnerable group of citizens. Food insecurity among certain students was a global concern, for lower- and middle-income countries, even before the onset of COVID-19 (Cady, 2016; Cheong, 2021; Fortin, Harvey & Swearingen White, 2021; Payne-Sturges, Tjaden, Caldeira, Vincent & Arria, 2018; Van den Berg, Abera, Nel & Walsh, 2013).

In South Africa, food insecurity rates of between 11% and 38% has been evident amongst students from Wits university in 2019 based on HFIAS findings (Wagner, Kaneli & Masango, 2021), while rates up to 86% were found amongst students of UFS in 2013 by utilising a single item measure and the HFSSM (Van den Berg & Raubenheimer, 2015). Food insecurity has various impacts on students, ranging from poor academic performance to nutrient deficiencies, and even death, therefore student food security is crucial for their quality of life and academic success (Banerjee, Radak, Khubchandani & Dunn 2021; Broton, 2017; Goldrick-Rab, Richardson, Schneider, Hernandez & Cady, 2018; Van den Berg & Raubenheimer, 2015).

Although the South African government attempted to assist vulnerable citizens with finances and food parcels during COVID-19, evidence on the efficiency thereof in preventing food insecurity is not clear. Additionally, many Higher Education institutions assisted students with resources such as support services, money, and mobile data (Macupe, 2020; Mungadze, 2020). There is limited data to confirm that these resources and support services were adequate to maintain students' health and well-being is lacking. Moreover, since students were studying online under isolated, confined, and extreme circumstances instead of being on campus, their awareness and access to support services were affected.

The objectives of this study were to assess food security dimensions relating to the availability, access, and utilisation of food to describe student food security during COVID-19; to examine their dietary intake based on food frequency; to explore the students' awareness and utilisation of nutrition-related support services; and lastly, to investigate the possible associations between socio-demographic variables and categories of food security. The health industry plays a crucial role in the community, and even more so during a pandemic (Fenton, Brown & Bastida, 2023), which is the motivation for selecting the students from this industry as population of the study.

5.2. METHODOLOGY

The methodology referred to in this section links with the overarching methodology described in Chapter 2 of this study. The selected methodologies pertaining to this chapter are discussed in the following sections. Focus group discussions and questionnaires were utilised as methodologies in this exploratory study. Moreover, the two methodologies were applied by means of a concurrent mixed methods design (Tashakkori & Teddlie, 2010). As a result, the focus group discussions provided more detailed, qualitative data to build on the quantitative data from questionnaires and to provide a richer context of the situation. The study was approved (refer to appendix E) in terms of ethical requirements by the Health Sciences Research Ethics Committee (UFS-HSD2021/0762/21). The study population was the Health Sciences students in their final years of study during 2021 at a University of Technology in the Free State province of South Africa.

5.2.1. Data collection

No sampling was performed for the questionnaire and the entire population was included and invited to participate in the questionnaire. Health science students were invited to participate via the institutions' online platform and invitations included a link to the electronic questionnaire. The electronic questionnaire was available for completion on the online QuestionPro platform. All participants provided informed consent to participate and did not have access to the questionnaire without first providing written consent (refer to Appendix B).

The questionnaire included sections on sociodemographic information (gender, age, course, residency place and details during COVID-19, as well as history of COVID-19 status), food security status (based on HFIAS), dietary intake, as well as nutrition-related support services at Higher Education institutions.

Food security was assessed using the HFIAS (Coates, Swindale and Bilinsky, 2007) which is commonly used to examine food security amongst diverse cultures, similar to the current study's population (FANTA, 2004; Coates, 2004). The original scale aims to measure the access components of household food insecurity, although some insight is presented on components such as utilisation. Furthermore, the scale consists of nine questions related to three different domains of food insecurity (access). The adapted version used in the current study had an additional two questions, on the access of water which also covers the utilisation domain of food security. Instead of investigating the food security of the past 30 days (as in the original scale), the scale was adapted to focus on the period during the COVID-19 pandemic including lockdown periods. The answer options were categorised into frequency options as follows: Never (not even once), Rarely (1-2 days per month), Sometimes (> 2 days but <10 days per month) and Often (> 10 days per month). Based on the scoring of the questions the HFIAS categorises household food security in four categories: food secure, mildly food insecure, moderately food insecure, and severely food insecure. Therefore, this section aimed to capture the changes to the students' food access and availability during the pandemic.

Dietary intake was investigated in the third section of the questionnaire and comprised of questions adapted from those included in the SADHS (Department of Health, 2007). This tool was used within the context of South Africa before (Nwosu, Fismen, Helleve, Hongoro, Sewpaul, Reddy, Alaba & Harbron, 2022) with the original SADHS tool consisting of a 30-item food frequency questionnaire. These 30 items were merged into a 16-item questionnaire for the purpose of the current study, by combining similar food items together into groups all questions were still covered (refer to Appendix C). A shorter food frequency table limited the length of the

questionnaire used in the study. This third questionnaire section contained the compressed food frequency table aimed at assessing changes in the students' dietary intake, from before COVID-19 and during the pandemic period. Participating students had to indicate a change in intake frequency for each item, if any. The answer options for frequencies included: Decreased intake (Daily intake, Weekly intake, or Monthly intake), No change in intake or Increased intake (Daily intake, Weekly intake, or Monthly intake). The final section of the questionnaire aimed at investigating the awareness and utilisation of the support services that were available at the specific higher education institutions during the pandemic (refer to section 2.4. of chapter 2).

The purpose of the section that investigated the institutional support services (also known as wellness centres or services) were to determine whether students' food security and dietary intake were influenced by the available support services that included poverty relief and meal vouchers (CUT, 2020). Additionally, data from this concluding section assisted to assess whether a need existed for additional support services. Therefore, information from this section provided direction for institutions to support students during future ICE events. As mentioned, the focus group discussion probed responses that were obtained with the questionnaire and included discussions on the following topics: food security, dietary intake and support services.

Systematic random sampling was utilised to select participants for focus group discussions. This selection was conducted by selecting every x^{th} student from class lists, whereas x being the target population divided by the desired sample size. Six to eight participants were recruited per focus group session, while two to three participants participated in the focus group discussions. Six semi-structured focus group discussions were held guided by a discussion schedule. The schedule included probes on the access to food and water during the pandemic, as well as changes in dietary intake during COVID-19. Additionally, awareness of available support services was probed and suggestions for support services and assistance during similar future events were queried during discussions.

Pilot studies were conducted prior to the questionnaires and the focus group discussions' data collection, although it is not essential to pilot qualitative data collection instruments such as discussion guides. These pilot studies were performed to ensure quality and to determine whether the tools were able to obtain the required data. Additionally, the validity of the questionnaire as quantitative data collection tool, as well as the trustworthiness of the focus group discussions as qualitative data collection tool were addressed. The validity of the questionnaire was confirmed by using a combination of existing data collection tools, as well as performing a reliability test on the questionnaire Likert-scales by means of Cronbach Alpha values (Tavakol and Dennick, 2011). According to the Cronbach alpha values all the questionnaire sections showed good internal consistency and reliability.

The following aspects were dealt with to ensure trustworthiness of this research study: credibility, confirmability, transferability, reliability, and dependability (Noble & Smith, 2015; Onwuegbuzie & Combs, 2011). The following measures were included to address the credibility and confirmability of the study: sufficient involvement of the researcher, triangulation of data collection methods and data, critical interview with peer members, and member checking during focus group discussions. Furthermore, the transferability was improved by detailed record keeping, a clear decision trail, as well as consistent and transparent data analysis and interpretation (Noble & Smith, 2015). Reliability was improved by utilising existing data collections tools to underpin probes of the focus group discussion, as well as questionnaire items. Moreover, triangulation increased dependability of the study findings.

5.2.2. Analysis of data

Data analysis was performed according to Vogl's (2018) mixed methods process. This analysis served a dual purpose of complementarity and expansion, where the data from the focus group discussions and literature reviews provided elaborative detail and contextualised the data. Data analysis included basic analysis in isolation and a process of mixed analysis (Vogl, 2018).

The IT Statistical Analysis Unit at Central University of Technology, Free State (CUT) assisted with quantitative data by utilising SPSS software. Descriptive statistics were calculated and included: frequencies and percentages (for categorical data), as well as means and standard deviations (for symmetrical numerical variables). Additionally, non-parametric statistics and correlation analysis were performed on quantitative data to investigate correlations between food security and demographic data.

The parametrical statistics were preceded by normality and reliability assessments of variables. The Shapiro-Wilk test was used for the normality assessment and the Cronbach alpha for reliability assessment (Laerd Statistics, 2019; Tavakol and Dennick, 2011). A normal distribution is evident when the p-value > 0.05. The results from the Cronbach's Alpha calculations for the food security section were 0.909 for the nine HFIAS items. As is evident from the results all variables were higher than 0.804, indicating an acceptable level of reliability (Laerd Statistics, 2019).

The analysis of the qualitative findings collected from the focus group interviews was based on the thematic analysis methodology (Maguire & Delahunt, 2017). This analysis is a qualitative descriptive method for identifying, analysing, and reporting patterns/themes within the discussion content. The analysis was conducted according to the process described by Maguire & Delahunt (2017), whereas ATLAS.ti9 software facilitated the manual thematic analysis that consisted of a three-coding framework (including two stages of coding, content analysis and ethnographic analysis). As a result, context-specific themes emerged from the qualitative data, some of which were aligned with the discussion schedule's probes. Thematic saturation was reached already with focus group two, after which no new themes were identified.

5.3. RESULTS

5.3.1. Sociodemographic information

A total of 289 students accessed the questionnaire (table 5.1.). Interestingly, 130 questionnaires were viewed by participants who consequently decided not to participate in the study. As a result, 100 complete and 59 incomplete questionnaires were obtained. The majority (49) of the incomplete questionnaires were usable. A completion rate of 68,9% was achieved and an average of 10 minutes were used to complete the questionnaire. A total of 17 students participated in the six focus group discussions.

Table 5.1. Questionnaire responses *(n=289)*

DESCRIPTION OF RESPONSES	NUMBER OF RESPONSES	INCLUDED IN THE STUDY
Questionnaires completed in full	100	Yes
Incomplete questionnaires	49	Yes
Incomplete questionnaires	10	No
Total responses included in the study = 159		

The majority of the questionnaire participants *(n=148)* were female (82%), while only 18% were males. Focus group participants *(n=17)* were all females. Participants of the questionnaire survey *(n=149)* were unevenly spread across the four courses of Health Sciences, namely: 4% from Biomedical Technology, 30% from Clinical Technology, 40% from Radiography and 26% from Somatology. Similarly, the distribution of focus group discussion participants *(n=17)* across courses were skewed, with 94% being from the Somatology and 6% from the Clinical Technology course. While focus group participants were randomly selected equally from the four courses as described in section 5.2.2., not all the selected participants showed up for the discussions. The age of participants *(n=149)* was between 20 and 35, of which 88% were in their early twenties (<25years).

Questionnaire participants *(n=149)* resided either at home, or in on-campus or private accommodation. More than half of the participants were residing at home, either with

parents/guardians who assisted with purchasing of groceries (36%) and cooking or without parents/guardians (33%). The rest of the questionnaire participants spent most of the COVID-19 period in campus or private residences where more often no meals were included (30%), whilst few residence students received meals (1%). In addition to the institution requesting students to vacate residencies, focus group participants indicated that a lack of income was also a reason for students to return home, as parents could not afford two households.

When considering the area where students resided during COVID-19, 76% stayed in urban areas (town/city) and 24% in rural areas. Despite students from rural areas indicating that their location resulted in limited grocery stores and issues with stock in the stores, it was also highlighted during focus group discussions that certain students from these areas had the privilege to plant and produce their own fresh vegetables. However, it was expressed that this was on a small scale and delivered limited produce.

5.3.2. Food security

In the quantitative questionnaire method of the study, data from the HFIAS questions assisted to calculate four types of indicators that helped to understand the characteristics of and changes in household food insecurity (access) amongst the surveyed population *(n=140).* These indicators provided an overview on: Household Food Insecurity Access-related Conditions, Household Food Insecurity Access-related Domains, Household Food Insecurity Access Scale Score and Prevalence.

5.3.2.1. Household food insecurity access-related conditions

This selection of findings reflects specific, disaggregated information about the behaviours and perceptions of the surveyed students as obtained from the questionnaires *(n=141)*. Therefore, each indicator is presented separately in Table 5.2. to illustrate the frequency of experiencing the conditions. While many (70%) students worried about not having enough food and fewer (27%) students experienced having no food in their homes, all these students are then classified as food

insecure despite the varying levels of severity. A noteworthy observation is that 29% of participants reported going to bed hungry some nights, whereas half of the participating students (50%) had to cut down on their daily number of meals.

Table 5.2. Students' food insecurity access-related conditions and domains including frequency (*n=141*)

Household Food Insecurity Access-related Domains	Questions enquiring **how often** students **experienced the following during COVID-19**	**Never (not even**	**Rarely (1-2 days per**	**Sometimes (> 2 days**	**Often (> 10 days per**
Category 1: Anxiety &uncertainty about food supply	1. Worry that you would not have enough food	30%	28%	31%	11%
	Totals for the category:		**30%**		**70%**
Category 2: Insufficient Quality (includes variety and preferences of food type)	2. Unable to eat the kinds of foods you preferred because of a lack of resources	31%	23%	29%	16%
	3. Ate just a few kinds of food day after day because of a lack of resources	32%	29%	26%	12%
	4. Ate food that you preferred not to eat because of a lack of resources to obtain other types of food	37%	31%	20%	12%
	Totals for the category:		**33%**		**67%**
Category 3: Insufficient food intake and its physical consequences	5. Ate a smaller meal than you felt you needed because there was not enough food	46%	28%	20%	6%
	6. Ate fewer meals in a day because there was not enough food	50%	22%	21%	7%
	7. Went to sleep hungry because there was not enough food	71%	21%	6%	2%
	8. Went a day without eating anything because there was not enough food	80%	14%	4%	2%
	9. No food at all in your household because there were no resources to get more	73%	21%	5%	1%
	Totals for the category:		**65%**		**36%**

It should also be noted that the students who had food could not necessarily eat what they preferred, but had to opt for what was available, as per results from questions 3 and 4. Similarly, focus group results showed that although students may have had adequate food, it was not necessarily the type of food they used, or preferred to consume. A probable reason may be the lack of variety available in retail outlets as focus group participants indicated, as well as limited financial funds and area of residency. Related statements from focus group discussions include:

> *"…it (food) was not what we used to eat when our parents were going to work." FG1:SP* (sic)
>
> *"…most of that (fruit and vegetables) was like finished in the shops." FG2:V* (sic)
>
> *"…they couldn't go out and go look for jobs…so they relied on the government for food parcels." FG2:V* (sic)

Therefore, the findings clearly indicate that hunger could not be prevented and certain students experienced food insecurity during COVID-19, at various frequencies, despite the government and institution's available assistance.

5.3.2.2. Household food insecurity access-related domains

The HFIAS questions relate to three different domains of food insecurity (access): 1. anxiety and uncertainty about the household food supply; 2. insufficient quality (includes variety and preferences of the type of food); 3. insufficient food intake and its physical consequences. Hence, findings were clustered into these three domains to provide insight into each domain. Table 5.2. presents the clustered findings with the percentage of participants that responded affirmatively to each question, regardless of the frequency of the experience. Thus, the percentage of participants who experienced the condition at any level of severity.

It is evident that anxiety and uncertainty about food supply often occurred amongst students (category 1), with 70% of students worrying about their food supply during COVID-19. Findings

suggest insufficient quality (category –) - including variety and preferences of the type of food - that was experienced by 67% of students. While this indicates food insecurity without definite hunger, the impact of inadequate quality of food remains a concern. Findings from focus groups are aligned with this, and statements included were:

> *"My food intake changed drastically." FG1:V* (sic)
> *"A lot, a lot of starch." FG2: V (sic)*

Category 3, insufficient food intake and its physical consequences, includes more serious food insecurity factors such as hunger. In comparison to category 2, this dimension's percentage of occurrence was lower. However, findings indicated that more than one third (36%) of students experienced a lack of food intake during COVID-19.

Moreover, the domains indicate a ranking of severity with category 1 being mild and category 3 severe. Therefore, although the findings indicate a higher score in the mild category 1 and a lower score in the severe category 3, the pattern may suggest that the students with milder food insecurity might have experienced worse levels of food insecurity if the ICE situation persisted.

5.3.2.3. Household food insecurity access scale score and prevalence

Although the findings illustrated per domain provided some information on the level of severity, the following findings provided more details on the severity levels of food insecurity. The nine questions from the HFIAS score provided a continuous measure of the degree of food insecurity (access). Calculating the continuous indicator per student, the maximum score is 27 (when the participant's response was "often" to all 9 questions, coded with response code of 3, and the minimum score is 0 indicating no food insecurity. Thus, the higher the score, the more food insecurity the student experienced.

Findings indicated that a 16% of participants were food secure, thus had consistent access to adequate food. More than half (54%) of the students had a food insecurity score of 1-10 indicating mild food-insecurity referring to anxiety over food sufficiency despite sufficient intake. Twenty-eight percent of students scored between 11 and 20, reflecting moderate food insecurity with inferior quality, less variety and choice of food. The highest food insecurity scores (21-27) were obtained by 2% of the students who had severe food insecurity with intermittent eating patterns and reduced food intake. These increased rates were indicated during focus group discussions to be related to the availability of money to buy food and to the unemployment rate:

"…since some parents lost jobs." FG5: LZ (sic)

"People lost their jobs, and it was just a struggle for most people." FG6: K (sic)

Table 5.3. Reasons for food insecurity *(n=235)*

Reasons	Responses	
	N	**Percent**
Unable to travel to a shop	29	12.3%
Lack of money	74	31.5%
Lack of appetite	26	11.1%
Limited time	36	15.3%
Poor health	6	2.6%
Phycological reasons	13	5.5%
Healthier lifestyle	19	8.1%
Shop had limited stock	22	9.4%
No resources to cook food e.g. electricity or paraffin	10	4.3%
Total	235	100.0%

In addition to income-related issues, other reasons for food insecurity were investigated by a follow-up question in the questionnaire, as reflected in Table 5.3. Participants could select more than one option, resulting in a total of 235 responses. The findings indicated that lack of money was the main reason for food insecurity concerns, as 32% of students agreed with this option.

Limited time to prepare food (15%), inability to travel to food suppliers (12%) and poor appetite (11%) were also of the more popular reasons provided for food insecurity rates.

5.3.2.4. Water access

Two water access questions were added to the nine HFIAS questions, with the same severity scale (never, rarely, sometimes, and often). These two questions covered some food security utilisation details on meeting physiological needs with sufficient, safe water. The findings indicated that 96% of participating students had sufficient water and 86% never had to drink from unsafe water sources. Similar findings were obtained from focus group discussions on water access, as evident in the themes and codes illustrated in Figure 5.1. During focus group discussions, students confirmed that water access was not a concern. However, students questioned the safety of available municipal water:

"Yes, they had tap water, but as we know that is not as drinkable." FG2: V (sic)

5.3.2.5. Overview of focus group findings on food security

The focus group discussion probed food security issues, including the following: "Were there enough food and water available during COVID-19 in your households? State reasons for this? How often have you experienced this? Who else had similar or different experiences?" Figure 5.1. illustrates the common denominators by means of themes and codes that emerged from the focus group discussions on food security. The four themes related to food insecurity included: availability decreased, decreased access due to limited movement, decreased access due to finances and utilisation limited. Only two themes were highlighted regarding food security: availability sufficient and sufficient water (utilisation).

As is evident in Figure 5.1, the themes and codes provided insight into three of the six dimensions of food security (HLPE, 2020): availability, access, and utilisation. These codes were aligned to the results from the questionnaire's section on food security, in particular the reasons for food

insecurity (Table 5.3.). The following codes emerged as reasons for food insecurity, in addition to reasons obtained from the questionnaires: available food was not fresh, access was limited due to fear to travel to shops, provision of government was not sufficient, utilisation was affected by limited electricity and attempting to save electricity due to finances. Contradicting the reason for food insecurity because of poor appetite, some focus group participants indicated that their appetite increased and many practiced binge eating habits to cope with emotions.

Figure 5.1. Food security related themes and codes *(n=17)*

5.3.3. Dietary intake

Findings from this section of the questionnaire provide insight into the changes in students' dietary intake with reference to specific types of food. Figure 5.2. illustrates that most of the dietary intake of students *(n=132)* decreased or were maintained, with limited types of foods' intake that increased during COVID-19. Therefore, the results of this section on dietary intake were aligned with the results from the previously discussed food insecurity section.

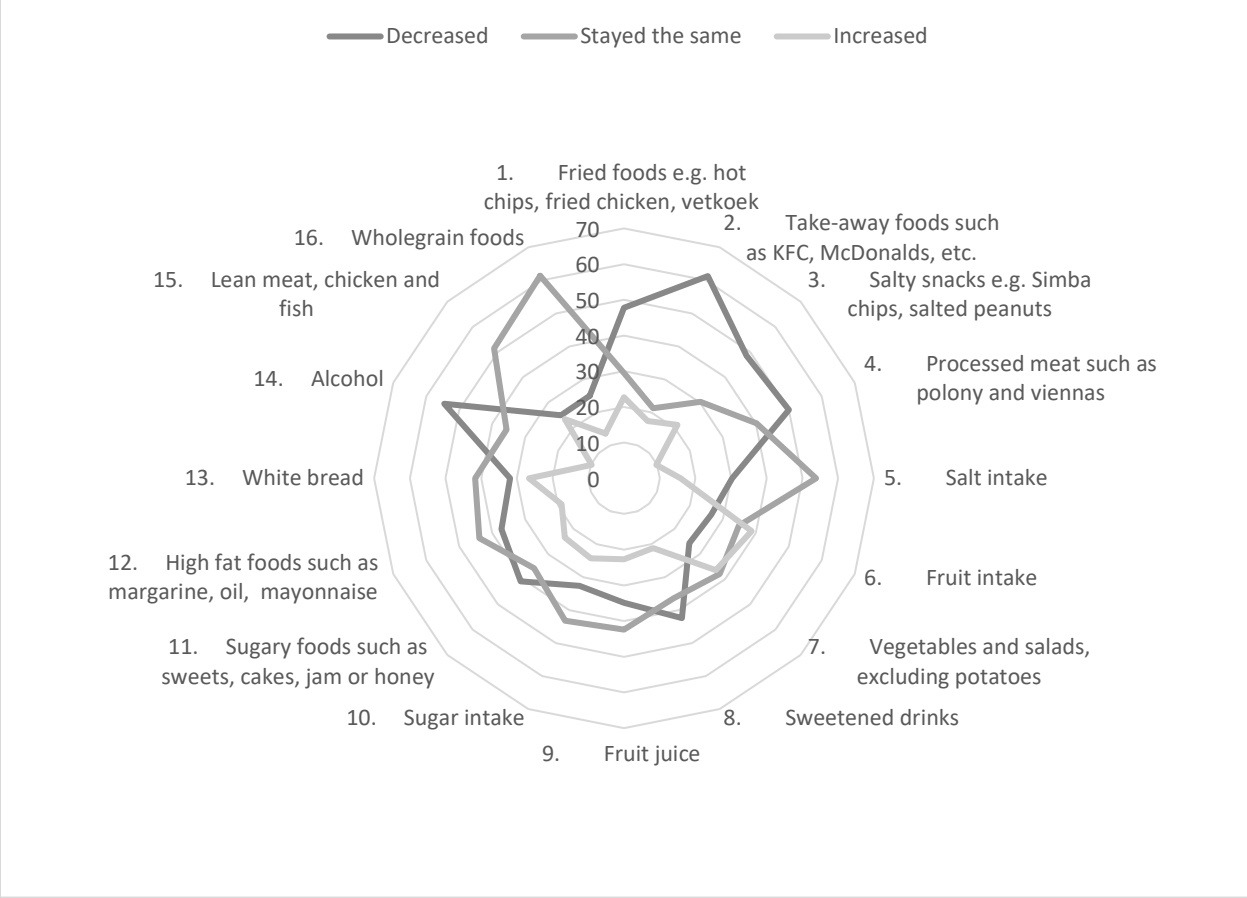

Figure 5.2. Food frequency intake change of students during COVID-19 *(n=132)*

More than half of the students indicated a decreased intake in take-away foods (61%) and alcohol (55%). Other food types that were indicated to have a decreased intake during COVID-19 were fried foods (48%), salty snacks (49%), processed meat (50%), sweetened drinks (42%) and sugary

foods (41%). While this points to a healthier diet, students from focus groups indicated that they often resided to comfort eating when they had such snacks available.

> *"…because you are stress eating." FG5: LZ (sic)*
> *"People mostly took comfort food." FG6: K (sic)*

Another noteworthy finding was that participants indicated an increase or maintenance in fruit and vegetables intake. In the fruit intake category, 35% of students stated their intake stayed the same and 39% indicated an increased intake. Moreover, in the vegetable and salad category 38% of students indicated a similar intake than before and 36% indicated an increased intake during COVID-19. These findings indicate that despite focus group students' statements on limited availability of fresh produce, less than a third of students experienced a decreased intake in fruit and vegetables. Another reason for the limited decrease in intake may be subsistence farming, as focus group participants stated that they often relied on their own fresh produce, while these were limited. Statements from fruit-and-vegetable-related discussions included:

> *"...because they are quite expensive and there was a decline in the supply of vegetables…so most people did not eat enough vegetables or fruit." FG6: K (sic)*
> *"The only vegetables that we had was cabbage and carrots because at home we planted those...We used all the ones we planted, and they were not enough." FG4: MM (sic)*

Similar to fruit and vegetable intake, more than half of the students indicated that their meat intake was maintained. This finding may be justified by the same reasoning as for intake of fruits and vegetables. Food types in the starch category stayed the same for most students. White bread intake stayed the same for 42% of students and wholegrain foods stayed the same for 61% of students. In contrast to the findings on starch, focus group participants suggested that their starchy food intake increased during COVID-19, with specific reference to instant noodles and mealie meals which were more affordable.

"…with the money that I have, I can get enough packets of noodles." FG3: B (sic)

"…because of the budget, they had to just buy the mealie meal and meat and bread." FG1: SS (sic)

5.3.4. Support services

The results from the Health Sciences students' awareness of available services *(n=160)* indicated that the majority of students (82%) were not aware of any support services to assist students with health-related issues being available at the specific institution. Moreover, only 1% of students indicated that they made use of the institutional food programme.

Although 18% of students indicated they were aware of services, the many irrelevant responses from the open-ended question that investigated which services they were aware of, indicated that not all of the 18% were aware of the actual services. Some of the responses *(n=24)* included: Supportive lecturers (4%), student Covid fund (4%), food parcels (4%), the institution's online teaching and learning platform (8%), health services/clinic (8%) and the Wellness Centre (25%). Thus, not all these responses were relevant to the question, e.g. the online teaching platform which is not considered as a support service. This might indicate that some students lacked knowledge on what support service entailed, and that a need existed for information sessions on what the purpose of available support services was.

Focus group discussions yielded similar responses regarding the available support services at the specific institution during the pandemic. Limited students were aware of available support specifically related to food security and dietary intake. Participants from one of the six focus group discussion indicated some awareness in this regard, with quotes such as:

"I am aware that CUT has a feeding scheme, but they need to do a background check…" FG3: B (sic)

"…remember when the cash students got their R1000, the R1000 from CUT. That was a great initiative that could have ever been made, so I feel like that in a way helped." FG3: NB (sic)

Additional concerns that were raised during focus group discussions were the accessibility of the available support services such as food parcels where students had to complete a daunting process of administration to qualify, as well as statements from students in need who were not confident to approach support services. Relevant statements follow:

"So, it could take a while like, they need to go through a whole procedure…" FG3: B (sic)
"I think it should really be something that is readily available when someone says, I am hungry, and they are able to help immediately." FG3: B (sic)
"… (some students) would have pride to submit their names or would not want to submit their names because they feel like if you say you do not have food now, you are being a charity case and everything because of pride…" FG3: NB (sic)

Participating students from focus group discussions requested assistance and additional services such as dietary guidelines/heathy eating programmes. These discussions included requests to be mindful about students' circumstances such as lack of funds for data to purchase variety of foods or to obtain resources needed to prepare the food. Quotes relating to these discussions included:

"If they told us how to go about, like healthy meals we can make out of cheap stuff, you know, and it would really help because then either way moving forward it is ideal for students with the little money we get to know how to have healthy meals because it is not like we have that much money either way, even with or without COVID." FG3: B (sic)
"We must cook things that are fast cooking instead of taking long hours, because if it takes long cooking things, it will use a lot of units of electricity…" FG3: NB (sic)

5.3.5. Associations

Initial statistical assessments were conducted by means of the Shapiro-Wilk normality assessment of the food security variable, resulting in a p value of 0.000 indicating a significant deviation from a normal distribution (p values <0.05). Therefore, the non-parametric equivalent for parametric tests were conducted in the following sections, as non-parametric tests do not assume normality in the data.

As a result, the Mann-Whitney non-parametric test was conducted to compare differences between two independent home residency groups: urban (town/city) and rural (farm/location). The aim of this analysis was to determine if the home residence categories had an association with the food security section's total score. The mean rank scores for each variable for both home residence categories are shown in Table 5.4.

Table 5.4. Mean rank scores according to home residence- *(n=139)* and gender *(n=140)* categories

	Variables	N	Mean Rank	Sum of Ranks
FOOD SECURITY TOTAL SCORE	**Home Residence**			
	Urban (town/city)	105	65.51	6878.50
	Rural settlement (farm/location)	34	83.87	2851.50
	Total	139		
	Gender			
	Male	23	82.76	1903.50
	Female	117	68.09	7966.50
	Total	140		

The results of the Mann-Whitney U comparison are captured in Table 5.5. The food security total score showed a statistically significant difference in the mean rank scores of students living in urban residences compared to students living in rural residences (Z=-2.318, p=0.020). As is evident from Table 5.4, the mean rank scores of the food security variable of students living in rural residences (83.87) were much higher than students living in urban residences (65.51). This

result indicates that the home residence of students had an influence of their food security score, with students living in rural communities having higher levels of food insecurity.

Table 5.5. Mann-Whitney U comparison based on home residence and gender categories

	Based on home residence category	Based on gender category
Mann-Whitney U	1313.500	1063.500
Wilcoxon W	6878.500	-1.591
Z	-2.318	.112
p value	.020	1063.500

A likely reason for the higher food insecurity of students from rural areas was mentioned during the focus group discussion of the current study:

> *"I live in a in a very small town, so there are no like shops or limited, the shops are limited…we went to buy food and then when you get to the shop, sometimes you don't find something that you are looking for…we had to take whatever that was there so that we can have food because there was no food at all because it was limited." FG1:MA (sic)*

Gender categories were investigated in an equivalent manner as the home residency groups. Therefore, a Mann-Whitney non-parametric test was conducted to compare the mean rank scores across the gender categories. The purpose of this analysis was to determine if the gender of students had any association to the food security section's total score. The mean rank scores for each variable of the gender category are captured in Table 5.4. It is evident that the gender ratio was heavily skewed (mainly females). This skewness could have impacted on the gender comparisons, as is evident in Table 5.5.

The results of the Mann-Whitney U comparison are shown in Table 5.5, and it showed no statistically significant difference between the gender categories, as the p values of all the tests are greater than 0.05. Therefore, the gender of students did not have any influence on their food

insecurity. The Kruskal Wallis non-parametric test was used to determine if the course that students are studying had any association with their food security section's total score. The mean rank scores for each variable for the corresponding registered course category is shown in Table 5.6.

Table 5.6. Mean rank scores according to registered course category

Ranks	Course registered for	N	Mean Rank
FOOD SECURITY TOTAL SCORE	Biomedical Technology	6	58.33
	Clinical Technology	41	57.50
	Radiography	56	78.58
	Somatology	38	76.39
	Total	141	

The result of the Kruskal Wallis comparison is shown in Table 5.7. It is evident that there was no statistically significant difference between any of the registered course categories and food security, as the p value was greater than 0.05. Therefore, it can be concluded that the registered course category of a student did not have any influence on their food security.

Table 5.7. Kruskal Wallis comparison based on registered course category

	FOOD SECURITY TOTAL SCORE
Kruskal-Wallis H	7.700
df	3
p value	.053

5.4. DISCUSSION

The results of the questionnaire and focus group study are discussed in an integrated manner as per the mixed methods design that was followed. The discussions are done according to the sequence of the four objectives of the current study fragment.

5.4.1. Sociodemographic information

Most of the questionnaire participants and all focus group participants were female. The study was not reliant on gender ratio, therefore the skewed gender ratio did not affect the findings. Most students were living at home during COVID-19, which was expected as many students had to vacate their campus and private residents due to campus COVID-19 regulations (Hendricks & Chirume, 2020; University of Cape Town, 2020). However, these students did not necessarily have the support of parents/guardians at their homes. Only about a third of the students had support from parents/guardians who could assist with household tasks such as cooking, and a theme arose from the focus groups pertaining to students managing the households and being the bread winners of their households. These socio-demographic findings could play a role in the results pertaining to food security, as parents/guardians may assist with students' access and availability of food.

5.4.2. Food security

The first objective of this study was to assess food security dimensions relating to the availability, access, and utilisation of food to illustrate stability of a student group's food security during COVID-19. While students from this specific institution received some degree of assistance from the institution (e.g. food parcels, mobile data, and money) (CUT, 2020; Macupe, 2020; Mungadze, 2020; National Student Financial Aid Scheme, 2020), questionnaire findings indicated food security access of about 30% of the students were maintained, and focus group discussions highlighted themes indicating concerns regarding availability and utilisation. These findings concurred with evidence from other studies, prior and during COVID-19 (UNICEF,2021).

Food insecurity amongst students was not a new tendency at international nor national level and has been a concern before the onset of COVID-19 (Bruening, Argo, Payne-Sturges & Laska, 2017; Crutchfield & Maguire, 2018; Kassier & Veldman, 2013; Van den Berg & Raubenheimer, 2015). International estimates prior to COVID-19 suggested that half of the United States' students experienced some degree of food insecurity according to four studies from 2009-2016 using the

6-item survey module (Broton & Goldrick-Rab, 2018). Similarly, a study in 2019 that utilised the 10-item US Household Food Security Scale Module found that the majority (80%) of students from two universities in southeast Nigeria were food insecure (Ukegbu, Nwofia, Ndudiri, Uwakwe & Uwaegbute, 2019).

Nationally, four studies from 2012 to 2019 (prior to the pandemic) found food insecurity amongst South African higher education students. In 2012, Kassier and Veldman (2013) assessed students at the UKZN by means of HFIAS and found 12,5% of students being food insecure. A study at UFS conducted during 2013 identified various levels of food insecurity amongst 64,5% of students using a single-item measure and amongst 84,6% of students using the HFSSM (Van den Berg & Raubenheimer, 2015). Similarly, a study conducted at Wits university in 2019 reported food insecurity amongst students prior to COVID-19. This study found various levels of food insecurity amongst 73% of students with the HFIAS and different degrees of hunger amongst 13% of students using the HHS (Wagner, Kaneli & Masango, 2021). Therefore, considering the findings of the mentioned studies it was expected that the COVID-19 pandemic and regulations would have increased food insecurity amongst students.

This expectancy was confirmed by the current study, as well as other studies amongst the general population. UNICEF (2021) indicated a significant upward trend in food insecurity of the world's population between 2019 and 2020 according to The State of Food Security and Nutrition in the World (SOFI) report that summarised global assessments. Furthermore, Van der Berg, Patel and Bridgman (2022) indicated the rates of South African adult and child hunger had doubled in the initial months of COVID-19 according to results from the National Income Dynamics Study – Coronavirus Rapid Mobile Survey (NIDS-CRAM). Similarly, Statistics SA indicated an increase in food insecurity amongst the South African population from 17.3% in 2019 to 23.6% in 2020 based on an assessment with the Food Insecurity Experience Scale (STATSSA, 2022). These increased rates were indicated to be strongly related to the availability of money to buy food (Van der Berg

et al., 2022) and unemployment rate (STATSSA, 2022). This concurred with this study's finding from both the questionnaire and focus group discussions.

Additionally, findings from the food security section of the questionnaire indicated that more students experienced food insecurity within the first two domains: anxiety and uncertainty about food supply and insufficient quality (includes variety and preferences). The pattern within the findings was aligned with the consistent pattern that Radimer identified with qualitative interviews and a 30-item hunger survey conducted amongst women. The pattern was as follows: the lived experience of food insecurity was initially characterised by anxiety and worry about enough food. Then, as conditions worsened, it resulted in less stored food in the home, followed by worsening quality and diversity of the diet, decreased quantity of food per meal, and, finally, in being forced to skip meals and feel hungry (Radimer, Olson, Greene, Campbell & Habicht, 1992). This might be the case even after the pandemic ended, as the negative impact thereof on other factors such as the economy, did not improve with immediate effect (Van der Berg *et al.,* 2022). The findings may assist Higher Education institutions with decisions on student-food-insecurity-related priorities when considering interventions and policies such as a framework for sustainable development goals (Ballard, Kepple & Cafiero, 2013).

Maslow's theory stated that individuals are dominated by physiological needs (e.g. the need for food), if these basic requirements are not met (Maslow, 1989). Moreover, compelling evidence suggest that food insecurity amongst students is associated with decreased academic performance, which in turn may hinder the graduation rate and economic growth of the country (Broton, 2017, Goldrick-Rab *et al.,* 2018; Raskind, Haardorfer & Berg, 2019; Sabi, Kolanisi, Siwela, & Naidoo, 2019). The reverse was also evident from studies showing a direct link between good diet quality and higher academic achievement (Burrows, Goldman, Pursey & Lim, 2017; Raskind *et al.*, 2019). Furthermore, the effects of food insecurity on psychosocial health impede students' academic performance and contribute to high wearing-out levels (Van den Berg & Raubenheimer, 2015). Therefore, findings from this paper together with existing literature

indicate that COVID-19 increased the urgency of policies and interventions to alleviate food insecurity and increase the success rate of students.

The findings from the questionnaire showed that no association existed between food security and the following variables: gender and course of study. The heavily skewed gender ratio could have impacted on the gender association findings. However, an association existed between food security and the two home residence categories.

This association with home residence indicated that the students living in rural communities had higher levels of food insecurity. A likely reason for the higher food insecurity of students from rural areas might be financial insufficiency. As South African studies indicated that households from rural areas had lower incomes (Mathebula, Molokomme, Jonas & Nhemachena, 2017). This probable reason supports the study by Diamond, Stebleton & del Mas (2020) that found a positive association between food insecurity (short and long term) and students who rely on study grants and/or are from lower income households. Since COVID-19 influenced the economy of South Africa which had still not recovered (Chitiga-Mabugu, Henseler, Mabugu & Maisonnave, 2021), the possibility of financial insufficiency amongst rural households is a concern that needed urgent attention. However, another probable reason for higher food insecurity during COVID amongst health students from rural settlements could be the lack of access of food as mentioned during the focus group discussion of the current study. While there might be a variety of reasons for the positive association between students from rural residencies and their food insecurity, investigating the matter should be prioritised by Higher Education institutions. This association could be used to identify food insecurity of at-risk students upon registration, and institutions can put into place mitigation measures for such students to ensure food security and academic success.

In contrast to food access, findings on water access indicated that most (96%) students had adequate amounts of running water. The findings on water access supported results from the

South African statistics amongst the South African population (STATSSA, 2018), and the fact that most students had access to water might have been due to the inclusion of water access rights in the South African Constitution, 1996. However, water supply was not uninterrupted nor 100% sufficient, and it is known that some South Africans still had to spend hours to collect water from streams and wells. The general household survey of 2018 indicated that 89% of South Africans had access to drinking water, while 38% rated the average water services as poor (STATSSA, 2018). The safety of the water from such sources was questionable, and the quality of the running water supplied by municipalities was not guaranteed. In the Blu Drop 2022 report, only 48% of municipalities' water supply were flagged as minimal risk 'drinkable' water (South African Department of Water and Sanitation, 2022). Thus, despite the figures on water access being high and commendable, the study did not investigate the quality of the accessed water. Hence the need to consider the results within the context of South Africa with various service delivery issues, including some persisting concerns around water access (Mudombi, 2020).

The COVID-19 pandemic and the government's endeavours to mitigate the spread exacerbated the challenges regarding water access and quality that prevailed long before COVID-19 (Matsheke, 2020). Therefore, despite the findings indicating that access to water was better than the access to food during COVID-19, it was concerning that some students still struggled to have clean and a constant supply of water. As numerous investigations have shown, this was a nationwide issue and not exclusive to the researched institution (Bruce, 2020; Mabeba, 2022).

5.4.3. Dietary intake

Findings from questionnaires indicated that the frequency of intake of most foods were either maintained or decreased, including the frequency of intake of alcohol, high fat, salt and sugary foods, including snacks and sweetened drinks. Some of these rates were expected, as South African COVID-19 regulations had restrictions on the fast food and alcohol industries (South African Government, 2020), aligned with the nutrition transition of South Africa as described by Ronquest-Ross, Vink and Sigge (2015). Moreover, another probable reason for this was the fact

that many of these foods were seen as luxuries and only necessities could be afforded during the pandemic (Van der Berg *et al.,* 2022). This probability reflects the influence of economic factors as mentioned in the three prevalent conceptual models of food choice (Chen & Antonelli, 2020; EUFIC, 2006; Marcone, Madan & Grodzinski, 2020)

Comfort eating or binge eating was another theme that emerged from the focus group discussions. This could be linked to the anxiety and depression caused by the stressful COVID-19 pandemic. Literature indicates that a stressful event causing anxiety and depression, in turn results in poor dietary choices and unhealthy eating patterns including overeating, binge eating, meal restriction and eating disorders (Mukigi & Brown, 2018; Ukegbu *et al.*, 2019). Moreover, this becomes an alarming cycle similar to experiencing food insecurity, which also resulted amongst students, again intensifying this stressful COVID-19 situation (Meza, Altman, Martinez & Leung, 2019; Shi, Davies & Allman-Farinelli, 2021).

Focus group discussions gave rise to a theme indicating lower intake of fruits and vegetables in contrast to the questionnaire findings that suggested maintenance of intake. The reason for the contrast was not clear. The smaller sample size of the focus group discussions could have influenced the results; however, the purpose of the focus group discussion was not to provide generalisable data but rather to provide richer descriptions to put questionnaire findings into context. Although agriculture was declared as an essential service during lockdown levels, transport and other logistical processes were not running at capacity during COVID-19. As a result, there was a delay of fruit and vegetable delivery in certain parts of the country (Fruit SA, 2021). Moreover, March is the end of harvest time for certain fruits and vegetables, and the job losses resulting from COVID-19 as well as the lives lost, could have impacted the agriculture sector's ability to deliver fresh produce. This evidence justified the claim made by focus group participants.

Another theme that was amplified during focus groups was the increase of starchy food, especially foods that needed less resources to prepare, for example instant noodles and bread. This food choice from focus group findings relates to the physical determinant category mentioned in the EUFIC food choice model (EUFIC, 2006). Moreover, in South Africa it is known that a large part of the population relies on starchy foods, such as bread and mealie meal, as the main part of their diet (Van Heerden, 2013). Therefore, the findings should be considered in the light of the South African context, though the intake of starchy food stayed the same. Despite basic food intake guidelines suggesting starch should be the basis of all meals, students' intake of starch was not necessarily in line with dietary recommendations (WHO, 2003) and should be viewed in relation to the intake of the other major food groups such as fruit, vegetables, and meat. The survey did not investigate aspects like macro- and micronutrient intake or nutrient deficiencies, due to these not being part of the current study's aim. However, it is recommended that future research studies investigate these aspects. As nutrition plays a vital role in general health and immunity, dietary intake should be based on a healthy, balanced intake to prevent nutritional deficiencies. This is especially important during a pandemic such as COVID-19, where healthy eating patterns can optimise the immune system function and contribute to a lower probability of contracting COVID-19, as well as improve the recovery of those who have been infected (Clemente-Suarez *et al.*, 2021).

According to the various results from surveys and focus groups, some students' diets were healthier, and others were less healthy during the pandemic. The students' access to healthier meals in their off-campus homes may be a contributing factor in their improved diets. On the contrary, when students' homes were food insecure or lacked parents/guardians to help with food access students may have reverted to poor dietary habits.

5.4.4. Support services

The third objective of the current study was to explore the students' awareness and utilisation of available health and wellness support services. Findings from the questionnaire indicated that

most (82%) of the students were not aware of the available health and wellness services at the relevant Higher Education institution. Moreover, focus group findings supported this finding. In addition to the need that existed for institutions to increase awareness of available services, a need for additional or expansion of services also became apparent – although the possibility existed that capacity and related budgetary issues as described by Moyo and McKenna (2021) may disincentivise institutions from raising more awareness and providing adequate services.

As is evident from this study and other studies, the COVID-19 pandemic has led to an increase in food insecurity of students, of which many were already vulnerable before the pandemic (Ukegbu *et al.,* 2019; Van den Berg & Raubenheimer, 2015). Although some universities had already implemented food relief programmes and other forms of support, there existed a growing need for more comprehensive and sustained efforts to address the nutrition-related issues. The ICE environment caused by COVID-19 have resulted in a sudden increased need, and literature predicted that certain effects such as poverty that resulted from COVID-19 would not disappear soon after the pandemic ended (UNICEF, 2021). Therefore, it is essential that Higher Education institutions either implement a food relief programme or review the existing programmes to meet the increased needs, as well as be prepared should future events lead to ICE environments to arise. Moreover, these programmes should pay attention to students who might not have the confidence to reach out to food relief programmes due to the fear of being labelled as poor or disadvantaged (Sabi, Kolanisi, Siwela & Naidoo, 2019). Without support to improve food security of students, many students might be forced to drop out of their studies, further exacerbating the social and economic challenges faced by the country (Bethea, 2019; Van den Berg & Raubenheimer, 2015).

In conclusion, few participating students had complete food security during the COVID-19 pandemic. This is a concerning but not surprising finding. Food insecurity does not provide information on the type of quality of the diet nor nutrient intake. The findings from the food frequency table shed light on the dietary intake and nutritional composition. In most cases,

students indicated their dietary intake decreased or stayed the same as before the pandemic. This confirmed and validated the findings of the food security section. Additionally, the results supported healthy changes such as decreased intake of snack-like foods, including salty snacks and sugary treats, with a constant intake of meat and vegetables. Despite these healthier findings on dietary intake, focus group participants indicated that often their diets consisted mainly of starchy foods such as instant noodles. Therefore, dietary intake items should be considered in relation to each other to assess if ratio of food intake was according to dietary recommendations; however, this assessment was not included in the current paper. Therefore, it is suggested that future studies aim to investigate such a quantitative relation in dietary intake of students. A noteworthy association was evident between food insecurity and students who resided in rural areas.

The findings of the paper on food insecurity and hunger were similar to findings among the general population during COVID-19 (Van der Berg *et al.,* 2022; Shepherd, 2022). While findings from this paper indicated food insecurity, hunger and decreased dietary intake during COVID-19, there were no related data on this population prior to COVID-19 to perform a comparative analysis. The lack of this data is acknowledged, although it did not influence the current study which was not a comparative study. However, evidence from other similar studies suggested that the findings of the current study could have been prevalent even before COVID-19, especially amongst students in the Free State (Van den Berg & Raubenheimer, 2015).

Despite significant investment in food security and other socio-economic areas of students by both the government and Higher Education institutions, food insecurity and hunger occurred during the isolated, confined, and extreme (ICE) environment resulting from COVID-19. It is also worthy to note that the available food relief programmes and institutional support services were expressed to not have been as effective due to reasons such as lack of awareness, difficulty to access and pride discouraging utilisation.

Given the prevalence of food insecurity and hunger before COVID-19 and the extended nature of the pandemic including slow economic recovery, support for vulnerable students became an urgent priority. It is assumed that the reflected levels of food insecurity and hunger amongst students would remain high due to factors such as the removal of emergency relief grants and food support, as well as the slow rate of economic recovery. Therefore, the need for intervention from Higher Education and government is essential, given the dire consequences of enduring hunger on students' quality of life and academic performance. Therefore, such intervention is needed not only to secure food intake amongst students when faced with an ICE environment such as pandemics, but also under usual circumstances.

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CHAPTER 6

An assessment of the impact of COVID-19 on nutrition-related health and wellness indicators: A case investigation of South African Health Sciences students

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ABSTRACT

Introduction and aim: The COVID-19 pandemic forced the world to adapt to a new way of life that was isolated and stressful. These circumstances affected the health and well-being of students who were more sedentary and stressed. This paper aimed to investigate the impact of the pandemic on health and wellness indicators of selected students.

Methods: A mixed methods design with questionnaires and focus group discussions as methodologies, was applied. The population comprised of final year Health Sciences students from a university of technology. The focus group discussions probed findings of the questionnaire survey and questions were developed based on issues emphasised in the literature, as well as two existing questionnaires: a questionnaire to assess adherence to diet and exercise advice and the Depression, Anxiety and Stress Scale of 21 Items (DASS-21).

Results: Most of the participants (82%) that completed the questionnaire *(n=148)* and all focus group participants *(n=17)* were females. Most survey participants resided in urban areas (76%), and 36% had parents/guardians at home. Most participants perceived their general health to have deteriorated and they reported that they fell ill more often during the pandemic compared to before. A third of participants experienced much weight gain (33%) or slight weight gain (24%), as well as decreased physical activity with an increase of 11% in the “no exercise” category. Similarly, findings from the focus group discussions showed that participants experienced weight fluctuations, including weight gain, as well as more sedentary behaviour. The reasons for decreased activity included lack of motivation (17%) and the fact that gyms were closed (24%) during the lockdown periods. Participants from the focus group and survey reported that their mental health deteriorated, with the anxiety levels falling in the severely extreme category (survey). Most (82%) participants were not aware of support services that were offered by the university and only 4% utilised the services. Poor mental health was significantly associated (p= 0.039) with food insecurity (as investigated by another sub-study of the overarching research study).

Conclusion: The isolated, confined and extreme (ICE) environment caused by the COVID-19 pandemic had a significant impact on the health and wellness indicators of students. The affected indicators included perceived general health, weight, physical fitness, and mental health. A need was identified for a health and wellness programme within Higher Education, including improved awareness, health and wellness training and support. Institutions should reflect on their COVID-19 response and consider a programme with additional interventions/strategies to optimise the health and wellness of students in anticipation of and during future ICE circumstances.

Keywords: COVID-19, Higher Education, ICE environment, weight fluctuation, physical fitness, mental health

6.1. INTRODUCTION AND RESEARCH PROBLEM

The COVID-19 pandemic had a profound impact on Higher Education students (Taeymans, Luijckx, Rogan, Haas & Baur, 2021). With most South African Higher Education institutions transitioning to remote learning, students were forced to adapt to a new way of life that were often isolated and stressful (Luescher, Schreiber, Moja, Mandew, Wahl & Ayele, 2020). In contrast to other isolated, confined and extreme (ICE) environment experiences such as space travels where individuals voluntarily participate and prepare for the situation (Bartone, Krueger & Bartone, 2018), the students were not prepared for the ICE environment that resulted during the COVID-19 pandemic.

The conditions of the ICE environment that resulted from the COVID-19 pandemic included isolation and movement restrictions, non-essential facilities like gyms were closed or operating at limited capacity, and gatherings that included sport activities were prohibited. Furthermore, increased levels of stress and anxiety were experienced due to various reasons (Staunton, Swanepoel & Labuschaigne, 2020). Higher Education institutions' students were young, vulnerable individuals who had to survive these ICE conditions. Moreover, many Health Sciences students, as part of experiential learning, had to work in high risk, overburdened health facilities

during the pandemic (Subramaney, Kim, Chetty, Chetty, Jayrajh, Govender, Maharaj & Pak, 2020).

Some of the significant impacts of the isolation and movement restriction during the COVID-19 pandemic on the health and well-being included increased sedentary behaviour and mental health issues (Stiegler & Bouchard, 2020; Stockwell, Trott, Tully, Shin, Barnett, Butler, McDermott, Schuch & Smith, 2021). The increased sedentary lifestyle also occurred due to students spending more time at home and less time engaging in physical activity due to restricted access to gyms and sport activities on and off campus (Romero-Blanco, Rodríguez-Almagro, Onieva-Zafra, Parra-Fernández, Prado Laguna & Hernández-Martínez, 2020). A lack of physical activity can have detrimental effects on health and wellness, ranging from weight gain to poor muscle tone and increased risk of chronic diseases such as diabetes (NIH, 2022, Romero-Blanco *et al.*, 2020). Furthermore, a lack of physical activity may affect emotional well-being and cognitive ability, which in turn may affect students' academic performance.

In addition to the sedentary behaviour that resulted due to the pandemic, mental health concerns also increased amongst students as a result of increased levels of stress and anxiety. Issues such as difficult or unsafe conditions at home and suddenly reverting to online learning contributed to the anxiety experienced by students during the pandemic (Luescher *et al*., 2020). As with physical activity, good mental health is essential for students' academic performance and overall quality of life (Wyatt and Oswalt, 2013).

The South African government and Higher Education institutions were aware of the vulnerability of students, and measures were put in place during the pandemic to assist students to maintain their health and well-being (Mlamla, 2020). Most Higher Education institutions strengthened support services such as counselling services (CUT, 2020; Linden, 2020). However, the evidence that these steps or services were adequate and effective to maintain student health and wellness during the pandemic was limited. In view of the above, this study investigated the following

research question: “To what extent did the ICE environment caused by the COVID-19 pandemic, have an impact on the nutritional health and wellness of Health Sciences students at an institution of Higher Education in the Free State province of South Africa?”

This paper reports on a sub-study that was nested within an overarching study which is described in chapters 1 and 2 of this thesis. The three objectives that are reported on in the present paper are firstly to assess the nutrition related health and wellness indicators of the particular student cohort, including weight trajectories, physical fitness, and mental health; secondly, to examine the students’ awareness and utilisation of the relevant health and wellness support services that were offered; and thirdly, to investigate the correlations between the mental health and food security of the students. Food security of the students was investigated in another section of the overarching study and some relevant results will be briefly mentioned in relation to correlation results.

6.2. MATERIALS AND METHODS

6.2.1. Research design

A mixed methods research design was applied with two simultaneous data collection methodologies (De Vos, Strydom, Delport & Fouche, 2012; Tashakkori & Teddlie, 2010). Two data collection instruments were included, namely a questionnaire that collected quantitative information and a focus group discussion that obtained more comprehensive qualitative data. The participants from both methods were from the same population, namely Health Sciences students in their final years of study during 2021 at a University of Technology in the Free State province of South Africa. These students were decided upon due to the health industries’ role during COVID-19.

All the students of the study population were invited to participate in the survey via the university’s online teaching and learning platform. The research study’s information letter was also made available on this platform. Systematic random sampling was used to recruit focus

group participants by utilising class lists to select students every x^{th} student (x being the target population divided by the desired sample size). An equal number of students were recruited for each of the six focus group discussions and included participants from all four the Health Sciences courses. Six to eight participants were invited per focus group discussion, although only two to three participants showed up to participate in each focus group discussion. This poor attendance of participants resulted in an unequal number of participants in the six focus group discussions, as well as uneven distribution of focus group participants across the four Health Sciences courses.

Recruited focus group participants received invitations (including study information) to participate in the study via the university's online teaching and learning platform. Utilising this platform assisted in anonymising students' identity. Informed consent was obtained from all participants prior to participating in the survey and focus group discussions. Students could not access the focus group discussion meeting link nor the electronic questionnaire link without agreeing to participate. Approval to conduct the study was obtained from the relevant university structures (Appendix F) and the Health Sciences Research Ethics Committee (HSREC) of the University of the Free State (Appendix F: UFS-HSD2021/0762/21).

6.2.2. Data collection instruments

Survey participants had two months to complete the online survey on QuestionPro. This survey software collected students' responses anonymously and were compatible with both laptops and smartphones. Focus group discussions were conducted at various time slots over a period of two weeks, to ensure that participants could join the online meetings at the most convenient time. Online focus group discussions were held by means of the Microsoft Teams application which also assisted with recording and transcribing of the meetings. An experienced focus group facilitator from the university conducted the focus group discussions according to the focus group discussion guide. The facilitator took field notes of discussions and ended each meeting with summarizing main points to seek verification.

Survey questions and focus group discussion probes were aligned with each other, with both underpinned by an in-depth literature review to identify the issues to investigate. The first section of the questionnaire collected sociodemographic and relevant personal information including: gender, age, course registered for, residence place and details during COVID-19, as well as COVID-19 status history. The other sections of the questionnaires relevant to the current sub-study included health and wellness indicators, mental health, and comments on support services. Focus group probes were aligned to encourage discussions on health and wellness, mental health, and institutional support services during COVID-19. The survey questions and focus group discussion that assessed the nutrition related health and wellness indicators covered the following items: perceived general health and COVID-19 risk factors, weight trajectories, physical fitness, mental health, as well as awareness, utilisation, and suggestions relevant to support services offered.

6.2.2.1. Perceived general health and COVID-19 risk factors

The general health of students was investigated by three self-report items of the questionnaire based on the students' own perception of their general health before the onset of COVID-19 and during the pandemic. Participants had to indicate if they tested positive for COVID-19 and provide information in relation to the severity of their symptoms, if any. Secondly, participants had to rank their general health on a scale of 1 to 5, from excellent (falling ill once or twice a year) to very poor (falling ill a few times per month). During focus group discussion a probe was utilised to explore if students perceived their general health to have changed from before COVID-19 to during the pandemic. Lastly, COVID-19 risk factors, also known as co-morbidities, of students were assessed by an item where participants could select which comorbidities they suffered from, if any. Five co-morbidity options as per Alam, Kabir, and Reza (2021) were specified, and participants could select more than one option. Additionally, an open-ended option "other" was added to this item to obtain additional information on risk factors not specified in the questionnaire.

6.2.2.2. Weight trajectories

The sections on weight trajectories and physical fitness were based on a questionnaire to assess adherence to diet and exercise advice (Dubasi, Ranjan, Arora, Vikram, Dwivedi, Singh, Kaloiya & Shalimar, 2019). This original questionnaire was based on 5-point Likert scale questions and was selected to inform these two sections of the current study's questionnaire due its good internal consistency (Cronbach's alpha of 0.94) as well as including similar sections as the areas being investigated in this study.

The students' current self-reported weight and perceived changes in weight since COVID-19 were collected. Students had to provide their weight in kilograms in an open-ended item and a change of weight by a five-point scale item. The five-point scale item obtained the perceptions of participants regarding a change in their weight and how it changed (increased or decreased) (Dubasi *et al.*, 2019). This item was followed by an open-ended item that explored the reasons for change in weight, if any. The possible change in weight was also a point of discussion during focus group interviews.

Secondly, an estimate of students' weight status was assessed by means of body mass index (BMI) and waist circumference. BMI is a measurement of body fat based on height and weight; both these measurements were obtained from questionnaires. The formula used to calculate the BMI was BMI=kg/m2 and results were compared against the following BMI categories: underweight = <18.5, normal weight = 18.5–24.9, pre-obesity = 25–29.9 and obesity class I-III = BMI of 30 or greater (WHO, 2010).

In addition to BMI as weight trajectory, students' waist circumference was requested in an open-ended question of the questionnaire. However, this questions' results were not considered reliable (more than 20% of values were unlikely) and are thus not reported.

6.2.2.3. Physical fitness

The students' self-reported physical fitness prior to and during COVID-19 were determined. Participants were asked to indicate on a five-point scale how often they exercised before COVID-19. Thereafter, the same scale was used to reflect on their exercise routine during the pandemic. These two items were followed by an open-ended question to provide reasons for the possible change in exercise frequency, if any. Physical fitness was also discussed during focus group discussions where participants were asked if they perceived that their exercise routine changed since the outbreak of the pandemic and if so, reasons for the change.

6.2.2.4. Mental health

Students' mental health during COVID-19 was investigated using the DASS-21. This scale comprises a set of three self-report sections designed to measure the emotional states of depression, anxiety, and stress of individuals. Each of the three DASS-21 sections contains seven items, divided into subsections with similar content. The depression section assesses dysphoria (dissatisfaction of life), hopelessness, devaluation of life, self-deprecation, lack of interest / involvement, anhedonia (inability to feel pleasure) and inertia (sluggishness). Secondly, the anxiety section assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. Lastly, the stress section is sensitive to levels of chronic non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient. Scores for depression, anxiety and stress are calculated by totalising the scores for the relevant items. Moreover, scores on the DASS-21 should be multiplied by two to calculate the final score (Lovibond & Lovibond, 1995).

The DASS-21 is based on a dimensional rather than a categorical conception of psychological disorder. The DASS-21 assumes that the differences between the depression, anxiety and stress experienced by normal subjects and clinical populations are differences of degree. Therefore, the results from this section of the questionnaire (DASS-21) could not be used to diagnose individuals

(Lovibond & Lovibond, 1995). Recommended cut-off scores for conventional severity labels (normal, moderate, severe) were as follows:

Table 6.1. DASS-21 severity labels (Lovibond & Lovibond, 1995)

	Depression	**Anxiety**	**Stress**
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely severe	28+	20+	34+

In addition to the data collected from the questionnaires on students' metal health, the mental health and emotional issues were also discussed during focus group discussions. Data from the focus group discussion aimed to obtain qualitative details on the mental health issues reported in the questionnaire.

6.2.2.5. Support services

The last section of the questionnaire assessed the Health Sciences students' awareness and utilisation of available services at the specific Higher Education institution. These institutional support services were often referred to as wellness centres or services and included services such as counselling (CUT, 2020). Furthermore, suggestions for additional services and assistance during similar future events were explored. In addition to the data collected from the questionnaires, the students' awareness and suggestions on support services were also obtained during focus group discussions. Data from the focus group discussion were aimed at obtaining qualitative details on the access and adequacy of support services, as well as innovative ideas for Higher Education institutions to support students during future pandemics and similar ICE situations.

6.2.2.6. Validity, reliability, and trustworthiness

Both the data collection methodologies were preceded by pilot studies to ensure feasibility and quality of data collection tools. Although, a pilot study is not essential for qualitative data collection instruments. The validity of the questionnaire was increased by including a combination of existing data collection tools. The reliability of the questionnaire was tested by means of the Cronbach Alpha test (Tavakol and Dennick, 2011). The Cronbach alpha values indicated that all the questionnaire sections were internal consistent and reliable.

The trustworthiness of this research study was ensured by attending to credibility, confirmability, transferability, reliability, and dependability (Noble & Smith, 2015; Onwuegbuzie & Combs, 2011). The following measures were included to increase the credibility and confirmability of the study: sufficient involvement of the researcher, triangulation of data collection methods and data, critical interview with peer members, and member checking during focus group discussions. Furthermore, transferability was addressed by means of detailed record keeping, a clear decision trail, as well as consistent and transparent data analysis and interpretation (Noble & Smith, 2015). Reliability was enhanced by utilising existing data collections tools to inform questionnaire items and focus group discussion probes. Lastly, triangulation increased dependability of the study findings.

6.2.3. Analysis

Data were examined using Vogl's (2018) method of data analysis for mixed method research designs. The data from the focus group discussion provided illustrative information and contextualised the data from the questionnaire, serving the dual purposes of complementarity and expansion in this research. For each methodology a preliminary basic parallel mixed analysis was run separately. After that, a four-step mixed analysis procedure was used, including consolidation and interpretation (Vogl, 2018).

The anonymous data from the QuestionPro survey software were downloaded in Microsoft Excell worksheets. The Central University of Technology, Free State's IT Statistical Analysis Unit conducted the statistical analysis on this quantitative data. This survey data was analysed by using SPSS software from BMI. Frequencies and percentages (for categorical data), as well as means and standard deviations were calculated as descriptive statistics (for symmetrical numerical variables).

The field notes and the transcripts generated by Microsoft Teams were integrated and moderated against recordings by an external moderator. All participants were allocated a unique number to keep their identity confidential. The moderated focus group discussion transcripts were uploaded onto an ATLAS.ti9 software application. The thematic analysis method, as outlined by Maguire & Delahunt (2017), was utilised to assess the qualitative data gathered from the focus group discussions. To find, examine, and report patterns and/or themes within the discussion content, this qualitative descriptive method of analysis was utilised. The findings were then thematically analysed in accordance with the six phases (Maguire & Delahunt, 2017). ATLAS.ti9 software was utilised by the researcher to perform manual thematic analysis. This analysis consisted of a three-coding framework that included two stages of coding, content analysis and ethnographic analysis. Context specific themes emerged from the coded and analysed, qualitative data. The identified themes and subthemes were verified by an external expert to ensure that the included themes and subthemes covered all the relevant data, and that no irrelevant data was included. Due to the nature of semi-structured focus group discussions, some of the topics were in line with the probes and questions in the discussion schedule, while other themes were far broader. Thematic saturation was reached after the second focus group, and no new themes emerged thereafter.

Data analysis on variables to investigate correlations was performed. Variables were first assessed for normality, after which parametrical/non-parametric and correlation analysis were

conducted. The aim of the corelation analysis was to provide more depth of the initial analysed data and a better understanding of the study population.

6.3. RESULTS AND DISCUSSION

6.3.1. Results

The survey and focus discussion findings are combined in accordance with the mixed methods design. The sequence of the results presentation is presented in the same order as the sequence of the survey questionnaire.

The survey questionnaire was accessed by 289 students, although only 159 students agreed to participate. While only 149 questionnaires were completed and could be included in the study. Although not all the questions of the 149 questionnaires were completed and therefore the sample size of the survey results may differ between questions. Seventeen participants were included in the six focus group discussions. All the focus group participants were females, while the gender ratio for the survey was 8:2 (female to male). Survey participants were from all four Health Sciences courses, although not an equal number of participants from each course. Four percent of survey participants were from the Biomedical Technology course, 26% from the Somatology course, 30% from the Clinical Technology course, and 40% from the Radiography course. All the participants were between the ages of 20 and 35 years.

Thirty-six percent of survey participants resided at home with parents/guardians during the COVID-19 pandemic, and 33% of the participants resided at home without parents/guardians who could assist with purchasing of groceries and cooking. The rest of the survey participants spent most of the COVID-19 period in campus residences or in private residences with either prepared meals (1%) or with no meals included (30%). Three quarters (76%) of participants resided in urban areas and 24% in rural areas.

Table 6.2. Overarching concepts, main themes and subthemes from focus group discussions

Overarching concepts	Main themes	Subthemes
Socio-economic circumstances	1. Need for resources	1.1. Financial issues
		1.2. Lack of electricity
	2. Home environment/ circumstances	2.1. Stressful situations at home
		2.2. Non-conducive learning environment
Health and wellness of students	3. Physical health issues	3.1. Poor physical health
		3.2. Body weight fluctuations
		3.3. Sedentary lifestyle
		3.4. Need exercise guidance
	4. Mental health issues	4.1. Fear and anxiety
		4.2. Stressed
		4.3. Depressed
		4.4. Feelings of loneliness
		4.5. Emotional outbursts
		4.6. Need emotional support
Academic issues	5. Study difficulties	5.1. Lack resources
		5.2. Poor concentration
		5.3. Lack motivation
		5.4. Increase stress

Five themes emerged within three overarching concepts from focus group discussions. The overarching concepts and themes were mainly contextual stressors that was affected by the COVID-19 pandemic. Each of the five themes contains subthemes as listed in table 6.2. Considering the subthemes, it is clear that themes and subthemes are associated and findings within the subthemes often overlap. Therefore, focus group findings will be discussed in relation to survey data and not within emerging themes.

6.3.1.1. Perceived general health and COVID-19 risk factors

The surveys' findings indicated that 75% of participants had not contracted COVID-19 at the time that the study was conducted *(n=149).* Amongst participants who had tested positive for COVID-19: 8% were asymptomatic, 14% experienced mild to moderate symptoms and 2% had severe COVID-19 symptoms. Additionally, the survey participants *(n=119)* perceived their general health to have decreased from before COVID-19 to during the pandemic. A decrease of 22% was evident in participants who indicated that they had excellent general health (e.g. fall ill once or twice a year) and a 4.2% decrease amongst the ones who indicated they had good health (e.g. fall ill three to five times per year) prior to COVID-19. In support of these results, the three categories including fair (e.g. ill every second month), poor (e.g. ill every month) and very poor general health (e.g. ill a few times a month) showed an increase of 26.2% from before the pandemic. In terms of the focus group participants who indicated that they became ill more often, they mentioned a poor immune system and dependency on vitamins:

> *"My immune system got weak, so I was more sick. And it's during 2020-2021. I was always sick." FG2:NM* (sic)
>
> *"And I have also come to find every time I relapse on my vitamins I get sick. Like I get sick every time I relapse all my vitamins, I get so sick." FG3:B (sic)*

The participants who responded to the question: "Do you suffer from any conditions that increased your risk for COVID-19?", indicated that 77% do not suffer from any comorbidities. Furthermore, 4% of participants reported suffering from cardiovascular conditions or hypertension. Six percent of participants were obese, and 8% indicated that they suffered from comorbidities not listed. Some of these specified comorbidities that were relevant regarding the question were asthma, human immunodeficiency virus, and lupus, while irrelevant conditions included anaemia and depression.

6.3.1.2. Weight trajectories

Participants indicated their weight in kilograms and whether they perceived a change in their weight since the onset of COVID-19. The weight of the male participants ranged from 55kg to 92kg, with the average weight of the male participants being 76kg. The female participants' weight range were between 40kg and 130kg with 68kg as the average weight. Table 6.2. indicates the participants' perception regarding changes in their weight since the onset of the pandemic. Most participants felt they gained much weight (33%) or a slight amount of weight (24%). In contrast, a few participants felt that they lost much weight (17%) or a slight amount of weight (5%). Twenty one percent of participants perceived no change in their weight.

Participants were requested to state a probable reason for their weight change, if any. These responses included a wide variety of reasons *(n=81)* with the common reasons being lack of physical activity (44%), elevated levels of stress/anxiety (17%), eating more (24%) due to emotions like stress, as well as eating unhealthily (6%). Reasons less often mentioned included: increased (4%) physical activity, eating less (0.1%), loss of appetite (1%), illness (2%), malnutrition (1%) and food insecurity (1%). Focus group participants' reasons for weight change supported the survey findings.

Table 6.3. Perceived weight change since COVID-19 *(n=199)*

Perceived weight change	**Percentage of participants**
Gained much weight	33%
Gained a slight amount of weight	24%
Perceived no change in weight	21%
Lost a slight amount of weight	17%
Lost much weight	5%

Moreover, focus group findings on weight were similar to the survey findings. Fifty eight percent of the focus group participants *(n=17)* gained weight and 38% lost weight. However, an additional theme emerged not aligned with the survey data namely: weight fluctuations of losing and

gaining weight during the pandemic (5%). This theme was mentioned in conjunction with the theme: “being ill more often.”

> *“I was gaining weight and losing weight…. Every three months, if I am healthy again, and then when I am sick for like a week, I lose all the weight that I gained.” FG:NM (sic)*

In addition to the weight of participants, BMI was calculated as a second weight trajectory. The BMI was calculated from the self-reported height and weight of survey participants, and participants were categorised as indicated in Table 6.3. Only 2% of the participants were categorised as underweight and 39% as normal weight. A concerning 33% of participants were in the overweight BMI category and 26% in the obese category.

Table 6.4. BMI categories of participants *(n=51)*

BMI category	BMI measurement	Percentage of participants
Underweight	<18.5	2%
Normal weight	18.5-24.9	39%
Overweight	25.0-29.9	33%
Obesity class I-III	>30	26%

6.3.1.3. Physical fitness

Similar to the information on change in weight, the participants were asked whether their exercise frequency changed since the pandemic (Figure 6.1.). The results reflect a definite decrease in exercise frequency that occurred since the onset of COVID-19. An increase of 11% was observed in the “no exercise” category and an 8% increase in participants who exercised once or twice a week. In support of these increases, decreases in exercise frequency were evident in participants who exercised three to four times (14%) and five to six times (4%) a week, as well as in participants who exercised daily (1%).

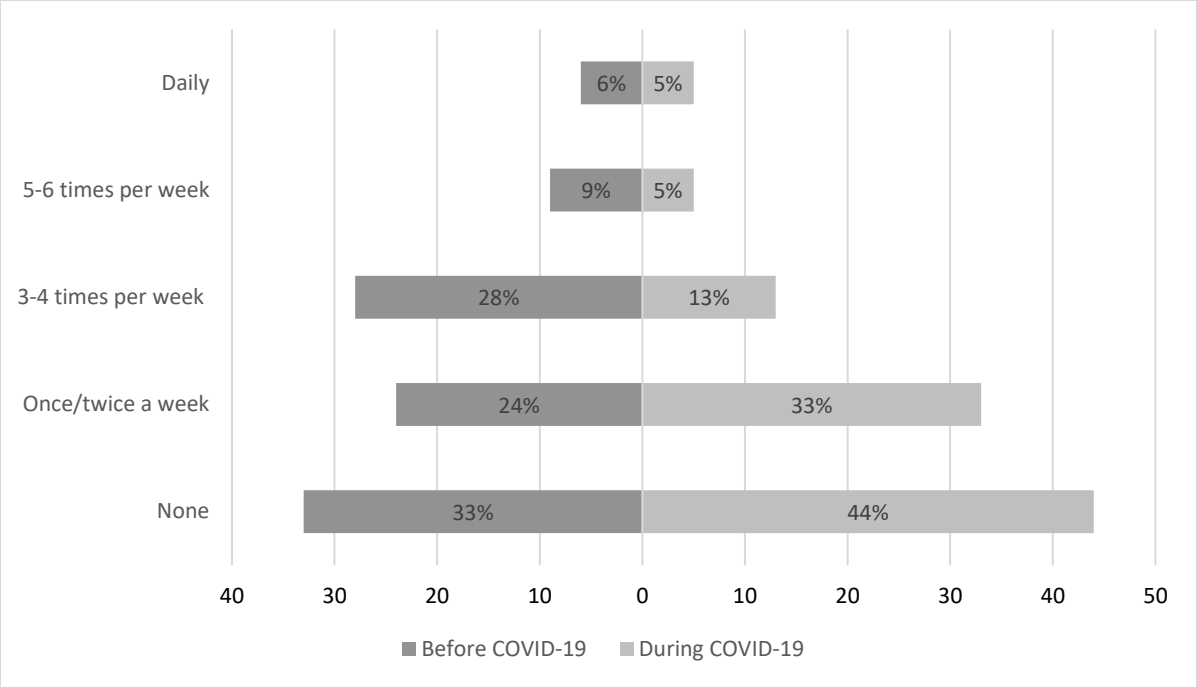

Figure 6.1. Change in exercise frequency since COVID-19 *(n=119)*

Participants who experienced a change in their exercise frequency were requested to provide reasons, if any. Fifty-eight participants provided reasons for the change in exercise frequency and these responses included a wide variety of reasons *(n=58).* The mentioned reasons included the lack of motivation (17%), COVID-19 restrictions (16%) including closed gyms (24%), more time (6%), less time (12%) mainly due to academic load (5%), lack of space or resources (5%), and a fear that increased activity will increase food need (4%). Less common reasons for change in exercise frequency included financial challenges (2%), fear of going outside (2%), depression (2%), a need to relieve stress (increase in exercise) (2%) and lack of energy (3%).

The focus group responses were consistent with the survey data. Focus group participants more often mentioned a decrease in physical activity, with reasons such as the survey participants' stated reasons. However, the lack of motivation and COVID restrictions were the main reasons for decreased physical activity. A participant did indicate that a change in the type of exercises

took place, and more static type of exercises were performed. Other participants indicated lack of knowledge regarding physical activity programmes. These statements were:

> *"… mine changed because we had to do more of static exercises and like in the house ..." FG5:LZ (sic)*
>
> *"…they can create like awareness on healthy eating… And then I also for exercising, like encourage students to exercise. It's not a lot that exercise because they focus more on academic stuff." FG1:SP (sic)*

6.3.1.4. Mental health

Interferential statistics for the metal health section of the questionnaire (based on DASS-21) provided insight into the mental health of participants *(n=107)* during COVID-19. Table 6.4. below reflects the data which were not distributed normally. The median for the depression section was 26, for anxiety 26 and for stress 30. However, these scores should be interpreted against the DASS-21 severity scale, as indicated in Table 6.1.

Table 6.5. Participants mental health results according to the DASS-21

			Statistic	Std. Error
Stress	**Mean**		31.29	.977
	95% Confidence interval for mean	**Lower bound**	29.35	
		Upper bound	33.23	
	5% trimmed mean		31.01	
	Median		30.00	
	Variance		102.208	
	Std. deviation		10.110	
	Minimum		14	
	Maximum		56	
	Range		42	
	Interquartile range		14	
	Skewness		.475	.234
	Kurtosis		-.535	.463

Anxiety	**Mean**		26.9159	.86152
	95% confidence interval for mean	**Lower bound**	25.2078	
		Upper bound	28.6239	
	5% trimmed mean		26.4008	
	Median		26.0000	
	Variance		79.417	
	Std. deviation		8.91164	
	Minimum		14.00	
	Maximum		56.00	
	Range		42.00	
	Interquartile range		12.00	
	Skewness		.765	.234
	Kurtosis		.509	.463
Depression	**Mean**		27.5514	1.06077
	95% confidence interval for mean	**Lower bound**	25.4483	
		Upper bound	29.6545	
	5% trimmed mean		26.8079	
	Median		26.0000	
	Variance		120.401	
	Std. deviation		10.97272	
	Minimum		14.00	
	Maximum		56.00	
	Range		42.00	
	Interquartile range		16.00	
	Skewness		.900	.234
	Kurtosis		.082	.463

The focus group subthemes included the three DASS-21 sections as mentioned in the survey results. In addition to the DASS-21 sections, the following findings emerged relating to emotions and mental health: fear, frustration, loneliness, sadness, relaxed, emotional outbursts and a need for emotional support (Figure 6.2.).

"I was really scared at that time because all we can think about was dying, getting ill and not getting treated or cured from a Covid. We were very scared." FG6:M (sic)

"…mentally, I was not OK because we are getting different news every day and scaring news every day." FG3:B (sic)

Figure 6.2. Focus group findings related to emotions and mental health *(n=17)*

The qualitative data obtained from the focus group discussions regarding mental health highlighted the existence of inherent complexities and interplay of numerous factors that could have affected mental health symptoms during COVID-19. These included contextual stressors brought on by the pandemic and the role of individual differences. Some of the contextual stressors due to the pandemic included financial and job insecurity, health anxieties and worries about virus contagion, socio-economic issues, as well as media coverage of the pandemic.

Examples of individual differences were persistent vulnerabilities (e.g. negative affectivity, difficulties regulating emotions), resiliency factors (e.g. problem-focused coping styles, trait resilience), and social factors (e.g. the quality of familial relationships and the strength of social networks). These complexities and interplay of factors should be considered when analysing the findings of studies that investigated the impact of the pandemic on the mental health of people. Additionally, such integrative approaches ought to consider the connections between various aspects of mental health and physical well-being.

Focus group participants also mentioned relations of their mental health negatively impacting on other parts of their life, e.g. binge eating, weight loss, lack of concentration that made studying difficult and ulcers. Some of the quotes from such discussions were:

> *"People mostly took comfort food. I think it was a way of distracting themselves from the whole situation outside." FG6:K (sic)*
> *"…my mental health was not OK. I was not able to concentrate." FG4:MM (sic)*
> *"In 2020 I had lost a lot of weight because I lost my mom and I was stressing a lot." FG3:NB (sic)*
> *"And then sometimes I have ulcer pains." FG3:NM (sic)*

6.3.1.5. Student support

The results from the survey indicated that 82% of Health Sciences students were not aware of any support services that assist with health-related issues at the specific institution. Moreover, 4% of students indicated that they made use of the institutional counselling services. Participants from focus group discussions responded in a similar manner and some also indicated that they were not aware what the purpose of the available services was. Examples of such responses are indicated below:

"Like honestly, I never knew for three years, four years now. But I have never been aware that we have those kind of services." FG3: NB (sic)

"I did not understand what the Wellness Centre was for." FG2: NM (sic)

Additional concerns that were raised during focus group discussions were the inability of the available support services to serve the high volume of students in need, as well as statements from students in need who did not make use of the mentioned services. Some of these statements were as follows:

"Sometimes you try to call or send an email and no one responds or no one answers the phone. So, you get discouraged to even try and cause try using other services that the institution provides, cause usually no one answers or response to anything." FG6: K (sic)

"No, Ma'am, I did not (make use of support services)." FG2: NM (sic)

Participating students from focus group discussions requested assistance and additional services such as exercise guidelines/programmes and healthy practices such as stress management. These discussions included requests to be mindful about students' circumstances that included lack of funds to access services or to obtain the necessary equipment. Quotes relating to these discussions were:

"…as an institution can look into having their own like fitness thing going … showing us how we can keep fit." FG3: B (sic)

"… I did not go to any (support services). I am staying at Botshabelo, so I will have to use a transport to go there." FG2: NM (sic)

"…that (small exercise groups) should be for free or be at a lower cost." FG4: K (sic)

"…We can get that (exercise programmes) on, YouTube and like everywhere on our phones but it is still difficult to join, doing exercise and all that stuff." FG6: M (sic)

6.3.1.6. Correlations

Before the inferential statistics were conducted, the variables were assessed for normality as the assumption of normality is a prerequisite for a substantial percentage of parametric statistical analysis. The Shapiro-Wilk test (Table 6.5) indicated that all variables significantly deviated from a normal distribution with p values <0.05. Therefore, non-parametric equivalents for the parametric tests were used for investigating the correlations between the variables (Laerd Statistics, 2019).

Table 6.6. Shapiro-Wilk Test of Normality

Variable	Statistic	df	p value
MENTAL HEALTH TOTAL SCORE	.952	107	.001
Stress	.961	107	.003
Anxiety	.950	107	.001
Depression	.912	107	.000

A Mann-Whitney analysis was conducted to compare the following variables: home residence categories, gender categories and mental health (including subsections). However, no statistically significant difference existed between the mentioned variables. Similarly, the result from a Kruskal Wallis comparison indicated that there existed no statistically significant difference between any of the registered course categories of any of the following variables: mental health, depression, anxiety, and stress.

Although the current paper did not report on the food insecurity of students, the overarching research study did investigate the Health Sciences students' levels of food security. However, the relationship between food insecurity and mental health is included the current sub-study. Therefore, the findings on participants' food insecurity are briefly reported prior to the related correlation results, to put these results into context.

Food security of Health Sciences students was assessed by means of the Household Food Insecurity Access Scale (HFIAS) and categorized into four categories: food secure, mildly food insecure, moderately food insecure and severely food insecure. Survey results showed that 16% of participants were food secure during the pandemic, 54% experienced mild food-insecurity, 28% experienced moderate food insecurity and 2% experienced severe food insecurity with irregular and smaller meals.

A Spearman's rho correlation analysis was performed (Laerd Statistics, 2019) to investigate the association between the following variables: the three dimensions of the mental health section and the food security section of the questionnaire. The results of the correlation analysis are reflected in the correlation matrix below (Table 6.6.).

Table 6.7. Spearman's rho Correlation Analysis

		FOOD SECURITY	**Stress**	**Anxiety**	**Depression**
FOOD SECURITY TOTAL SCORE	Correlation coefficient	1.000	.117	.253**	.218*
	p-value	.	.231	.008	.024
	N	141	107	107	107
Stress	Correlation coefficient	.117	1.000	.769**	.822**
	p-value	.231	.	.000	.000
	N	107	107	107	107
Anxiety	Correlation coefficient	.253**	.769**	1.000	.773**
	p-value	.008	.000	.	.000
	N	107	107	107	107
Depression	Correlation coefficient	.218*	.822**	.773**	1.000
	p-value	.024	.000	.000	.
	N	107	107	107	107
MENTAL HEALTH TOTAL SCORE	Correlation coefficient	0.199*			
	p-value	0.039			
	N	107			
**** Correlation is significant at the 0.01 level (2-tailed).**					
**** Correlation is significant at the 0.05 level (2-tailed).**					

The total scores of the food security section (based on HFIAS) and total scores of the mental health section (based on the DASS-21) were compared to investigate a relationship. The results indicated a positive and statistically significant relationship existed between the food security section's total score and the mental health section's total score (rs=0.199, p=0.039). Moreover, the total score of the food security was also compared to the three subsections of the mental health section.

Similarly, a positive and statistically significant relationship existed between the food security section's total score and two of the three subsections of mental health were identified: anxiety and depression. This relationship between the food security total and the anxiety variable (rs=0.253, p = 0.008) indicated that participating students with higher total food security scores (more food insecure) also had higher anxiety scores. Likewise, participants with lower total food security scores (more food secure) had lower anxiety scores. Furthermore, the relationship between the food security total score and depression subsection (rs=0.218, p=0.024) indicated that participating students with higher total food security scores (more food insecure) had higher depression scores. Correspondingly, students with lower total food security scores (more food secure) had lower depression scores. In contrast to the relationship of food security with anxiety and depression, no statistically significant relationship existed between the total food security scores and the stress subsection of mental health.

The results from the comparison between the three subsections of the mental health section indicated that a positive statistically significant relationship existed between the stress and anxiety variables (rs=0.769, $p < 0.001$), and a positive statistically significant relationship between the stress and depression variables (rs=0.822, $p < 0.001$). This positive statistically significant relationship between the variables means that as one variable increases, the other variable also tends to increase. There was also a positive statistically significant relationship between the anxiety and depression variables (rs=0.773, $p < 0.001$). Therefore, due to the impact of food

insecurity on stress and anxiety, it would have indirectly also impacted the depression levels of individuals despite the fact that no significant relationship was found.

6.3.2. Discussion

6.3.2.1. Perceived general health and COVID-19 risk factors

The results on the infection rate of participants during COVID were low in relation to the South African COVID-19 infection statistics amongst the public (Reuters, 2022). A probable reason might be that all-contact classes were suspended early after the onset of the pandemic and implementation of strict COVID-19 protocols were enforced at universities upon return (Pijoos, 2020; Van Schalkwyk, 2020) to contain the spread of COVID-19 amongst students as far as possible. Also, many young people who contracted COVID-19 may have been asymptomatic and thus unaware that they have been infected (Day, 2020). However, even though students may not have tested positive for COVID-19, the pandemic still influenced the wellbeing and general health of the students who participated in this study.

The decrease in general health perceived amongst participants was not isolated to this study and compares well with the results reported by Statistics South Africa (STATSSA) amongst the public of South Africa (STATSSA, 2020). Many reasons were responsible for the decrease in general health during the pandemic. These included the following: COVID-19 received more attention than other non-communicable diseases, the additional burden from COVID-19 on the already insufficient health services in South Africa; fear of seeking medical attention for various reasons, e.g. becoming COVID infected; poor water and sanitation services in South Africa – especially in rural areas; increased sedentary lifestyle due to COVID-19 regulations; and an increase in stress levels (Adebiyi *et al.*, 2021; Kim, Nyengerai & Mendenhall, 2020; Mbunge, 2020; Sekyere, 2020; STATSSA, 2020).

A retrospective study investigated the prevalence of disease severity and comorbidities amongst hospitalised health care workers (Ratshikhopha, Muvhali, Naicker, Tlotleng, Jassat & Singh,

2022). Similar to the current study, obesity and hypertension were amongst the most frequently mentioned comorbidities. Moreover, the study indicated that these pre-existing comorbidities were significantly related to the severity of COVID-19 (Ratshikhopha *et al.*, 2022). This is valuable information for the development of occupational health policies and vulnerability risk assessments of health care students and workers, especially considering future COVID-19 outbreaks or pandemics that might result in similar circumstances. Furthermore, the role that comorbidities might play in the general health of participants should be noted. For example, obesity and hypertension increase the risk for other life-threatening diseases and fatality (Jiang, Lu, Zong, Ruan & Liu, 2016). While not all comorbidities can be controlled by an individual, being informed on the contributing lifestyle behaviours might assist individuals to prevent comorbidities and the risks that result from such comorbidities (Hruby, Manson, Qi, Malik, Rimm, Sun, Willett & Hu, 2016).

6.3.2.2. Weight trajectories

Many participants reported gaining weight (36%), which could be detrimental to their health. As mentioned, obesity increases the risk of developing non-communicable diseases such as diabetes, cardiovascular diseases, certain types of cancers, poor health-related quality of life and premature death (Fontaine & Barofsky, 2001; Hruby *et al.,* 2016). These results indicated the need for participants to receive guidance on the importance of preventing weight gain through healthy dietary and lifestyle behaviours for long-term health and wellness – not only during pandemics, but under all circumstances.

The reasons provided by participants for their reported weight gain and high BMI, included unhealthy dietary and lifestyle behaviours. The fact that the students included in the study were from Health Sciences may have contributed to this awareness as they should be knowledgeable on the link between lifestyle and health. Other reasons that could have contributed to weight were prolonged screen time, short sleep duration or shift work (Hruby *et al.,* 2016). Thus, despite

the knowledge that the Health Sciences students have regarding the role of healthy diet and lifestyle in weight management, a need still existed for further education on these topics.

The high percentage of students (>50%) in the overweight and obese BMI categories were similar to the results observed in other studies where adolescent obesity in South Africa were found to be high (Nwosu, Fismen, Helleve, Hongoro, Sewpaul, Reddy, Alaba & Harbron, 2022; Otitoola, Oldewage-Theron & Egal, 2021). However, the findings contradicted the findings of an international study on the BMI of Higher Education students, where more than half of the students were in the healthy weight category (Sanci, Williams, Russell, Chondros, Duncan, Tarzia, Peter, Lim, Tomyn & Minas, 2022). Even more concerning than the high percentage of overweight and obese students, was the lack of realisation in a large percentage of being overweight or obese. This is based on comparing the few participants (4%) who reported that they have the COVID-19 comorbidity: obesity, with the much higher percentage who are found obese according to their BMI categories. The contradictory findings support the identified need amongst participants to be educated on healthy body weight.

The above-mentioned weight trajectory findings were mainly based on self reporting items. Although self-reporting could have been a limitation, the circumstances of the research setting made anthropometric measurements impractical. Therefore, the possibility of recall bias and self-reporting limitations should be considered in regard to the weight trajectory findings.

6.3.2.3. Physical fitness

The reported weight gain and high percentage of students with BMI in the overweight and obese categories emphasises the importance of eating a healthy diet and physical exercise. The survey results indicated that a definite decrease in physical fitness occurred during the pandemic, most probably due to movement restrictions and closed gyms during the pandemic.

These findings contradicted findings from a Swiss study amongst Health Sciences students which found that more than 60% of the students participated in health-enhancing physical activities during the COVID-19 lockdown (Taeymans, Luijckx, Rogan, Haas & Baur, 2021). However, the current study did not investigate activity during COVID-19 hard lockdown only, but rather a more extended period during COVID-19.

Similar to the findings of the current study, a large number of studies reported a decrease in physical activity and an increase in sedentary lifestyles during the COVID-19 pandemic (Castañeda-Babarro, Arbillaga-Etxarri, Gutiérrez-Santamaría & Coca, 2020; Ng, Cooper, McHale, Clifford & Woods, 2020; Stockwell *et al.*, 2021). This was concerning as a sedentary lifestyle has a negative impact on other health-related factors. A study by Maugeri, Castrogiovanni, Battaglia, Pippi, D'Agata, Palma, Di Rosa and Musumeci (2020) found a significant positive correlation between the decrease of physical activity and psychological health and well-being of individuals during COVID-19. In turn, such unhealthy lifestyles and anxiety are associated with long-term effects on cardiovascular health (Mattioli, Sciomer, Cocchi, Maffei & Gallina, 2020). Therefore, relevant strategies are required to assist students to maintain a regular exercise routine during ICE circumstances such as the COVID-19 pandemic. Additionally, education programmes that can empower students with knowledge about the benefits of physical activity and exercise are critically important. Finally, educating Health Sciences students as future health care professionals could play an essential role in disseminating relevant knowledge to those with whom they come into contact (Alotaibi, Al-Sayegh, Nadar, Shayea, Allafi & Almari, 2021; Bughrara, Swanberg, Lucia, Schmitz, Jung & Wunderlich-Barillas, 2023).

6.3.2.4. Mental health

The results obtained with the DASS-21 provided important information about mental health of the participants. The DASS-21 severity scale showed that the anxiety levels of students were in the severely extreme category. Furthermore, both depression and stress levels of the students were in the severe category.

The experience of anxiety was the most significant of the three mental health disorders. Other studies that assess mental health supported the findings of the current study, indicating above-normal stress and anxiety levels amongst individuals during the pandemic (Vindegaard & Benros, 2020). Sources of stress during the pandemic that could have impacted on the mental health of students were highlighted in other studies as difficult relationships, changes in academic life, isolation/social distancing, and fear of COVID-19 infection (Bughrara *et al.*, 2023; Zurlo, Cattaneo & Valonne, 2020).

Aligned with these sources of stress from the literature, the focus group discussions about mental health highlighted numerous factors that could have affected students' mental health during COVID-19. At the same time, students' mental health impacted negatively on other aspects of their lives, e.g. eating patterns and concentration levels. This qualitative data reiterated associations between poor mental health and physical health, and were similar to the findings of other earlier studies (Prince, Patel, Saxena, Maj, Maselko, Phillips & Rahman, 2007; Luescher *et al*., 2020; Whiteford, Degenhardt, Rehm, Baxter, Ferrari, Erskine, Charlson, Norman, Flaxman, Johns, Burstein, Murray & Vos, 2010). Comparable results were also obtained in studies investigating the mental health of Higher Education students prior to the COVID-19 pandemic. However, the high percentage of participants that reported poor mental health was not surprising, since most university students were at the age range that is the peak period of onset of mental and substance use disorders (Sanci *et al.*, 2022).

Numerous studies have investigated the link between mental health and academic performance of Higher Education students (Wyatt, Ostwalt & Ochoa, 2017, Wyatt & Oswalt, 2013). Wyatt and Oswalt (2013) found that mental health issues such as stress have a significant impact on academic performance, especially of undergraduate students. Moreover, poor mental health, together with poor academic performance, might pose a serious threat to health, with higher rates of self-injury and suicidal thoughts being reported amongst such students (Wyatt *et al.*,

2017). In addition to this threat on health, poor mental health also has negative effects on the long-term physical health of individuals.

Approximately 14% of the world's disease burden has been linked to mental health issues, demonstrating how crucial mental well-being is to overall health. The consequences of mental disorders are frequently underappreciated because of a poor understanding of the connections between mental disease and other health conditions. Mental health is essential to physical health based on the complex interactions between these two. Moreover, mental illnesses increase the risk of contracting both infectious and non-communicable diseases, as well as purposeful and unintentional harm (Prince *et al.*, 2007; Whiteford *et al.,* 2010). This interdependence became apparent in the results of the current study where focus group participants indicated that their poor mental health led to poor behaviour that negatively impacted their physical health (e.g. binge eating). Interdependence was also observed in the opposite direction, where poor physical health might have impacted the mental health of participants such as the reported low physical activity which relates to poor mental health according to Maugeri *et al.* (2020). The cycle of negative influences on each other highlighted the importance to consider the impact of COVID-19 on students in a holistic manner, instead of focusing on isolated aspects of their health and well-being.

In accordance with the correlation results on food security and mental health (including subsections), previous studies have similarly demonstrated that food insecurity and mental health are closely related. The relationship was evident in studies focusing on the COVID-19 period (Fang, Thomsen & Nayga, 2021), as well as the time before the pandemic (Pourmotabbed, Babaei, Jalili, Symonds & Miraghajani, 2020). The relationship indicated that food insecurity was the independent variable impacting on the dependant variable: mental health. These two dependencies were commonly mentioned in literature.

One of the food insecurity dependencies was the well-described impact thereof on nutritional status, growth, and development (Thompson, Cohen & Meerman, 2012). Some authors advocated that food nourishes emotional and psychological well-being (Block *et al.*, 2011; Woolf, 1929). Therefore, the lack of proper nutrition associated with food insecurity contributed to poor mental health, including poor cognitive ability.

The less often described non-nutritional impacts of food insecurity have been found to have a positive relationship with mental health. Thus, individuals who experienced food insecurity were more likely to experience poor mental health outcomes such as depression, anxiety, and stress (Diamond, Stebleton & del Mas, 2020; Pourmotabbed *et al*., 2020). The stress of not having enough food or not knowing when the next meal will come could have had a significant impact on individuals' mental well-being. While the current study did not find a significant relationship between food insecurity and depression, other studies found that food insecurity is associated with depression. However, these findings were associated with studies investigating long term food insecurity (Diamond *et al*., 2020), in contrast to the short-term investigation of the current study. In addition to investigating the relationship of food security with mental health subsections of the questionnaire, the mental health subsections were also compared to each other.

The results from the comparison between the three subsections of the mental health section showed a relationship between the stress and anxiety variables, stress, and depression variables, as well as anxiety and depression variables. Therefore, due to the impact of food insecurity on stress and anxiety, it would have indirectly also impacted the depression levels of individuals despite that fact that no significant relationship was found. Since these findings were amongst Higher Education students, the possibility existed that poor mental health also impacted other essential factors, such as academic performance (Wyatt & Oswalt, 2013), which were not investigated within the scope of this study.

6.3.2.5. Student support

The results showed that a high number (82%) of students were unaware of any institutional support services, and despite their need for mental health assistance, limited students made use of the available counselling services (1%). Similar findings were reported in an Australian study amongst students who experienced poor mental health but did not make use of available institutional support services (Sanci *et al.*, 2022). To optimise available support services when experiencing events that lead to ICE environments, awareness of the services should be promoted amongst students. This could include providing online support and interventions which may be more appealing to students (Sanci *et al.*, 2022). Results of focus group discussions supported the quantitative findings where students also indicated that they were not aware of the purpose of the available services.

As was evident from this study and others that the pandemic has led to increased levels of stress, anxiety and BMI paired with decreased levels of physical activity among students (Brooks, Webster, Smith, Woodland, Wessely, Greenberg & Rubin, 2020; Stockwell *et al.*, 2021). These health challenges were attributed to factors such as social isolation, financial difficulties, and uncertainty about the future. Due to the significant impact on the health of students, support services at Higher Education institutions, such as counselling, are necessary to address challenges (Van Staden & Naidoo, 2022). To ensure effectiveness of such services, the purpose thereof should be well communicated to students. Moreover, these services should take cognisance of the target group's circumstances to improve access and utilisation of the services (Van Staden & Naidoo, 2022).

In conclusion, the results of the study indicated that the ICE environment caused by COVID-19 had a significant impact on the nutritional health and wellness indicators of Health Sciences students who participated in the study. The indicators included perceived general health, weight trajectories (including BMI), physical fitness and mental health. The mentioned negative impact is highlighted in the following summary of findings.

The majority of students perceived their general health to have decreased from before COVID-19 to during the pandemic; however, most students did not contract COVID-19. One third of the Health Sciences students felt that their weight has increased. Similarly, one third of participants were in the overweight BMI category, and approximately a third (26%) in the obese BMI category, indicating an increased risk for conditions such as type 2 diabetes and cardiovascular diseases. This finding was contradictory to the mere 6% of students who indicated that they had obesity as a COVID-19 comorbidity. Another important finding was that the frequency of physical activity drastically decreased. Lastly, the findings on mental health were concerning with the mean scores for anxiety at a severe level, according to the DASS-21 evaluation.

The interrelationship that existed between physical health and mental health was highlighted in the qualitative data obtained from the focus group discussions. The qualitative data also brought to light the link between poor mental health and academic performance, as well as students' contextual circumstances and variables. These circumstances and variables could have influenced the investigated health and wellness indicators, in addition to the influence of COVID-19. Therefore, the findings of the study should be interpreted considering the context of the specific student cohort.

A need was identified amongst students for a health and wellness programme that include creating awareness, health and wellness training and support. It was recommended that Higher Education institutions and governments should reflect on the manner in which they have responded to COVID-19 and consider a programme with additional interventions and strategies to optimise health and wellness – also during future ICE circumstances. It was assumed that such a programme might also have a positive impact on students' academic performance and overall quality of life. Additionally, empowering Health Science students as future health care professionals with knowledge might improve the health and wellness of the broader community should they disseminate their knowledge.

The study indicated a need for data on the health and wellness of students prior to the pandemic, to compare the health and wellness of students before and after the pandemic. Obtaining such data may confirm whether poor health already existed prior to COVID-19. Therefore, future research should investigate the health and wellness of South African students under usual circumstances to establish if a need for assistance and/or interventions also exist outside of ICE circumstances.

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CHAPTER 7

Toward a health and wellness programme to ensure optimal student performance and well-being within ICE environments

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ABSTRACT

Introduction and aim: Research from around the world has identified numerous negative impacts of the COVID-19 pandemic and resultant isolated, confined and extreme (ICE) environment had on students. These included decreased physical activity, changes in diet, weight gain, food insecurity and poor mental health. This paper proposes an intervention programme that highlights the strategies that universities could apply to prepare for future situations, similar to those encountered during COVID-19.

Methods: Design thinking and project management processes were integrated towards a proposed intervention to respond to the challenges that emerged from the findings of the study. The integrated design process was based on the Stanford model and consisted of six phases: (1) Initiation and planning, (2) Empathise, (3) Execute and Define, (4) Ideate, (5) Prototype, (6) Closure.

Results: A mind-map with strategies was developed and presented by means of two areas, namely awareness and communication, and resources. In the awareness and communication category the following strategies were suggested: increasing communication of offered support services, running awareness campaigns, developing skills and knowledge and evaluation of the student cohort as part of ensuring adequate capacity support services. The resources category consisted of a wellness software application with AI, an adequate and accessible food aid programme, and a wellness support programme that includes nutrition and fitness assistance components. It was recommended that the proposed programme be implemented by Higher Education institutions according to the Nadler-Tushman model of congruence, whereby implementation is based on a process of transformation to reach the output. The proposed programme is adaptable, enabling institutions to respond in alignment with their specific contexts and ensure congruence amongst all elements.

Conclusion: A programme with strategies and interventions is proposed to institutions through reflection on their current support service structures, and amendment of current strategies to suit specific circumstances. The proposed programme serves as a point of departure for institutions looking to ensure student health and wellness, as well as academic performance during future ICE events.

Keywords: COVID-19, Higher Education, ICE environment, design thinking, project management, Nadler-Tushman model

7.1. INTRODUCTION

The coronavirus disease of 2019 (COVID-19) resulted in a major global pandemic with the enforcement of various far-reaching regulations by governments to contain the spread of the virus. These regulations varied from closing of non-essential businesses to movement restrictions and isolation (Stiegler & Bouchard, 2020). Therefore, the effects of the COVID-19 pandemic involved far more than merely being infected by the virus itself. The regulations that were applicable during the pandemic resulted in an ICE environment that impacted the lives of young and old (Suedfeld & Steel, 2000).

Higher Education institutions had to conform to certain regulations during the pandemic, such as vacating campus residences and reverting to online teaching and learning (Van Schalkwyk, 2020). As a result, students had to cope with both the negative effects of the ICE environment and the challenges of remote, online studying. Numerous negative impacts which the COVID-19 circumstances and resultant ICE environment had on students, have been identified by research conducted across the globe. Decreased physical activity, changes in diet, weight gain, food insecurity and poor mental health are some of the identified negative impacts (Jehi, Khan, Halawani & Dos Santos, 2023; Bughrara *et al.,* 2023; Taeymans *et al.,* 2021, Zurlo *et al.,* 2020).

As a result, a study was initiated to examine food security and related wellness indicators of Health Sciences students in central South Africa during COVID-19 and to propose a programme to Higher Education institutions toward alleviating the impact of ICE events. The current paper utilised the data collected during the mentioned study with the aim of proposing a programme with interventions and strategies to the Higher Education platform in South Africa. Research studies, such as the current study are particularly important in countries with developing economies, like South Africa, due to the socio-economic challenges of students in these countries. The results obtained in the sub-studies concurred with the findings of other studies reported in the literature and indicated that the circumstances of the COVID-19 pandemic significantly affected students' food security, dietary intake, general health, physical fitness, weight, and mental health.

The impact of ICE environments is not only associated with the mentioned negative effects (Choukér & Stahn, 2020), but is also closely linked to individual factors such as personality, ability to cope (resilience), psychological and social support. Prior to the COVID-19 pandemic Higher Education institutions offered mainly in-person psychosocial support to students (Linden, 2020) and some type of nutritional support (Wegerif & Adeniyi, 2019). During the pandemic, such services had to be expanded to enable support to the increased and altered needs of students. Preceding the pandemic, the Wellness Centre of the Central University of Technology, Free State (CUT) offered support services in the form of meal vouchers and face-to-face counselling sessions to students. However, these services were expanded during the pandemic by means of financial assistance and a mobile/online counselling service (CUT, 2020). As is evident from the results of the current study, these support services were not adequate to ensure students' food security, and health and wellness status. The findings of the current study highlighted a need for a Higher Education programme to alleviate the impact of COVID-19 circumstances on students, and also for Higher Education institutions to review the existing students support services to identify areas in need of improvement and change. Hence, the Higher Education programme is recommended to be implemented by means of a change model. Such a model has the potential

to assist Higher Education institutions to transform their offered support services to meet the needs of students during an ICE environment such as the COVID-19 pandemic.

7.2. METHODOLOGY

The study coherently utilised design thinking and project management principles as methodology to develop interventions and strategies for Higher Education to limit the negative impacts of ICE environments on students (Table 7.1.). In addition, the Nadler-Tushman Congruence model was then utilised to discuss and interpret the proposed interventions and strategies.

Table 7.1. The integrated design thinking and project n

Five Project planning phases	Stanford design thinking phases	Research methods	d tional rt		Problems/ challenges	Solutions/recommendations
1. Project initiation & 2. Planning		Identify project & compile a proposal with among other an aim, objectives, methods.	Identification of objectives (refer to chapter 1)			
	1. Empathise	Literature and document reviews	Objectives I and ii	Food relief Financial assistance Psychological counselling		
3. Execute	2. Define	Qualitative & quantitative data assist with defining the challenges/impacts of ICE on students	Objectives iii-vii		Food insecurity worsened. Dietary intake changed. Weight gained. Physical activity decreased. Poor mental health.	
	3. Ideate	Interpretation of data and brainstorm ideas for solutions to identified challenges – by means of integrated model phases				Brainstorming for broad set of solutions
	4. Prototype	Discussions and interpretation of interventions and strategies (solutions)	Objective viii			Proposed programme for Higher Education as illustrated in mind map below (Figure 7.2.) to be implemented according to the Nadler-Tushman model (section 7.4.2)
5. Project closure		Concluding research project, present limitations, finalising thesis, publish articles to communicate findings				Recommend areas for future research
	5. Test	Postdoctoral phase (outside the scope of this study)				

4. Monitor and control

7.2.1. Design thinking as methodology

Design thinking is defined as a methodology or mindset that facilitates innovative solutions to problems and operates at the interface amongst human values, business, and technology. This is a well-researched method for non-design trained professionals to solve problems, find solutions and design an action plan (Stanford University, 2023). The Stanford Design Thinking Model was utilised in the current study with some adaptations. This design thinking model was originally proposed by Hasso-Plattner and is popular within the Higher Education environment as it enables the creation of human-centred solutions (Stanford University, 2023; UCT, 2023). The five phases in the Stanford design thinking process include empathy, define, ideate, prototype and test. These phases can be defined as follows.

- "Empathise" is the first phase and is the middle point of a human-centred design process. This initial phase is aimed at comprehending how and why people do things, as well as their physical and emotional requirements. In other words, this phase refers to the work that the designer performs to understand who the users are and what is important to them to design for within the context of the problem/challenge. This includes actions such as conducting research, observing users, and gathering data to gain insights into their behaviour and preferences.

- Once the designer has a proper understanding of the users, the next phase is to delineate the problem. This involves synthesising the data collected on the users and their context and identifying the core challenges that need to be addressed. These core challenges emerge from a process of synthesising information to discover connections and patterns. Therefore, this phase comprises conceptualising the collected information and creating a meaningful and actionable problem statement. This problem statement is also known as the designer's point-of-view: the explicit expression of the problem to be addressed.

- The third phase, “ideation”, involves generating ideas and exploring different solutions to the problem. The importance of “ideate” is the transition from identifying problems to creating solutions for the users. Therefore, this phase involves integrating the information on the problem and the users to generate innovative and creative solutions. Initially, the widest possible set of ideas should be considered, while identification of the best solutions is discovered later by means of user testing and feedback. Ideation may include actions such as brainstorming, sketching, and prototyping to produce innovative and creative solutions.

- Once ideas have been generated, “prototypes” of the solutions should be created during the fourth phase. A prototype can be anything that the user can interact with and ideally it should be something that the user can experience. Prototypes may include rough sketches, interactive models, innovative gadgets, a role-playing activity, or even a storyboard, depending on the complexity of the solution. The prototype phase is crucial as it assists to ideate and problem-solve, communicate, and start a conversation, test possibilities without committing to one, and manage the solution-building process in smaller, testable parts.

- The final phase is to assess the prototypes with users and gather feedback on how well these solutions met their needs. This phase also provides an opportunity to gain empathy for the users and to learn more about the problem and suitable solutions. The “test” phase involves conducting user testing and refining the prototypes to result in a solution that works well for users.

Overall, the Hasso-Plattner design thinking process is a powerful tool for problem-solving that guides creation of innovative solutions that meet user'' (Higher Education students, in this case) needs. By following these five phases, the designer (researcher in this case) can gain a deep understanding of the users, identify the core challenges that need to be solved, generate creative

ideas, prototype the solutions, and test them with users to ensure they work well in practice (Stanford University, 2023). Despite the mentioned strengths of design thinking in problem-solving, it was anticipated that the addition of some project management principles could add value to the design process, providing a more comprehensive design model within the context of the research study. Therefore, the design thinking method was integrated with five phases of project management as described by the Project Management Body of Knowledge (PMBOK).

7.2.2. Project management as methodology

Project management refers to managing of a temporary project as a unique endeavour aiming to produce a result with a defined beginning and end (usually time-constrained, and often constrained by funding or staffing). Such a project aims to reach specific goals and objectives, usually to achieve positive change or add value (Philips, 2004; Project Management Institute, 2023). This definition fitted the context of the current research study where the research project aimed to suggest a programme with the goal to mitigate the effects of future ICE environments on students' health and wellness. The following five project phases are included in project management (PMBOK): initiation, planning, execution, monitoring/controlling, and closing (Siems, 2023).

- "Project initiation" is the formal start of a project. The project must be defined, and the need therefore justified. Therefore, a problem should be evaluated, and it should be determined if the project will solve the problem. Therefore, key aspects of the initiation phase are the project plan, stakeholders to involve, purpose, scope, timeline, size, risks, and objectives to be obtained. It usually begins with the issue of a project mandate which briefly describes the purpose of the project and authorises budget spend (nibusinessinfo, n.d.; Siems, 2023).

- "Project planning" is the second phase of project management where the detailed project is defined with among other a schedule, goals, technical requirements. This stage typically

begins with setting goals. Two popular approaches to set goals include: the SMART method (specific, measurable, attainable, realistic and timely) and the CLEAR method (collaborative, limited, emotional, appreciable, refinable). After setting goals the roles and responsibilities of stakeholders should be defined, followed by the scope statement. The latter refers to the objectives, benefits, and deliverables to be produced by the project. The time schedule, costing and resources available, progress checkpoints and risks are also part of the project planning phase (nibusinessinfo, n.d.; Siems, 2023).

- The "project execution" phase is the third phase of project management and refers to the implementation of the project plan. This phase entails performing tasks and activities defined by previous phases of the project to produce the deliverables. Activities included in this phase is managing resources, communicating with stakeholders and quality assurance (nibusinessinfo, n.d.; Siems, 2023).

- The "monitoring and control phase" often overlaps with the execution phase. The monitoring and control phase implies measuring project progression and objectives reached, as well as identifying problems that might have occurred together with solutions thereof. Examples of performance areas to measure are the time schedule and budget and completion of tasks. In some instances, schedules and resources might need adjustment, which will also occur during this phase (nibusinessinfo, n.d.; Siems, 2023).

- During the last phase, "project closure", the work will be completed, and the project will be dissolved. This closure does not necessarily refer to the success of the project, but rather indicates the final point of the project. The project closure can include the following aspects: identifying successes and failures, presenting deliverables, archiving documents, and preparing the final budget and report. Following the project closure a project review should be performed to identify successes and failures, as well as future areas for improvement (nibusinessinfo, n.d.; Siems, 2023).

7.2.3. Application and adaptations of the design thinking and project management phases

The Stanford design thinking and project management processes were integrated, adapted, and applied to the final sub-study (Table 7.1.). Within the context of the study the researcher was the designer and project manager, while the students were the users and the beneficiaries in the mentioned processes. The two processes were integrated and adapted as follows: only the first four phases of the design thinking approach were applied. The last phase, testing of solutions, fell outside the scope of the study and could be addressed during a postdoctoral phase. Furthermore, the first two phases of project management, initiation and planning were combined and added prior to empathising of design thinking. The execution phase of project management was merged with the define stage of design thinking. The monitoring and controlling of the project management were integrated into all the phases as a measurement to ensure quality and to reach the objectives. Lastly, the project closure was added as the last phase, following the prototype. Therefore, the adapted and integrated design process consisted of six phases: (1) Initiation and planning, (2) Empathise, (3) Execute and Define, (4) Ideate, (5) Prototype, (6) Closure. These six phases of the integrated process were applied to this study (Table 7.1.) in the following manner:

In the initiation and planning phases the researcher identified the research problem, namely: “How did the ICE environment resulting from the COVID-19 pandemic impact the nutritional health and wellness of students?” Therefore, if this impact could be determined, a programme with preventative strategies and interventions could be developed for Higher Education institutions to ensure optimal performance of Higher Education students when experiencing events that lead to ICE environments. Additionally, a research proposal document was compiled to plan and guide the research project. This document included the aims, objectives, timeline, methods, and budget relevant to the study. Chapters one and two of the overarching study contain most of the aspects from the initiation and planning phase.

Various actions were taken to empathise with the users that included conducting literature and document reviews on the context of Higher Education during COVID-19, as well as surveys and focus group discussions to gather data on, and to gain insights into the behaviour and preferences of Health Sciences students during the pandemic. More specifically, the behaviour and preferences of students relating to food security, dietary intake and related health and wellness indicators, were investigated. The current study's chapters three and four contain the relevant information from literature and documents.

The execution and define phase involved the data collection as well as the interpretation thereof. The research study was executed according to the planning and data were collected by means of questionnaires and focus group discussions. The quantitative data from the survey and the qualitative data from the focus group discussions were interpreted and discussed against literature to define the core challenges that had to be addressed. These core challenges referred to the identified impacts of the ICE environment, which resulted during COVID-19, on food security, dietary intake and health and wellness of students. Chapters 5 and 6 of this study contain the data as well as the identified challenges that emerged from the data. These challenges led to the creation of a meaningful and actionable problem statement: Based on information generated in this study, what future strategies and recommendations may be proposed to the Higher Education fraternity, to limit the impact of probable future ICE incidences on student well-being and performance? This problem statement was in alignment with the last objective of the umbrella study which was covered in the results section of this chapter.

The ideation phase focused on the transition from identifying problems to considering viable solutions for mitigation of the impact of ICE environments, like COVID-19, on students. This ideation phase commenced already during the data collection phases (survey and focus group discussion) of the current study, where students were requested to suggest and brainstorm support services and other solutions that may assist them during a pandemic like COVID-19. Additionally, this phase entailed considering and integrating the findings regarding the

pandemics impact on students' food security, dietary intake and related health and wellness indicators. Finally, the researcher constructed a wide set of viable solutions by means of brainstorming possible solutions. Factors considered during this brainstorming were students' suggestions on support services, other ideas from students on mitigating the impact of COVID-19, as well as the researchers' ideas and solutions.

Once all the ideas were generated, the ideas were streamlined and integrated to create a prototype of solutions. This prototype included a food security and wellness programme captured in a mind map (Figure 7.2.) as illustrated in the results section of this chapter. The mind map presented interventions and strategies developed by means of the design thinking project management model (Table 7.1.). The interventions and strategies from the prototype were discussed and interpreted according to the Nadler-Tushman Congruence model (section 7.2.4). The prototype was aimed at mitigating the impact that ICE environments, like pandemics, had on students' food security, dietary intake and related health and wellness indicators. Moreover, the prototype was used to communicate recommendations from this study to Higher Education institutions and other relevant stakeholders during the closure phase.

During the last project closure phase, the research project was completed and reflected upon in the concluding chapter of this overarching research project. This reflection included a summary of the outcomes like the successes of the research project, as well as identified limitations and future recommendations. Lastly, the research project was submitted in the form of a research thesis towards obtainment of a degree and publishing of articles as means to communicate the findings and mitigation programme of the research project to all relevant stakeholders.

The monitor and control principles of project management were not a phase on its own but were integrated into all six phases to monitor aspects of the study. An example was the ethical clearance process involved in the initiation and planning phase (refer to Chapter 2). This process ensured that the project adhered to ethical measures prior to executing the research project. In

other words, ethical clearance provided permission of data to be collected during this research project.

7.2.4. The change model

In order to conceptualise a suitable change model for the implementation of the current study's findings, the processes as reviewed by Gareth Morgan's organisational metaphors (Tohidian & Rahimian, 2019), were considered. The "organism" organisational metaphor suited the context of this study and it approached change by initiating research, followed by presenting and discussing data, and ending with designing and implementing a solution. The guiding principles of this approach to change include participation and involvement of stakeholders, awareness of the need for change, designing change in response to the changes in the environment and supporting people through change. Various models of change are associated with this approach such as Lewin's three step model, Kotter's eight step model, William Bridges' managing the transitions model, and Nadler and Tushman's congruence model (Cameron & Green, 2019). A change model that serves as gap analysis depends on aspects such as specific target objectives, process, environment as well as inputs and outputs. According to Rouse (2014), the Nadler-Tushman congruence model of change highlights how gaps can result from inadequate inputs and transformation functions that fail to work coherently, as well as how gaps in the output can lead to identification of problems in the inputs and transformation functions. Moreover, in this model of Nadler-Tushman the environment has a strong impact on the process itself, as well as the inputs and outputs of the system (Cameron & Green, 2019). Therefore, the Nadler-Tushman congruence model was deemed suited for Higher Education institutions to identify gaps within the offered support services, as well as to implement changes from both the gap analysis and recommendations of this final study objective.

The Nadler-Tushman Congruence Model is reported to be an elementary framework used to analyse the key drivers of performance in an organisation and to improve the drivers to all work in congruence with one another. Organisational theorists, David A. Nadler and Michael L.

Tushman developed the Congruence Model in the early 1980s as a tool for identifying the causes of organisational performance problems, as well as the improvement thereof. The Nadler-Tushman model is based on the principle that an organisation can only succeed when the following four elements are congruent: work, the people who do it, the organisational structure, and the culture (Figure 7.1.). Problems arise when incongruence between the four critical elements occur (Cameron & Green, 2019). Therefore, this model based on congruence of key drivers was well aligned with the four key aspects (four Ps) of project management which contributed to the methodology of this fragment of the study (Olivier, 2016). The alignment between the change model and the project management principles further supported the suitability of using the Nadler-Tushman's model of change in context of this research study.

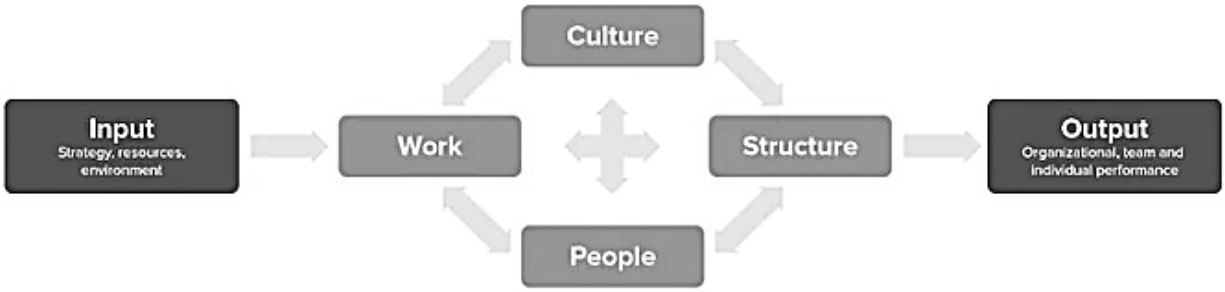

Figure 7.1. Nadler-Tushman Congruence model (Nadler & Tushman, 1980)

Considering the strengths and wide recognition of Nadler and Tushman's (1980) congruence model, it was projected for implementation within the Higher Education context, and provided that the relevant institutional stakeholders collectively work on this study's proposed health and wellness programme, it will contribute to successful, desired outcomes for the students. Furthermore, literature confirmed that the Nadler-Tushman Congruence model can successfully be adapted to serve other contexts, such as Higher Education (Filipovic, Vasic, Tica, Veg &

Sinikovic, 2020). Therefore, the Nadler-Tushman Congruence model is suggested as a change model for Higher Education institutions to implement the proposed interventions and strategies.

7.3. RESULTS

The execution and define phase entailed data collection and defining of an actionable problem statement which was aligned with the last objective of this research study. This problem statement enquired future strategies and recommendations for the Higher Education fraternity to limit the impact of probable future ICE incidences on students. Moreover, this was informed by the challenges experienced by students that resulted from the impact of COVID-19 circumstances and which emerged from the findings of the study (Table 7.2.) which were collected during 2021, captured in chapters 5 and 6.

The following challenges were identified in relation to food insecurity, guided by objective iii of the research study mentioned in Chapter 1. Food insecurity existed amongst students during the COVID-19 pandemic, while no data were collected on the food security of the students prior to the pandemic. Students experienced a lack of money for food and for resources to prepare food. Some students reverted to binge eating in response to emotions experienced during the pandemic.

Guided by objective iv, involving dietary intake, the following challenges according to findings presented in Chapter 5 occurred. Students' dietary intake changed during COVID-19, to a healthier quality diet with evidence of a decreased intake of food high in salt, sugar, and fat. However, some controversies regarding dietary intake emerged between the data from the survey and focus groups discussions which was difficult to explain and identified as a risk when interpreting the relevant food frequencies. Some students changed to healthier diets and others to less healthier diets during the pandemic, which may be due to the circumstances relating to food access and availability in student homes away from campus. However, students expressed a need for healthy, cost-effective dietary guidelines to assist them to eat a healthy diet.

Table 7.2. An overview of the main findings from sub-studies

Overarching concepts investigated	Main findings
Food security	• 16% of survey participants were food secure • 54% experienced mild food-insecurity • 28% experienced moderate food insecurity • 2% experienced severe food insecurity including hunger
Dietary intake	• Survey participants followed healthier diets with less intake of sugary and salty snacks • Focus group participants reported to less poor dietary habits such as increased starch and binge eating
General health	• Students reported deterioration of their general health
Weight trajectories	• 57% perceived weight gain during COVID-19 • 33% of students were overweight • 26% of students were obese
Physical fitness	• Low levels of physical activity reported
Mental health	• Poor mental health were experienced by students • Participants' anxiety levels were often extremely severe

Student support service	• 82% students were unaware of existing support services
	• Less than 5% of students utilised available support services
	• Students expressed a need for:
	  ○ A comprehensive, accessible food aid
	  ○ Healthy lifestyle guidelines such as healthy diets and exercise routines
	  ○ Expansion of services to accommodate the high number of students in need

Objective v involved investigation of health and wellness indicators that included perceived general health, weight trajectories, physical fitness as well as mental health. Findings in relation to this objective were captured in Chapter 6 and gave rise to numerous challenges. Students perceived their general health to have decreased and as a result they fell ill more often. Students perceived weight gain during COVID-19, while this finding was not supported by self-reported weight measurements. Numerous students were overweight or obese according to BMI categories, although a limited number of students indicated suffering from obesity as a COVID-19 comorbidity, thus indicative of the need for awareness regarding healthy weight. Low levels of physical activity were evident amongst students. Students suffered from poor mental health. Especially anxiety levels were often reported to be extremely severe. Other factors contributed to poor mental health and anxiety. No parents/guardians to assist students with managing households and challenges regarding online learning were two of the prevalent contributing factors to poor mental health.

Findings regarding the fifth objective relating to students' awareness and utilisation of offered institutional support services were presented and discussed in chapters 5 and 6, and the following challenges were identified accordingly. Limited students were aware of the existence of support services at the institution. Food insecurity existed despite available food parcels and meal vouchers. Although, these services were limited and aimed at the most severe form of food insecurity, namely hunger. Students had trouble accessing food relief support at the institution due to a tedious application process or feelings of embarrassment. This highlights the importance of changing the application process at the university and ensuring that those that do receive food aid are not known to other students (confidentiality). Poor mental health existed despite available counselling services. Although counselling services expanded during COVID-19, students expressed the concern that counselling services did not have the capacity to attend to all students in need of assistance - thus indicating a lack of resources in the form of counselling staff at the institution. The need for more accessible and confidential support services that

address health and lifestyle matters including exercise guidelines and eating habits were exhibited.

Investigation associations between variables were guided by objective vii, and from the findings (refer to chapters 5 and 6) student challenges arouse as follows. Students who resided in rural areas experienced higher levels of food insecurity. Students who experienced food insecurity showed a larger prevalence of poor mental health, especially higher levels of anxiety. Gender associations did not exist.

7.4. DISCUSSION

Objective viii, the last objective of the research study, entailed the proposal of a programme for Higher Education institutions. This programme served as the prototype/solution and contained interventions and strategies that emanated from the mentioned challenges in the results sections of this chapter. The prototype of solutions was illustrated by the mind map below (Figure 7.2.) based on the change model of Nadler-Tushman. The recommended interventions and strategies represent the strategy element of the original Nadler-Tushman (Figure 7.1.) and were discussed alongside the relevant challenges that it originated from. This strategy was designed by performing the research project according to methodology (presented in Table 7.1.) to investigate the output, which was students' health and wellness during COVID-19 that resulted in an ICE environment.

7.4.1. The proposed programme as strategy

The interventions and strategies of the proposed food security and wellness programme (Figure 7.2.) were considered in two categories, namely awareness and communication, and resources. The communication and awareness category was mainly aimed at improving support services and empowering students. Furthermore, the resources category was aimed at increasing certain resources at the institution to better assist students in need.

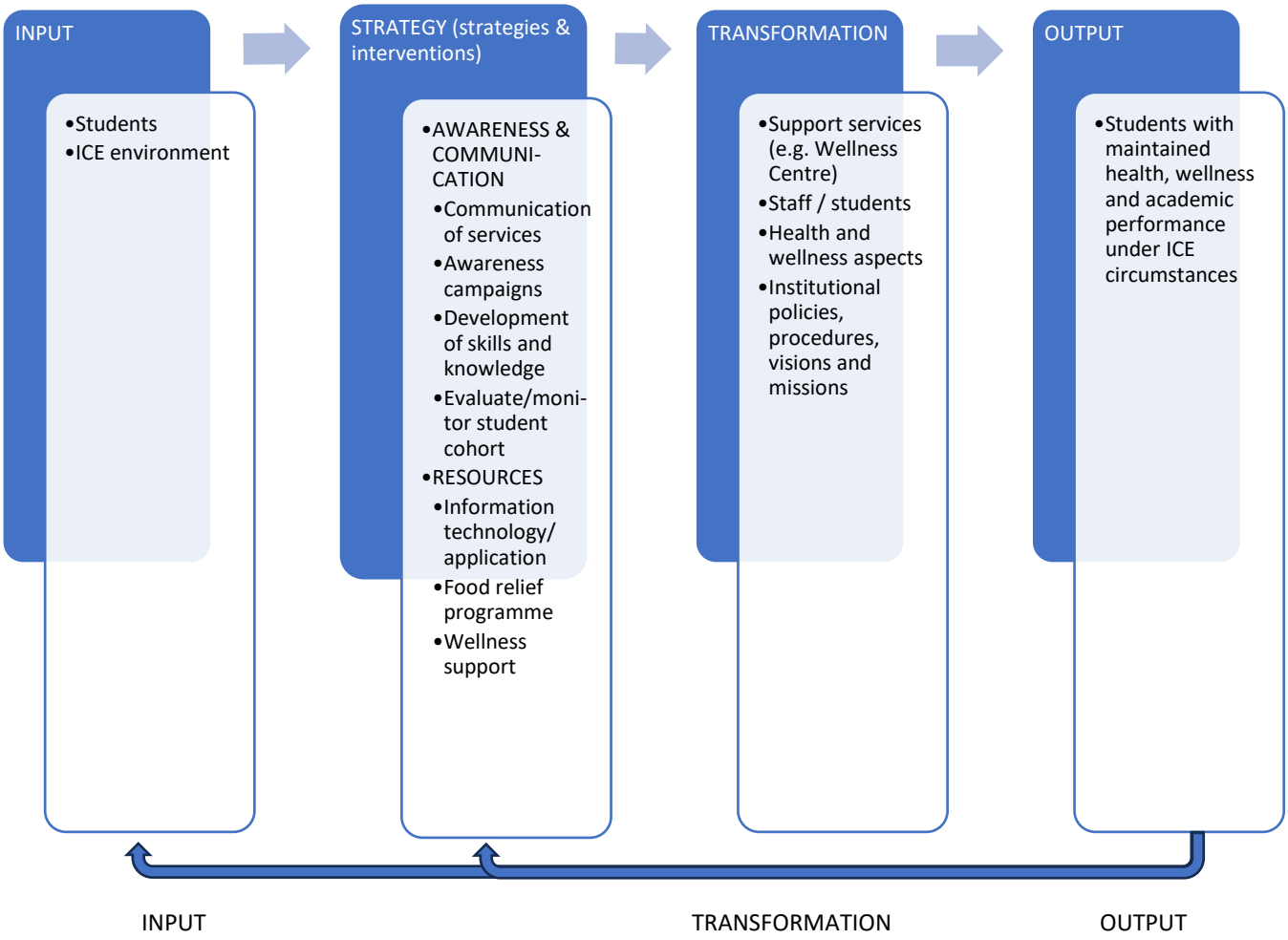

Figure 7.2. Proposed food security and wellness programme as strategy in a Nadler-Tushman model

This proposed food security programme should be implemented as soon as possible under normal circumstances and not only when faced with an ICE environment, for institutions to have strategies in place and to be prepared should an ICE environment arise. Although this research study collected data during COVID-19 with the aim to determine the impact of the resulting ICE environments on students, no comparisons could be made with students' health and wellness prior to the pandemic because no data were available on the investigated aspects amongst the specific student cohort prior to the COVID-19 pandemic. Therefore, the possibility existed that identified challenges experienced by students during COVID-19 could have existed under usual

circumstances, in which case students could benefit from immediate implementation of the proposed programme.

The communication and awareness interventions and strategies entailed the following: communication of services, evaluation/monitoring of students, awareness campaigns and development of skills and knowledge (Figure 7.2.). Communication of the offered support services (Figure 7.2) should be increased by means of marketing which will increase the lack of awareness that existed amongst students. It is essential that marketing of services is structured in a manner to continue communication when experiencing events that lead to ICE environments, e.g. bundle mobile messages to students. Considering students ubiquitous use of mobile technology, the use of mobile-based communication methods is well suited (Johnson & Kalkbrenner, 2017). Important aspects to be included in this communication should be the purpose, ways of access (on-campus as well as during campus evacuations), and different services available (Roberts, Dunworth & Boldy, 2018). In other words, this communication should not merely aim at creating awareness of the existence of services but also aim at creating awareness of the purposes and manners of access to the specific support services. Not all students were aware of the purpose of counselling services, e.g. they were not aware that this division could assist them with coping strategies for anxiety. Moreover, limited students knew that such services were available to them free of charge, and a fear of financial implications could have hindered them using the services. Lastly, students were not aware of the variety of services offered. This lack of awareness could have resulted in the poor utilisation of services. For example, some students were aware of the counselling services but not the social services which could have assisted to alleviate socio-economic issues such as a lack of money for food.

It is foreseen that, should students be aware of all the available support services and the access to and purpose of each, they will utilise these services and as a result, may attend to the challenges relating to mental health and food insecurity (Hughes, Serebryanikova, Donaldson & Leveritt, 2011; Roberts, Dunworth & Boldy, 2018). In addition to utilisation, aspects such as

funding and sufficient capacity of support services also influence the success of such services. If students are aware of services prior to facing an ICE environment, they will be able to approach the relevant support services to seek the necessary assistance during such environments. Furthermore, the vicious cycle between food insecurity and mental health will be prevented, as less food insecurity will result in improved mental health (Block, Grier, Childers, Davis, Ebert, Kumanyika, Laczniak, Machin, Motley, Peracchio, Pettigrew, Scott & Van Ginkel Bieshaar, 2011). Conversely, optimum mental health will prevent poor dietary habits (e.g. binge eating) that may occur due to emotional challenges (Mukigi, Thornton, Binion, Brown, Church, Cook, Henry, Hopkinson, Masucci, Pruett, Rogers, Singleton, Vichi-Miller, Wofford & Brown, 2018). Improved mental health will also improve physical health as it may result in improved immunity of students and fewer students falling ill (Mukigi *et al.,* 2018). Lastly, improved academic performance may be experienced by students once mental health improves due to the link between these factors (Maimane, 2016; Raskind, Haardorfer & Berg, 2019).

In addition to communicating that support services are available, awareness campaigns (Figure 7.2.) can also be useful to assist with awareness of available services at South African Higher Education institutions as suggested by Stoltenkamp, Kies and Smit (2007). Suggested focus areas of such awareness campaigns should cover the establishment of a support structure, marketing initiatives and consultative forums. The institution should explore innovative manners of presenting awareness campaigns during events that lead to ICE environments, e.g. social media campaigns. Social media platforms, like Facebook, can be an effective marketing tool for business and education institutions. This type of social media marketing should not be unsystematic and should be preceded by development of coherent strategies and goals as stated by Assimakopoulos, Antoniadis, Kayas and Dvizac (2017). Furthermore, awareness campaigns can serve as an informal manner to reach out to students who are too embarrassed to seek assistance from support services, as they meet support staff and establish a type of familiarisation/relationship which is said to increase students' confidence to seek assistance (Hyun, Quinn, Madon & Lustig, 2006). Additionally, these awareness campaigns can inform

students about health risks such as anxiety and obesity. This will deal with the students' lack of knowledge regarding obesity and the related health risks. Moreover, knowledge on obesity may assist with motivating students to maintain healthy body weight (Harring, Montgomery & Hardin, 2010). It is suggested that the South African Food-based dietary guidelines (Vorster, Badham & Venter, 2013) be included in the awareness campaigns, as these guidelines are well established in the country and could assist to address various identified challenges. Apart from knowledge on obesity, a need existed for additional knowledge and skills to address identified challenges.

Development of skills and knowledge is another strategy within the communication/awareness category. The identified challenges indicated that the students need to be empowered with the following knowledge (Figure 7.2.): healthy, cost-effective dietary guidelines, and exercise guidelines. Empowering students with knowledge on dietary guidelines will support them to follow a healthy diet in accordance with recommended dietary allowances, and to prevent possible nutrient deficiencies. It must be acknowledged that knowledge does not necessarily lead to improved practices when there are barriers that are difficult to overcome, such as poverty. Nutrient deficiencies may compromise immunity and health (Clemente-Suárez, Ramos-Campo, Mielgo-Ayuso, Dalamitros, Nikolaidis, Hormeño-Holgado & Tornero-Aguilera, 2021), and therefore this strategy may also improve students' general health, causing them to fall ill less often. Moreover, a healthy diet could form part of endeavours to address the high levels of overweight and obesity in students (Lofgren, 2015). The following considerations are necessary when empowering students with knowledge on healthy eating, especially within the South African context: directly address prevalent misconceptions about healthy eating and unhealthy eating practices; increase self-efficacy regarding the purchasing and preparation of healthy food; represent diverse cultural traditions and consider the issues of affordability and availability of food ingredients (Everett-Murphy, De Villiers, Ketterer & Steyn, 2015). Additionally, innovative ideas on saving costs while eating healthy to suit the poor economic status of some students should be included, like growing their own vegetables from cuttings, cheaper manners to prepare food or lists with equivalent options for food types containing essential nutrients. Such innovative

ideas may assist students to maintain a healthy dietary intake despite limited availability of certain food or limited resources, as has occurred during the COVID-19 pandemic. Similar to other strategies, empowering students with skills and knowledge can be conducted by means of face-to-face initiatives on campus but might need innovative strategies to empower them during off-campus periods like ICE events. As mentioned earlier, mobile communication is a suitable means of communicating with students (Johnson & Kalkbrenner, 2017). However, when developing health messages, both the content (the what) and the executions (the how) of the message should be considered as described by Nan, Iles, Yang and Ma (2022).

Besides knowledge on dietary intake, knowledge on exercise guidelines will also deal with challenges identified earlier. Students expressed the need to receive knowledge on exercise routines, especially students who do not participate in sport and cannot afford to join fitness clubs. Knowledge must include the health benefits of exercise and innovative routines that do not necessitate expensive equipment or large exercise space, to enable students to be physically active despite financial issues or movement restrictions, like during ICE circumstances. This knowledge on exercise routines aim to increase physical activity of students, which in turn may decrease the occurrence of overweight, improve general health as well as mental health (Harring *et al.*, 2010; Taeymans *et al.*, 2021).

A need for certain skills were also identified as a challenge, which included stress management, skills and time management. These skills can be taught by the Student Support Division in the form of workshops, mentorship programmes, or can be included in curricula at programme level. Various studies have documented the benefits of including an intervention such as stress management into curriculum (Butcher, Thompson, Williams, Cooke & Merlo, 2021). Benefits of stress management skills will assist with maintaining mental health, especially during ICE situations, and in turn prevent deleterious habits and improve academic performance. Time management will assist students to cope with household management while studying online when faced with an ICE environment. Such coping mechanism will alleviate stress and improve

mental health (Keogh, Bond & Flaxman, 2006). It is recommended that Higher Education institutions evaluate and monitor students (Figure 7.2) to identify students who may be vulnerable to suffer from the mentioned challenges. According to the correlation findings of the current study, certain factors increased the tendency of the following challenges to occur: food insecurity and poor mental health. Food insecurity was more prevalent amongst students residing in rural areas, and food insecure students suffered more often from poor mental health. Therefore, this information can assist the institution to identify vulnerable students and to communicate specific relevant support services to those at-risk students, especially when facing an ICE environment like the COVID-19 pandemic. Additionally, the institution can also have an indication of the probable future student requests for specific services which can assist the institution to plan management of resources and make provision for such student requests. Such provision will in turn ensure that support services have adequate capacity to support all the students in need should an ICE environment occur.

The second category of the intervention and strategy programme referred to resources (Figure 7.2). This is a critically important category and mainly refers to expansion of existing support services which may have substantial financial implications to the university. This category includes information technology, food aid programme, and wellness support. These three resource-related strategies were aimed to address a wide variety of challenges.

The information technology intervention (Figure 7.2) is based on development of a health and wellness application (app) or software for students. Development of such applications involves in-depth research and did not fit into the time available in the current study. However, it is said that software applications are popular amongst younger generations such as students and are also useful within the health and wellness sector, where it is often combined with artificial intelligence (AI) (Þórarinsdóttir, Kessing & Faurholt-Jepsen, 2017; Amisha, Malik, Pathania & Rathaur, 2019; Haga, Shaw, Kneifel, Bond & Ginsburg, 2020; ReportLinker, 2021). Suggested beneficial functions to be ideally included are mentioned here. The app should contain self-

reporting questionnaires to analyse various aspects of health (e.g. BMI) to determine weight status, fitness level to identify specific training needs, mental wellness to identify areas of concern, food intake and behaviours to identify dietary adaptation needs, supplementations, or food insecurity. The findings of questionnaires should be automatically made available to students upon completion thereof to inform the students of health risks relating to the health aspect analysed in the respective questionnaire. This will assist students to realise the need to seek assistance from available support services. Furthermore, this will assist the university in identifying students in the direst circumstances such as those that are hungry and those that suffer from severe mental health issues. The application should also automatically reply with the relevant support service contact details to students in health risk categories. Alternatively, the app must make use of AI to provide knowledge and guidelines to students in need thereof, e.g. suggest possible food types to consume if the students' nutrition analysis identified a possible nutrient deficiency. The application must contain a knowledge database with information leaflets such as weight loss programmes, at-home exercise programmes and breathing exercises for management of anxiety. Another useful function would be if the app could send automated requests to support services to contact the student in need of assistance. This will especially be useful to assist students without mobile data/airtime to contact support services during ICE environment, as well as reaching students who are too embarrassed to approach support services for assistance or where tedious application processes limits access to services.

The suggested app has mainly two benefits to the institution: it will enable the institution to assist students remotely (for example during ICE environments) and it will alleviate pressure on staff as resource. It is recommended that such an app be researched and developed for the institution, as the app may deal with many of the challenges that the students experienced.

A second resource that should be implemented as an intervention at the institution is a more comprehensive food aid programme (Figure 7.2). Despite the meal vouchers that some students received from the institutions, food insecurity still existed, and students expressed that access to

the offered support was long and difficult. Therefore, the institution should invest in a food aid programme which is easy to access for all students in need. The aforesaid food aid programme will necessitate innovative ideas to be viable during events that lead to ICE environments, as providing fresh food will not be possible under these circumstances. Moreover, the available resources for students to prepare or collect food should also be considered. Therefore, providing students with non-perishable, convenient and nutritious food products like tailored ration packs to prevent nutrient deficiencies will be ideal, which is often utilised during other ICE environments such as military operations in extreme cold weather circumstances (Marriott & Carlson, 1996; Romero-Garcés, Romero-Rincón, Romero Alvarado, Santos Simancas & Palencia-Sánchez, 2023). This could limit loss of fresh food going to waste, while the students could benefit from maintaining food security and acquiring the recommended daily allowances for nutrients to maintain optimal health. As mentioned earlier, strategies to mitigate food insecurity could also positively influence students' immunity, mental health, and academic performance (Ruegsegger & Booth, 2018).

Wellness support was the last intervention in the resource category (Figure 7.2). This intervention refers to both expanding the capacity of the current services, as well as including additional support services in this division. The institution should expand the counselling services of its Wellness Centre either by appointing more counsellors or by utilising other methods of counselling/emotional assistance such as AI included in the suggested student support app. Expansion of current counselling services will attend to the challenge of these services not attending to all the students in need, especially during an ICE occurrence. In addition to mental wellness support, a need for nutritional and fitness support became evident. It is proposed that these two services should be added to the current support services, either by employing professionals like dietitians, fitness trainers or personal wellness coaches in the Wellness Centre, or providing such assistance by other means, e.g. online support or a student support app. Addition of such services will be especially beneficial to younger students who are transitioning to independent life as part of commencing their studies away from home (LaFountaine, Neisen

& Parsons, 2006). Moreover, these services could attend to the high overweight and obesity levels amongst students, as well as the lack of physical activity (Asselin, Ortiz, Pui, Smailagic & Kissling, 200). The implementation and sustainability of the mentioned appointments will be reliant on financial resources, which the support division or the university should be able to provide. Therefore, it is suggested that a staff member should be appointed to seek funding for appointment of personnel, as well as to provide sufficient services such as a more comprehensive food aid programme.

The implementation of the discussed strategies and interventions, which represent the strategy in the Nadler-Tushman Congruence model (Figure 7.7.), will necessitate Higher Education institutions to review their current practices relevant to support services. Such a review will serve as a gap analysis to guide transformation of the current support services to mitigate the negative impacts (challenges) of an ICE environment on students in future. This gap analysis process is proposed to be performed according to the three-step process, as described by Filipovic *et al.* (2020), which is based on the Nadler-Tushman model.

7.4.2. Three-step gap analysis based on the Nadler-Tushman Congruence model

Filipovic *et al.* (2020) suggests that when performing gap analysis with the Nadler-Tushman model, a three step-process should be followed. The three steps of this process include: identifying and analysing the elements, analysing the relationship between the elements and, lastly, developing and maintaining congruence. These three steps will be discussed in the context of the current study.

Step 1: Identifying and analysing the elements

The original Nadler-Tushman model consists of six elements as illustrated in Figure 7.1. These elements included input (strategy, resources, and environment), work, culture, structure, people, and output (organisational, team and performance). When this model was applied within the context of the current study, the elements of the model were represented as follows (Figure 7.3.):

The students under ICE circumstances represented the input and maintaining the health, wellness and academic performance of the students during this ICE environment was the output. Furthermore, the strategy was represented by the proposed programme that includes strategies and interventions for Higher Education institutions (Figure 7.2.). The elements involved in the transformation includes the support services (e.g., the Wellness Centre) that represented the work, health and wellness aspects, culture (also referred to as informal process), institutional regularity code (e.g. policies, procedures, visions, missions) that represented the structure (also referred to as formal process), and the staff/students that represented the people. A brief analysis of each element within the "transformation of support services" area (center of the figure) will be provided.

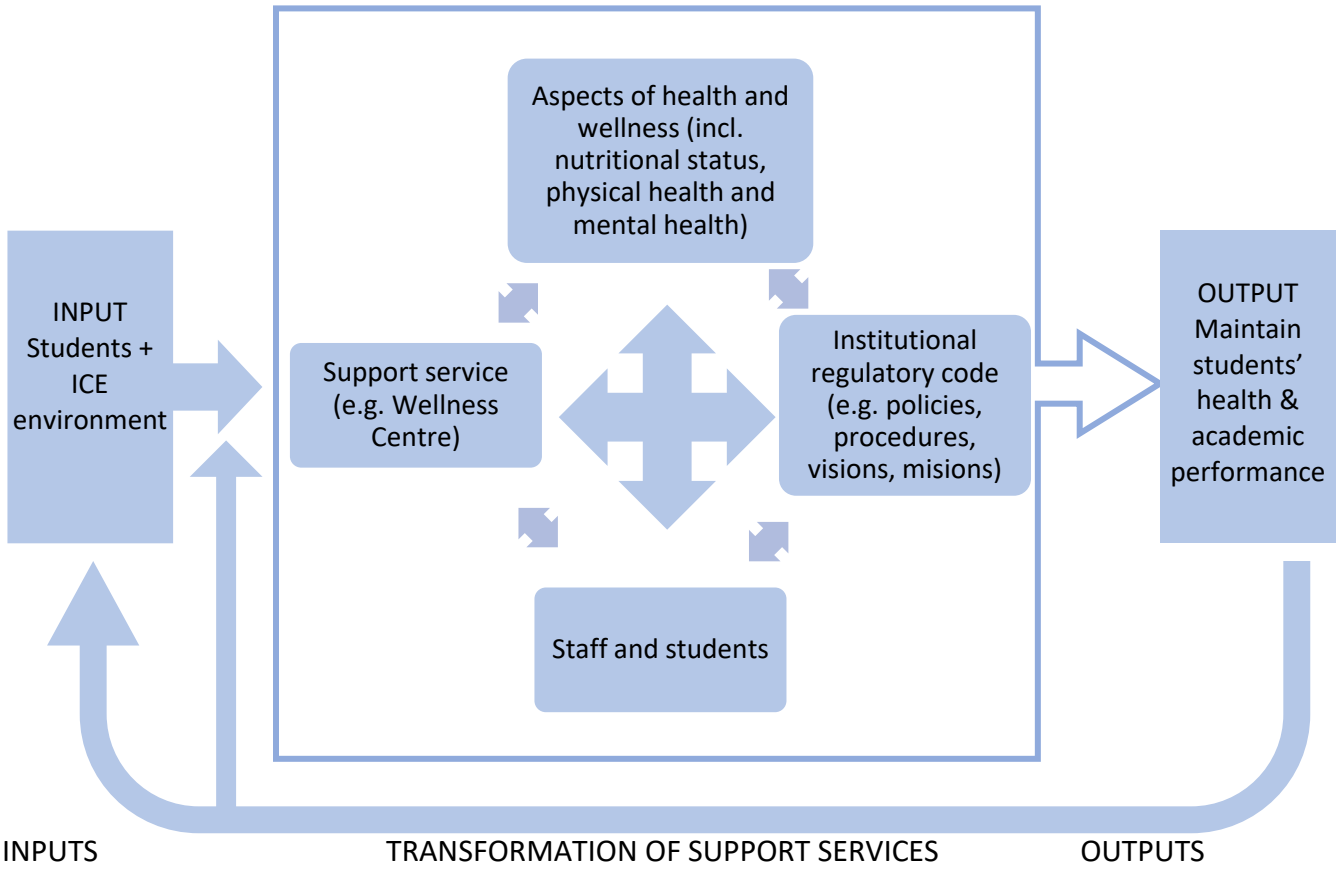

Figure 7.3. Applied Nadler-Tushman Model of Congruence

Support services (work) is the institutional department that was responsible for supporting students' health and wellness. Therefore, this service is often referred to as a wellness centre. The investigated institution included medical assistance, psychological counselling, and social services as support services (CUT, 2020). According to the findings discussed in Chapter 6, these support services should be expanded to also cover nutritional guidance and physical fitness guidance, as well as development of skills and knowledge amongst students, regarding health and wellness e.g., weight management. As result, a person or division should be appointed to seek funding from external entities to assist with the awareness campaigns and expansion of support services. Moreover, the division should increase its visibility and create awareness by means of communicating its available services, purposes thereof and means of access. It is important that this communication, as well as the support services provided, can be conducted under ICE circumstances when students are not on campus. Prior to ICE environments the support service department should evaluate and monitor the student cohort to early detect possible at-risk students, amongst which the offered support services should especially be communicated.

The health and wellness aspects (culture/informal process) referred to the areas that were investigated in the current study and include: food security, dietary intake, general health, weight management, physical fitness, and mental well-being (refer to Chapter 1). As is evident from literature, these aspects are interconnected and should be in synergy to ensure optimal health (Dodge, Daly, Huyton, & Sanders, 2012; Kruger, 2019). For example, food insecurity results in poor mental health, as was evident in the findings reflected in Chapter 6. Similarly, good mental health can prevent poor dietary habits like binge eating (refer to Chapter 6). Therefore, when these aspects of health and wellness are in synergy, opposite to the findings of the current study, they can help individuals achieve optimal health and well-being, and thus reaching the output reflected in Figure 7.3.

The institutional regulatory code (structure/formal process) plays an imperative role in the transformation process (Figure7.3.), although the details of the existing policies, procedures, vision, and mission of the investigated institution were not discussed in the research project. Therefore, the proposed strategies and interventions (Figure 7.2.) did not take into consideration the institutions' existing regulatory code but were purely based on the findings from the current study. Hence, it is suggested that the institution review its policies and procedures, as well as visions and missions against the proposed transformation model (Figure 7.3.) to identify if the application of the regulatory code should be altered, or if the relevant documents are insufficient to obtain the output.

Staff and students (people) referred to the staff that provided support at the support services division, and the students referred to the students that needed support. The staff at the investigated institution's support services department included social workers, nurses, and counsellors. However, the number of counsellors must be increased to ensure that the support services have the capacity to assist all the students with poor mental health during an ICE situation (refer to Chapter 5). Moreover, additional staff should be employed to provide the additional support services, such as dietitians and fitness instructors. Alternatively, the staff component can be relieved with an information technology app containing AI features that can provide the required services. The students in need of support services did not all approach the support service division for assistance, as mentioned in chapters 5-6. Therefore, strategies and interventions should be put in place to increase the utilisation of the support services (Figure 7.2.).

Step 2: Analysing the relationship between the elements

The support service department influences the staff, students, health, and wellness, as well as the institutional regulatory code. Additional support services will necessitate an increase in the staff component to present the services. It is foreseen that if the support service division increase its visibility/awareness and ensure easy access, increased utilisation of the services by students

could be experienced. Furthermore, should the additional services be included in the support service division, the health and wellness aspects could improve and hopefully result in synergy. Lastly, if the support services department increased types of services, number of staff, communication as well as improved access and capacity, it is imperative that the institutional regulatory code provide support by means of policies, procedures, visions, missions, as well as resources.

The health and wellness aspects (food security, dietary intake, general health, weight management, physical fitness, and mental well-being) influence each other when they are not in synergy. In other words, when one of the aspects of the health and wellness element is not optimal it will not only increase the need for support regarding the specific aspect, but due to disrupting the synergy between the aspects, other aspects will also be negatively impacted resulting in further needs to arise. For example, should food insecurity exist, it results not only in a need for food relief, but also in poor mental health, which creates an increased need for counselling and poor general health, and in turn an increased need for medical attention.

In addition to the internal interconnectedness that exist between the aspects of health and wellness, the health and wellness element impacts on the other three elements of the transformation area in Figure 7.3. If one health and wellness aspect is not optimal, it will result in a need within a student for assistance which should be provided by the support service department, and thus resulting in a need for staff to provide the assistance. Moreover, the institutional regularity code should make provision for all aspects related to students' health and wellness in its vision and mission, as well as policies and procedures to reach the output.

The institutional regulatory code (structure/formal process) has an impact on all the elements in the transformation section due to the roles thereof in resource management, policy, and procedures. The institutional regulatory code should inform the resource allocation for the implementation of the proposed programme and will thus have an impact on the staffing, health,

and wellness aspects, as well as the support services being offered. Adequate staff should be employed in the support service division to ensure sufficient capacity to serve all the students in need, especially during ICE situations. Adequate money should be available for providing food relief to prevent food insecurity, as a health and wellness aspect. Similarly, the necessary funding should be made available to support services to function at the required capacity, as well as to provide the variety of support services required e.g. physical fitness support. It is suggested that the university and/or support services division should seek external funding to assist with the mentioned financial implications. Furthermore, the regulatory code should include policies and procedures to enable easy access to support services and continuation of support services during ICE situations.

Staff ensure the functioning of the support services department, and as a result it ensures synergy within the health and wellness element. Furthermore, staff employment and functioning are regulated by the institutional regulatory code. Students in need of support increase the need of a support service department to exist. Furthermore, should such students in need use the support service it will improve their health and wellness. Hence, institutional regulatory codes should provide procedures that will enable students to access the available support services.

Step 3: Developing and sustaining congruence

The congruences of the elements' relationships are referred to as sustainable congruence. As a result, when Higher Education institutions execute the proposed programme's strategies and interventions, they should analyse each element and implement transformation processes to remedy any incongruence between elements. If all elements and sub elements (for example, aspects of health and wellness) are congruent, the odds of successfully obtaining the output improve. An example is to identify the number of students from rural areas. This number will propose an estimate of students in need of food relief during an ICE environment (student element).

The institution should then ensure that enough resources (institutional regulatory code element) are made available to sustain a food aid programme (support services) and to prevent food insecurity (health and wellness element). If such a congruence exists, food insecurity will be addressed which could have negatively impacted the health and wellness, as well as the academic performance of students during an ICE situation (output). This congruence is equivalent with the Stanford Model of Professional fulfilment (Bohman, Dyrbye & Sinskey, 2017). According to Bohman *et al*. (2017), this model conceptualises well-being/fulfilment as being influenced by three components: (1) culture of wellness, which refers to the supportiveness of the environment which is the support services division in this case; (2) efficiency of practice, which refers to the institutional regulatory code that makes it easier or more difficult to complete the work referring to support in this case; and (3) personal resilience, which refers to individual self-care - in this case the actual health and well-being of students. Important to note from this equivalent model is that it emphasises that personal resilience (health and wellness) cannot make up for sustained exposure to a negative culture and inefficient processes - thus, stressing the essential role of the institution, including its support service division and regulatory code in the endeavour towards the well-being of students (Butcher *et al*., 2021).

Lastly, the output resulting from the transformation should be evaluated to reflect on the efficiency of the transformation process to have mitigated the negative impact of the ICE environment on the health and wellness of the student cohort. If the output is successfully obtained, it will influence the input because the output would have resulted in healthier students (Figure 7.3.) during an ICE environment. For example, if the students obtain knowledge and skills from the support service department with regard to coping skills for anxiety, their mental health will be supported, and the output will be students with maintained mental health and academic performance. However, should these students who are now empowered with these coping skills enter another ICE environment, the input will be different as they are more prepared than the students prior to the initial transformation. Conversely, if the output is not successfully reached and negative impacts on the students' health and wellness are identified, the institution should

determine viable solutions to amend strategies proposed in this study. The solutions can be designed by using the suggested design model illustrated in Table 7.1. Moreover, it is suggested that students be involved in this designing of solutions, similar to the solutions of the current study.

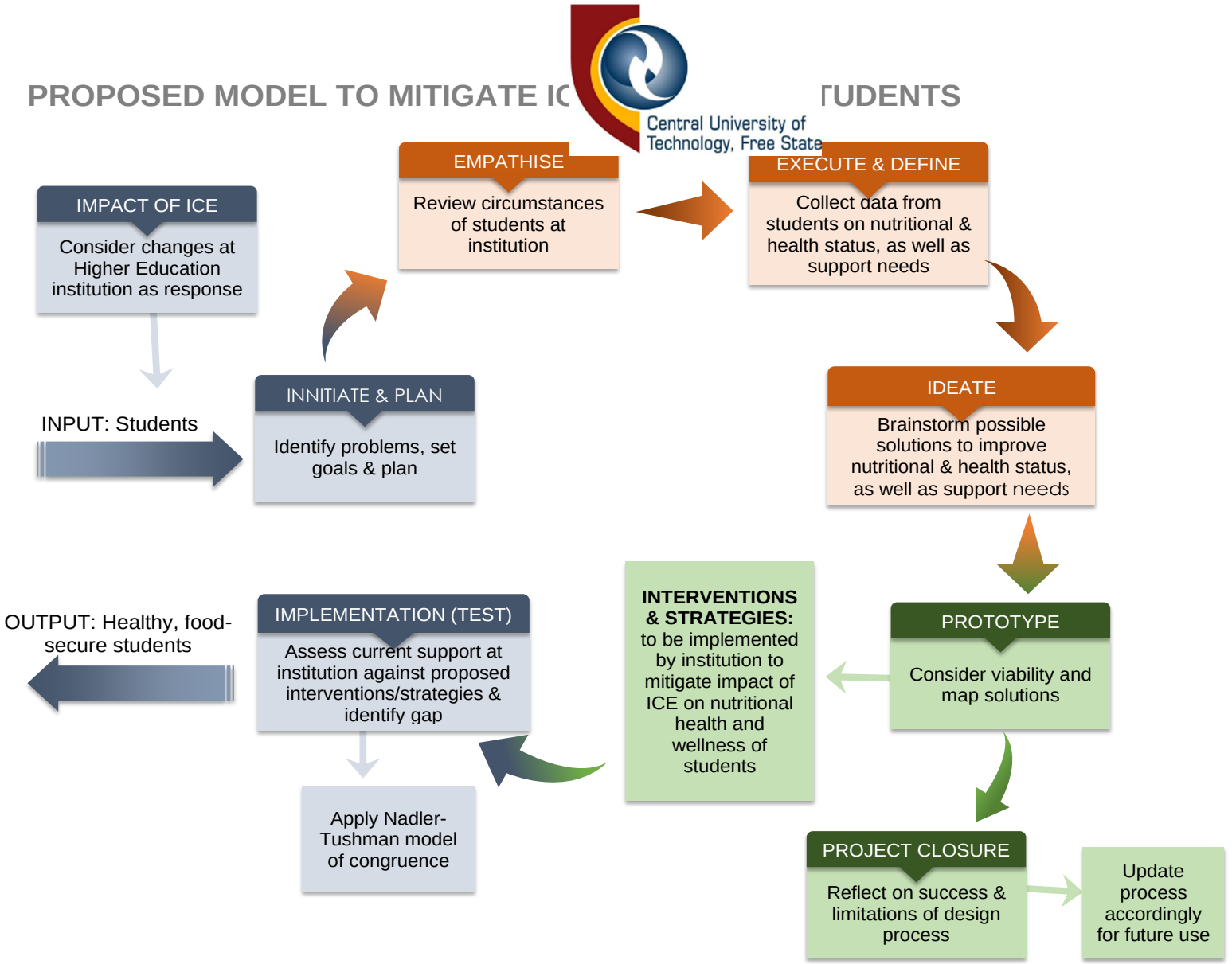

Figure 7.4. Overview of the process proposed to mitigate the impact of ICE environments on students' nutritional health and wellness

Student involvement has two benefits within this context: they have first-hand experience of their needs and utilisation of services. Secondly, involving them as co-creators will increase awareness and a sense of agency in the wider university community (Baik, Larcombe & Brooker, 2019). It is anticipated that if a specific Higher Education institution makes amendments to the proposed programme, together with sustaining congruence between the elements in accordance with the specifications of the institution, the proposed programme can be adapted to suit the circumstances of the specific institution. In such a manner, the findings alluded to in Chapter 7 of this research study can be extrapolated to other institutions where the need exists to maintain student health and wellness during an ICE environment such as the COVID-19 pandemic.

In conclusion, the findings of the overarching research study confirmed the need for Higher Education institutions to implement strategies and interventions to alleviate the negative impact of ICE environments, like COVID-19 circumstances, on the health and wellness of students. Design thinking and project management principles were integrated as methodology to design strategies and interventions as a proposed programme (prototype) to Higher Education institutions (Figure 7.4.).

This integrated process consisted of six phases which was applied to design interventions and strategies (Figure 7.4.) that emanated from the challenges (identified from the study's findings). The strategies and interventions were streamlined into a mind map and categorised into awareness and communication, and resources. It was recommended that the proposed programme be implemented by Higher Education institutions according to the Nadler-Tushman model of congruence (Figure 7.4.). Implementation based on this model entails a process of transformation at the institution to reach the output: students with maintained health and wellness, as well as academic performance during an ICE environment. The applied model is not a one-size-fits-all model, and institutions must implement the model in their specific contexts and ensure that congruence exists between all the elements of the model. Furthermore, the output is not guaranteed with implementation of the programme, and institutions must reflect

on the output so as to amend the strategies to suit their specific circumstances. Therefore, the proposed model of strategies and interventions serves as a point of departure for institutions wanting to extrapolate the findings to their contexts.

Some strategies and interventions were proposed, while the solution options were not exhausted. In some instances, the proposed strategies lacked details specifically with strategies that necessitate in-depth research and development, for instance the student health and wellness app. Therefore, it is recommended that future research studies investigate the feasibility of the proposed app.

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CHAPTER 8

Conclusions

This study aimed to investigate the changes in the nutritional health and related wellness indicators of students at a designated Higher Education institution, which occurred due to COVID-19 circumstances. Additionally, a health and wellness programme was designed by means of an integrated model based on Stanford design thinking and project management principles. The programme is specifically aimed at Higher Education institutions to review and transform their current support services to mitigate the negative impacts on students that may arise during future events that could lead to ICE environments. The conclusions of the study are presented in section 8.1. according to the objectives of the study. Furthermore, overall limitations will follow in section 8.2. and recommendations in section 8.3.

8.1. CONCLUSIONS

8.1.1. The influence of isolated, confined, and extreme environments (ICE) on nutritional and related health and wellness indicators: a systematized review

This chapter provided a comprehensive, critical literature review of the possible influences of an ICE environment on nutritional-related health and wellness indicators. Moreover, literature was described within the South African Higher Education environment. Evidence suggested that preceding the COVID-19 pandemic, students had health and wellness problems relating to food insecurity, sedentary lifestyles, and poor mental health. These concerns related strongly to socio-economic inequalities, both in South Africa and other countries around the globe. Assessing how current institutional support services attempted to assist students and information on awareness and utilisation of such services would be valuable. Additionally, utilising students to assist with designing health and wellness interventions would be ideal to integrate aspects from before the pandemic struck (Ahmed, Ilieva, Clarke & Wong, 2021; Paganini, Ben-Zeev, Bokolo, Buthelezi, Nyaba & Swanby, 2021).

8.1.2. An exposé of regulatory and Higher Education strategies in response to the COVID-19 pandemic in SA

In this chapter the responses of regulatory bodies and Higher Education to the COVID-19 pandemic were investigated and reported on by means of a narrative review. The South African government enforced quick regulations to limit the spread of the virus (Staunton, Swanepoel, & Labuschaigne, 2020). However, the government was criticised that they devalued certain rights of citizens with regulations like the national strategy and hard lockdown, which did not adequately take cognisance of the citizens' socio-economic realities (Staunton, Swanepoel, & Labuschaigne, 2020). Therefore, the pandemic was not the initial cause of the country's socio-economic issues but has amplified the existing inequalities of society. This was also evident in the consequences that followed the Higher Education sector's response to COVID-19 (Staunton, Swanepoel, & Labuschaigne, 2020; Paterson, 2021).

While Higher Education institutions considered the overall well-being of vulnerable students such as their need for food and flexible learning programmes, the institutions' acts of social justice contained contradictions (Kele & Mzeleni, 2021). However, institutions' support service divisions should get credit for extending their services and innovatively reaching out to students in need with assistance such as online counselling for academic and personal issues (Schreiber, Luescher, Perozzi, & Bardill Moscaritolo, 2021). Moreover, in defence of Higher Education institutions, many of the concerns that aroused from Higher Education's response to the pandemic was due to factors out of the institutions' control and a result of broader societal problems (Luescher, Schreiber, Moja, Mandew, Wahl & Ayele, 2020). Although the study investigated the impact of the responses of Higher Education and governments on students to assist Higher Education institutions to be better prepared for similar future events.

8.1.3. Food security and dietary intake of a cohort of South African students during the COVID-19 pandemic

This chapter addressed four objectives of the study, namely, to examine firstly food security dimensions, secondly dietary intake, based on food frequency, thirdly, students' awareness and utilisation of food-related support services and lastly, associations between various demographic profiles and food security of the student cohort. According to findings, some students experienced food insecurity and hunger during the COVID-19 pandemic. The findings from the food frequency table indicated that students' dietary intake have been either similar or the frequency of some items decreased during pandemic. The questionnaire results supported healthy changes such as decreased intake of salty snacks and sugary treats, while focus group participants indicated unhealthy changes such as diets mainly reverting to starchy foods. Although the reason for the controversy was difficult to determing, evidence did indicate that dietary intake was influenced by factors extending beyond personal choice, such as available resources to purchase or prepare food. Noteworthy associations were evident between food insecurity and students who resided in rural areas, where students from these areas were more food insecure. Lastly, they expressed that the available food aid programmes and institutional support services were not sufficient (which was also supported by findings on food insecurity) due to reasons such as lack of awareness, tedious application to obtain access and pride discouraging utilisation.

8.1.4. An assessment of the impact of COVID-19 on nutrition-related health and wellness indicators: a case investigation of South African Health Sciences students

In this chapter, three objectives were addressed: the assessment of the nutritional related health and wellness indicators, students' awareness and utilisation of related institutional health and wellness support services and possible associations between the various demographic profiles, food security and mental health. The investigated nutritional-related health and wellness indicators included general health, weight trajectories, physical fitness, and mental health. Findings indicated that the ICE environment caused by COVID-19 had a significant impact on the

nutritional health and wellness indicators. Students' general health decreased, and they reported falling ill more often. Students perceived weight gain during COVID-19 and the BMI calculations indicated prevalence of the overweight and obese categories, raising the concern of poor weight management. More concerning was that the frequency of physical activity drastically decreased and mental health scores indicated poor mental health with severe levels of anxiety experienced. Significant associations between mental health and food insecurity implied that food insecure individuals suffered from poorer mental health. The need was identified by students for transformation of support services related to health and wellness that included increased awareness, additional services (nutrition and fitness related), increased resources (more staff and food parcels) and improved access.

8.1.5. Toward a health and wellness programme to ensure optimal student performance and well-being within ICE environments

The last objective of the study was addressed by this chapter, which proposed a health and wellness programme with interventions and strategies. The programme was designed by an integrated model as described in Chapter 7 and consisted of interventions/strategies that emanated from the challenges identified in the previous chapters' (sub-studies) findings. Strategies and interventions included two categories: awareness and communications, and resources. Higher Education institutions were recommended to implement the programme according to the Nadler-Tushman model of change. Therefore, the implementation was suggested to take place as a process of transformation where the proposed programme should serve as a point of departure.

8.2 OVERALL LIMITATIONS OF THE STUDY

Although the current study did not aim to serve as a comparative study, and although there is a lack of equivalent data on the student cohort before COVID-19, it became evident that the pandemic could not be held exclusively responsible for the findings of this study. Literature indicated that various health and wellness concerns amongst certain students in South Africa

were evident preceding the pandemic. Participants were selected only from the Health Sciences department only and based on their knowledge of the health and wellness field, they could have made better lifestyle choices than students from other fields of studies. As a result, it was difficult to extrapolate the study's findings to students from all fields of study. Focus group discussion participants were limited in numbers and could have been biased due to also participating in the questionnaire of the study, which was not considered earlier in the study. All information provided by participants were self-reported, thus no medical diagnosis could be confirmed. Moreover, self-reporting could be a limitation in the study, for instance the findings on weight-trajectory items, where participants reported on perceived weight changes, could have been influenced by recall bias as result of utilising self-reporting instead of anthropometric measurements which was impractical during COVID-19.

8.3 RECOMMENDATIONS

8.3.1 General recommendations to Higher Education

Based on the results of the current study and supported by literature, the following summarised recommendations are made to Higher Education institutions:

1. Higher Education institutions should consider all the systemic-contextual factors that affect their students' learning when reflecting on their support services provided to students, especially when facing an ICE environment. According to Schreiber, Luescher, Perozzi, & Bardill Moscaritolo (2021) these factors include the students' personal domains (intra-personal factors), their socio-cultural situation (cultural experience, social norms and beliefs), the university at which they are enrolled (their living and learning experience as well as the institutional culture, resources, learning framework and epistemology), the macro structures, services and functions (food, shelter, health, water, electricity and connectivity). These domains actively and simultaneously shape the environment, as well as each other (Schreiber, Luescher, Perozzi, & Bardill Moscaritolo, 2021). Therefore, during events that lead to ICE environments institutions should provide support stretched

beyond facilitating online learning, integrating all the mentioned aspects, to provide support to students in line with the social justice mandate of institutions (Schreiber, Luescher, Perozzi, & Bardill Moscaritolo, 2021; Luescher *et al.,* 2020).

2. Health and wellness aspects are inter-related and as a result influence each other (Ruegsegger & Booth, 2018). Therefore, it is recommended that support services offered at Higher Education institutions should include services supporting all health and wellness aspects, so as the maintain synergy between aspects. Such synergy would be ideal in maintaining overall, optimal health and wellness of students (Dodge, Daly, Huyton, & Sanders, 2012; Kruger, 2019).

3. Higher Education institutions should reflect on their existing support services against the proposed strategies and interventions described in the current study, as findings indicated that students' health and wellness were impacted negatively during COVID-19. It is recommended that institutions use the Nadler-Tushman Congruence Model (Nadler & Tushman, 1980) to identify gaps in the support services and to transform services as described by Filipovic, Vasic, Tica, Veg and Sinikovic (2020). In the case where support services do not reach the output of ensuring all aspects of students' health and wellness, and maintaining students' academic performance during an ICE environment, additional strategies and interventions should be developed. It is suggested that institutions use the comprehensive, integrated design model as described in this study (LBTC, 2023; nibusinessinfo, n.d., Stanford University, 2023; UCT, 2023) to design such strategies and interventions. As students become empowered with knowledge and skills to prepare them for ICE situations, overtime, institutions should review their support services once again. Therefore, reflection and improvement should occur as a continuous process as Dewey advocated already in 1933.

8.3.2 Recommendations for future research

As literature indicated that health and wellness concerns existed prior to the COVID-19 pandemic amongst students worldwide (Cady, 2016; Cheong, 2021; Pascoe, Hetrick & Parker, 2020; Varghese, Norman & Thavaraj, 2015), it is recommended that the current study is repeated under usual circumstances (not an ICE environment). Such findings may indicate if the findings in the current study exist also under usual circumstances, which will increase the need for Higher Education institutions to expand and/or transform their offered support services.

According to Haga, Shaw, Kneifel, Bond and Ginsburg (2020) the use of software applications is popular amongst younger generations as well as within the health and wellness sciences (Þórarinsdóttir, Kessing & Faurholt-Jepsen, 2017). Moreover, the recent AI developments are said to be ideal to assist with health and wellness support and guidance (Amisha, Malik, Pathania & Rathaur, 2019). Therefore, future research should be conducted on a software application to support the services offered by institutional support service divisions. However, it is important that such an application should take into consideration the circumstances of students and should adhere to recommendations made in this study.

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APPENDICES

Appendix A Information letters

Central University of Technology, Free State

FACULTY OF HEALTH AND ENVIRONMENTAL SCIENCES

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT
FOOD SECURITY AND RELATED WELLNESS INDICATORS OF HEALTH SCIENCES STUDENTS IN CENTRAL SOUTH AFRICA DURING COVID-19: A PROGRAMME TO MITIGATE THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS ON STUDENTS

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT INFORMATION:
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WHAT IS THE AIM / PURPOSE OF THE STUDY?
The main aim of this study was to conduct an in-depth assessment to inform the development of a programme with strategies and interventions that may contribute to improving the nutritional health and wellness of individuals at Higher Education institutions during ICE environments.

WHO IS CONDUCTING THE RESEARCH?
This research project is being conducted by Juanita Jonker as part of a PhD in Environmental Health at the Central University of Technology, Free State.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?
This study has received approval from the Health Sciences Research Ethics Committee of the University of the Free State. A copy of the approval letter can be obtained from the researcher. Approval number:

WHY WERE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

You are invited to participate in this research project because you were a registered student of the Health Sciences Department of the Central University of Technology, Free State (CUT) during the COVID-19 pandemic. Your contact information has been obtained from CUT to invite you to participate. In total, we aim to contact 300 students to complete the questionnaire.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

As participant, you will be expected to complete a questionnaire that will take approximately 15-20 minutes to complete. The questionnaire comprises of six sections, namely: demographic information, food and hunger during COVID-19, food frequency during COVID-19, health and wellness during COVID-19, mental well-being during COVID-19; and general comments on COVID-19.

CAN PARTICIPANTS DECLINE TO PARTICIPATE?

Your participation in this research study is voluntary. You may choose not to participate. Should you decide not to participate or withdraw from this study, you will not be penalised. If you agree to participate, you will be given this information sheet and be requested to provide consent before completing the questionnaire. As participant, you may withdraw without stating a reason, but it will not be possible to withdraw the information once submitted.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY AND WILL PARTICIPANTS RECEIVE PAYMENT OR ANY INCENTIVES?

There is no compensation linked to this study; however, your contribution to this research study will be highly valued. Participants may not benefit directly from participating in this study, but future students may benefit from informed institutions who may be better prepared for the effect of future pandemics on students.

WHAT WILL THE RISK AND DURATION OF PARTICIPATION BE?

There are no adverse risks associated with participating in this study. The only inconvenience will be to spare +-20 minutes of your time to complete the questionnaire. To mitigate this risk, the questionnaires can be completed at any time and place within the provided time frame.

WILL RESPONSES BE KEPT CONFIDENTIAL?

Your responses will be kept confidential, and we will not record any information that will personally identify you. The results of this study will be used for scholarly purposes only. Group data may be included in publications and presentation, e.g. journal articles and conference proceedings. In these cases, privacy will be protected, and participants will not be identifiable.

HOW WILL THE INFORMATION BE STORED AND MANAGED?

All data is stored in a password-protected electronic format and destroyed within 15 years after completion of the degree. Future use of the stored data will be subject to further Health Sciences Research Ethics review and approval.

HOW WILL PARTICIPANTS BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

Following completion of the study, the results/findings will be shared with the relevant head of department. Kindly note that no individual results/findings will be made available. The participants may also request results/findings via e-mail. The researcher will ensure that confidentiality is maintained when providing feedback/results.

WHERE CAN MORE INFORMATION ABOUT THE STUDY BE FOUND?

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Juanita Jonker on 051 507 3985, 072 176 1364 or jjonjker@cut.ac.za .

Thank you for taking time to read this information sheet and for participating in this study.

FOCUS GROUP INFORMATION DOCUMENT

Study title: FOOD SECURITY AND RELATED WELLNESS INDICATORS OF HEALTH SCIENCES STUDENTS IN CENTRAL SOUTH AFRICA DURING COVID-19: A PROGRAMME TO MITIGATE THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS ON STUDENTS

Dear focus group discussion participant

I, Juanita Jonker, am conducting research on food security and related wellness indicators during covid-19. This research will provide information that can be directly related to Health Sciences students. The aim of the study is to provide a programme with strategies and interventions that may contribute to improving the nutritional health and wellness of individuals at the selected institution and potentially applicable to other institutions as well, when facing an ICE environment.

I am kindly inviting you to take part in my research study.

As a participant, you would be requested to answer structured questions during a focus group discussion. You will be expected to answer questions regarding your food consumption, buying patterns and preferences, as well as nutrition-related wellness during Covid-19. The questions will be in lay terms for all participants to understand what information is requested. Suitable probes and prompts will follow on each of the questions to ensure that the correct, as well as an adequate amount of information, is collected during the discussion. These group discussions will be on an online platform in accordance with COVID regulations and links will be e-mailed to participants. The online discussions will be recorded to verify information captured in the notes taken by the facilitator during these interviews. Discussions are expected to be 60 minutes in duration. The language of communication will be English, for all focus group discussions, while participants may ask for clarification when unsure.

No risks have been identified, and participant identity and feedback will be treated as highly confidential. Participation is voluntary, and refusal to participate will involve no penalty or loss of benefits. Participants who agreed upon participation may still withdraw at any time during the duration of the study without any negative results. Potential benefits of your participation are

increased knowledge in this field of study resulting from feedback received from the study. Participants participating in this research study will not be remunerated nor will they be liable for any costs.

The outcome of this study is to propose a programme to improve the nutritional health and wellness of individuals at the selected institution and potentially applicable to other institutions as well, when experiencing events that lead to ICE environments like pandemics. The outcomes will be communicated to all participants and relevant authorities in a concluded report by electronic mail or on the institution's online teaching platform. The outcomes of this research study may also be published in journals or presented at congresses at any stage after completion of the study. Signing the informed consent form will permit publishing of the results of this study.

Researcher Details:

Name:	Juanita Jonker
Employer:	Central University of Technology, Free State (CUT)
Work Address:	20 Pres. Brand Street Bloemfontein 9301
Work Tel. No.:	051 507 985
Fax No.:	051 507 3448
Cell No.:	072 176 1364

Appendix B Informed consent forms

Central University of Technology, Free State

FACULTY OF HEALTH AND ENVIRONMENTAL SCIENCES

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT

FOOD SECURITY AND RELATED WELLNESS INDICATORS OF HEALTH SCIENCES STUDENTS IN CENTRAL SOUTH AFRICA DURING COVID-19: A PROGRAMME TO MITIGATE THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS ON STUDENTS

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT INFORMATION:

Juanita Jonker 0721761364 jjonker@cut.ac.za

FACULTY:

Health and Environmental Sciences

STUDYLEADER(S) NAME AND CONTACT INFORMATION:

Prof. JFR Lues	Dr C Walsh 051 507
3145	051 4013818
rlues@cut.ac.za	WalshCM@ufs.ac.za

WHAT IS THE AIM / PURPOSE OF THE STUDY?

The main aim of this study was to conduct an in-depth assessment to inform the development of a programme with strategies and interventions that may contribute to improving the nutritional health and wellness of individuals at Higher Education institutions during events that lead to an ICE environment.

WHO IS CONDUCTING THE RESEARCH?

This research project is being conducted by Juanita Jonker as part of a PhD in Environmental Health at the Central University of Technology, Free State.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Health Sciences Research Ethics Committee of University of the Free State. A copy of the approval letter can be obtained from the researcher. Approval number:

WHY WERE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

You are invited to participate in this research project because you were a registered student of the Health Sciences Department of the Central University of Technology, Free State (CUT) during the COVID-19 pandemic. Your contact information has been obtained from CUT to invite you to participate. In total, we aim to contact 300 students to complete the questionnaire.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

As participant, you will be expected to complete a questionnaire that will take approximately 15-20 minutes to complete. The questionnaire comprises of six sections, namely: demographic information, food and hunger during COVID-19, food frequency during COVID-19, health and wellness during COVID-19, mental well-being during COVID-19, and general comments on COVID-19.

CAN PARTICIPANTS DECLINE TO PARTICIPATE?

Your participation in this research study is voluntary. You may choose not to participate. Should you decide not to participate or withdraw from this study, you will not be penalised. If you agree to participate, you will be given this information sheet and be requested to provide consent before completing the questionnaire. As participant, you may withdraw without stating a reason, but it will not be possible to withdraw the information once submitted.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY AND WILL PARTICIPANTS RECEIVE PAYMENT OR ANY INCENTIVES?

There is no compensation linked to this study; however, your contribution to this research study will be highly valued. Participants may not benefit directly from participating in this study, but future students may benefit from informed institutions who may be better prepared for the effect of future pandemics on students.

WHAT WILL THE RISK AND DURATION OF PARTICIPATION BE?

There are no adverse risks associated with participating in this study. The only inconvenience will be to spare +-20 minutes of your time to complete the questionnaire. To mitigate this risk, the questionnaires can be completed at any time and place within the provided time frame.

WILL RESPONSES BE KEPT CONFIDENTIAL?

Your responses will be kept confidential, and we will not record any information that will personally identify you. The results of this study will be used for scholarly purposes only. Group data may be included in publications and presentation, e.g., journal articles and conference proceedings. In these cases, privacy will be protected, and participants will not be identifiable.

HOW WILL THE INFORMATION BE STORED AND MANAGED?

All data is stored in a password-protected electronic format and destroyed within 15 years after completion of the degree. Future use of the stored data will be subject to further Health Sciences Research Ethics review and approval.

HOW WILL PARTICIPANTS BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

Following completion of the study, the results/findings will be shared with the relevant head of department. Kindly note that no individual results/findings will be made available. The participants may also request results/findings via e-mail. Confidentiality will be maintained when providing feedback/results.

WHERE CAN MORE INFORMATION ABOUT THE STUDY BE FOUND?

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Juanita Jonker on 051 507 3985, 072 176 1364 or jjonjker@cut.ac.za .

Thank you for taking time to read this information sheet and for participating in this study.

CONSENT FORM TO PARTICIPATE IN RESEARCH FOCUS GROUP DISCUSSIONS

You are requested to participate in a research study, FOOD SECURITY AND RELATED WELLNESS INDICATORS OF HEALTH SCIENCES STUDENTS IN CENTRAL SOUTH AFRICA DURING COVID-19: A PROGRAMME TO MITIGATE THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS ON STUDENTS, being conducted by Mrs Juanita Jonker.

You have received a detailed explanation, by means of an information letter, about the study by Mrs Juanita Jonker.

You may contact Mrs Juanita Jonker at 072 176 1364 or (051) 507 3985, any time if you have any queries about the research study conducted.

Your participation is voluntary, and you will not be held accountable or be penalised in any manner if you refuse to participate or decide to cease participation.

If you agree to participate in the research, you will be given a signed copy of this document. Signing this informed consent form will permit publishing of the results of this study.

The research study, including the above information has been verbally explained to me. I understand what my participation in the study means and I voluntarily agree to participate.

_____ _____

Signature of participant Date

_____ _____

Signature of witness Date

(Where applicable)

Central University of Technology, Free State

Appendix C Questionnaire

Central University of Technology, Free State

FACULTY OF HEALTH AND ENVIRONMENTAL SCIENCES

RESEARCH QUESTIONNAIRE FOR THE STUDY: FOOD SECURITY AND RELATED WELLNESS INDICATORS OF HEALTH SCIENCES STUDENTS IN CENTRAL SOUTH AFRICA DURING COVID-19: A PROGRAMME TO MITIGATE THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS ON STUDENTS

Information letter

I have read and understood the attached information letter and hereby provide my informed consent to participate in the study. *

☐ **Yes** ☐ **No**

Section 1: Demographic Information

Click to select the applicable answer. * Required

Gender *

☐ Male ☐ Female ☐ Other

Age *(drop box options)

☐ years

Course that you are registered for *

☐ Biomedical Technology
☐ Clinical Technology
☐ Radiography
☐ Somatology

Where did you spend most of your time **DURING** COVID-19 **(after January 2020)**? *

☐ Campus/private residence where meals are included and prepared by residence personnel.
☐ Campus/private residence where NO meals are included, and you are responsible for preparing meals.
☐ Home with caretakers e.g. parents or grandparents who assist with cooking.
☐ Home without caretakers e.g. self-responsible for buying groceries and cooking.
☐ Other? (Specify) _____

State where your home/residence as answered in the previous question, is situated: *

☐ Urban (Town/City)
☐ Rural settlement (Farm/Location)
☐ Other? (Specify) _____

Have you ever tested positive for COVID-19? *

☐ No

Yes, with

☐ no symptoms (asymptomatic)
☐ mild symptoms
☐ moderate symptoms
☐ severe symptoms

Section 2: Food and hunger during COVID-19

Please indicate how often you experienced the following **DURING** COVID-19 **(after January 2020)**.

	Never (not even once)	Rarely (1-2 days per month)	Sometimes (> 2 days but <10 days per month)	Often (> 10 days per month)
Did you worry that your household would not have enough food? *	☐	☐	☐	☐
Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources? *	☐	☐	☐	☐
Did you or any household member eat just a few kinds of food day after day because of a lack of resources? *	☐	☐	☐	☐
Did you or any household member eat food that you preferred not to eat because of a lack of resources to obtain other types of food? *	☐	☐	☐	☐
Did you or any household member eat a smaller meal than you felt you needed because there was not enough food? *	☐	☐	☐	☐
Did you or any other household member eat fewer meals in a day because there was not enough food? *	☐	☐	☐	☐
Did you or any household member go to sleep at night hungry because there was not enough food? *	☐	☐	☐	☐
Did you or any household member go a whole day without eating anything because there was not enough food? *	☐	☐	☐	☐
Was there ever no food at all in your household because there were no resources to get more? *	☐	☐	☐	☐
Did you ever go thirsty because of a lack of water (including other fluids) to drink?*	☐	☐	☐	☐
Did you ever need to drink water from unsafe sources such as rivers and dams due to a lack of safe water?*	☐	☐	☐	☐

Which of the following reasons contributed to experiences that you identified above: *(May select more than one answer)*

☐ Unable to travel to a shop	☐ Lack of money	☐ Lack of appetite	☐ Limited time	☐ Poor health	☐ Psychological reasons	☐ Healthier lifestyle	☐ Shop had limited stock	☐ No resources to cook food e.g. electricity or paraffin

Other *(specify)*:_____

Section 3: Food frequency during COVID-19

How did your food intake change, if at all, since the COVID-19 pandemic **(after January 2020)**? *

	Decreased				Increased		
	Daily intake	Weekly intake	Monthly intake	Stayed the same	Monthly intake	Weekly intake	Daily intake
1. Fried foods such as hot chips, fried fish, fried chicken, fried meat, vetkoek or doughnuts *							
2. Take-away foods e.g. KFC, Captain Do Rego's, McDonalds, pizza delivered,etc. *							
3. Salty snacks such as Simba chips, Doritos, cheese curls, salted peanuts, salty biscuits, etc. *							
4. Processed meat such as polonies, viennas, meat pies, or sausage rolls *							
5. Salt intake*							
6. Fruit intake*							
7. Vegetables and salads, excluding potatoes*							
8. Sweetened drinks incl. fizzy drinks e.g. Coke or drinks e.g. Oros where water is added (excl. diet or unsweetened drinks) *							
9. Fruit juice *							
10. Sugar intake *							
11. Sugary foods such as sweets, cakes, biscuits, jam, syrup or honey *							
12. High fat foods like cream, margarine, oil, fat, mayonnaise *							
13. White bread *							
14. Alcohol *							
15. Lean meat, chicken, and fish *							
16. Wholegrain foods *							

Section 4: Health and wellness during COVID-19

Rate your general health status:	**Excellent** *(e.g. fall ill once a year)*	**Good** *(e.g. fall ill 3x per year)*	**Fair** *(e.g. fall ill every second month)*	**Poor** *(e.g. fall ill monthly)*	**Very Poor** *(e.g. fall ill more than once a month)*
BEFORE COVID-19 **(prior to December 2019)** *	☐	☐	☐	☐	☐
DURING COVID-19 **(after January 2020)** *	☐	☐	☐	☐	☐

Indicate whether you suffer from the following co-morbidities (existing chronic diseases) that may predispose you to COVID-19 complications? *

- ☐ Hypertension
- ☐ Obesity
- ☐ Chronic lung conditions e.g. TB
- ☐ Diabetes
- ☐ Cardiovascular conditions

Other? (Specify) _____

What is your current height? _____m
What is your current waist circumference (measure over the bellybutton) _____cm
What is your current weight? _____kg

Do you feel your weight changed due to COVID-19?*

☐ Yes, I gained much weight	☐ Yes, I gained a bit of weight	☐ No, I felt no change in weight	☐ Yes, I lost a bit of weight	☐ Yes, I lost much weight

If, yes, what do you think are possible reasons for the change?_____

_____

How often did/do you exercise:	I don't exercise	Once a week	3-4 times per week	5-6 times per week	Every day
BEFORE COVID-19 **(prior to December 2019)** *	☐	☐	☐	☐	☐
DURING COVID-19 **(after January 2020)** *	☐	☐	☐	☐	☐

If your exercise routine changed since the onset of COVID-19, please provide possible reason/s for the change?_____

Section 5: Mental well-being during COVID-19

*Please read each statement and select how much the statement applied (if at all) to you **DURING** COVID-19. There are no right or wrong answers. Do not spend too much time on any statement.*

	NEVER *(Did not apply)*	***SOMETIMES*** *(Applied to me to some degree)*	***OFTEN*** *(Applied to me to a great degree)*	***MOSTLY*** *(Applied to me most of the time)*
I find it hard to unwind				
I experience dryness of my mouth				
I cannot experience any positive feelings				
I experience breathing difficulty in the absence of physical exertion (e.g. rapid breathing, breathlessness)				
I find it difficult to take action and do things				
I tend to over-react to situations				
I experience trembling (e.g. in the hands)				
I feel that I have a lot of nervous energy				
I am worried about situations in which I might make a fool of myself				
I feel that I have nothing to look forward to				
I find myself getting agitated often				
I find it difficult to relax				
I feel down and blue				
I struggle to stay focused on what I am doing and get sidetracked easily				
I feel I am close to panic				
I am unable to be excited about anything				
I feel I am not worth much as a person				
I feel that I am very touchy				
I am aware of my heart's beat in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)				
I feel scared without any specific reason				
I feel that my life is meaningless				

Section 6: General comments on COVID-19

Were you aware of any assistance that was put in place by CUT during COVID to assist students with health-related issues? *

☐ Yes ☐ No

If you were aware of the services mentioned, which of these services did you make use of? *(May select more than one answer)*

☐ None
☐ Institutional support services (Specify) _____
☐ Faculty-specific services (Specify) _____
☐ Departmental-specific services (Specify) _____
☐ Programme-specific services(Specify) _____
☐ Student organisations (Specify) _____
☐ Other? (Specify) _____

Select which of the following services, in addition to existing services, could have assisted students like yourself during a pandemic such as COVID-19: * *(May select more than one answer)*

☐ Student feeding scheme.
☐ Training and awareness to maintain/improve nutrition.
☐ Training and awareness to maintain/improve physical health.
☐ Training and awareness to maintain/improve mental well-being.
☐ No additional services were necessary.

State any suggestions to institutions to better assist students during future pandemics:

_____
_____

THE END

Thank you for taking part in this research project.

Appendix D Focus group discussion schedule

INTRODUCTION (6 min)

WELCOME

Introduction

- **OUR TOPIC IS :** FOOD SECURITY AND RELATED WELLNESS INDICATORS OF HEALTH SCIENCES STUDENTS IN CENTRAL SOUTH AFRICA DURING COVID-19: A PROGRAMME TO MITIGATE THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS ON STUDENTS
- **THE RESULTS WILL BE USED TO :**
  propose a programme to Higher Education institutions that may maintain and/or improve food security and wellness during future outbreaks or other circumstances that result in ICE environments.
- **YOU WERE INVITED BECAUSE :**
  you were a registered student of the Health Sciences Department of the Central University of Technology, Free State (CUT) during the COVID-19 pandemic.

GUIDELINES

- No right or wrong answers, only differing points of view.
- We're recording one person speaking at a time and please say your name before you start talking to assist with transcribing the discussion.
- We're on a first name basis although no names will be included in the reports of the discussion and participants will not be identified from any material.
- We will keep all videos off, and you are welcome to participate with a fake name/pseudonym.
- You do not need to agree with others, but you must listen respectfully as others share their views.
- My role as moderator will only be to guide the discussion.
- So please talk to each other.
- Should you not feel comfortable answering honestly in this group, you are welcome to send me your views via e-mail or arrange a private meeting.

GROUP MEMBERS:

Before we start, if you have not submitted your informed content to participate in this research study, please leave the meeting. Then can each one of you just unmute yourself and say the course you are registered for.

CONTEXT/BACKGROUND (2 min.)

Let's take a moment and take ourselves back to the midst of COVID-19. Close your eyes as we go back to 2020….. PAUSE

Remember where you stayed during the hard lockdown and then the other levels of lockdown thereafter. Think of remote teaching and learning ALONE away from campus, no friends, no fellow students.

Some of us were unsure, maybe afraid, isolated from others, lonely, wearing masks and worrying about the sick…PAUSE

Now, let's think how our lives changed from before COVID to during the time of the pandemic?

Firstly, let us talk about our food intake:

Section 2: Food and hunger during COVID-19 (10 min.)

Was there enough food and water available during COVID in our households?

Probes: State possible reasons for this? How often have you experienced this? Who else has had similar or different experiences?

Section 3: Food frequency during COVID-19 (10 min.)

How did your food intake change, from BEFORE COVID to DURING the pandemic?

Probes: Did you eat more or less certain foods? Think of salt, sugars, fatty foods such as takeaways, meat or fresh food like veggies and fruit. Could you state possible reasons – was it due to comfort, cravings, availability, or other issues?

Section 4: Health and wellness during COVID-19 (8 min.)

How did your general health change, from BEFORE COVID to DURING the pandemic?

Probes: Were you ill more often or less often? Did you gain or lose weight, if so why? Were you able to exercise, like usual?

Section 5: Mental well-being during COVID-19 (8 min.)

How did your mental health change, from BEFORE COVID to DURING the pandemic?

Probes: Which emotions did you experience during COVID which you did not experience or experienced less often before COVID? Emotions can be positive like at peace, relaxed and happy or negative like stressed, afraid, lonely, or depressed. What made you experience these positive/negative emotions?

Section 6: Summary and general comments on COVID-19 (12 min.)

If we summarise,

- Your amount of food in households mostly ☐stayed the same/☐became less/ ☐or more during COVID.
- You increased eating foods like_____
  and decreased food like_____
- COVID had ☐a negative or/ ☐positive impact on your general health and
- ☐a negative or/ ☐positive impact on your mental health.

As a final question, which support services at the CUT assisted with any of these issues?

Probes: How did it attend to the matters? Who else made use of these services?
What other services can you suggest assisting with the mentioned matters from the discussion e.g. training on proper nutrition and home exercise programmes, or a feeding scheme for needy students?

_____

CLOSING REMARKS (5 min.)

Is there anything else you felt we missed or wanted to add on this topic?
Probe: Any suggestions to institutions to better assist students during future pandemics?

Central University of Technology, Free State

Appendix E HSREC Ethics approval

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

02-Sep-2021

Dear Mrs Jonker, Juanita

Conditionally Approved

Research Project Title:
THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS ON FOOD SECURITY AND ASSOCIATED WELLNESS INDICATORS: TRENDS AMONGST SOUTH AFRICAN HEALTH SCIENCES STUDENTS DURING THE COVID-19 PANDEMIC

With reference to your application for ethical clearance for your research: it has been determined by the General/Human Research Ethics Committee of the University of the Free State that this research is ethically sound and may receive full ethical approval after the following provision(s) have been attended to:

Please upload gatekeeper's permission from CUT.

Please attend to the abovementioned within sixty (60) days. Failure to respond or make prior arrangements within this time will result in your application being withdrawn (terminated). Please note: **This is not a valid ethical approval until you (the applicant) have attended to the above mentioned provisions and the ethics committee has validated them.**

Yours sincerely

Dr Adri Du Plessis
Chairperson: General/Human Research Ethics Committee

205 Nelson Mandela Drive Bloemfontein 9300 South Africa
P.O. Box 339 Park West Tel: +27 (0)51 401 9337
Bloemfontein 9301
duplessisA@ufs.ac.za

Central University of Technology, Free State

Appendix F CUT approval

INSTITUTIONAL PLANNING AND QUALITY ENHANCEMENT

Central University of Technology, Free State

MS JUANITA JONKER

PERMISSION FOR MS JUANITA JONKER TO CONDUCT HER RESEARCH FOR HER PHD STUDY AT CUT ENTITLED "THE IMPACT OF ISOLATED, CONFINED AND EXTREME ENVIRONMENTS ON FOOD SECURITY AND ASSOCIATED WELLNESS INDICATORS: TRENDS AMONGST SOUTH AFRICAN HEALTH SCIENCES STUDENTS DURING THE COVID-19 PANDEMIC"

Dear Ms Jonker

This is to confirm that you have been granted permission to conduct research at the Central University of Technology for your PhD study entitled **"**the impact of isolated, confined and extreme environments on food security and associated wellness indicators: trends amongst South African Health Sciences students during the Covid-19 pandemic".
The conditions of the conditional permission are:

- The research will not interrupt any of the official activities at the Central University of Technology;
- You will supply us with the copy of your report;
- The cost of all related activities will be covered by yourself;
- Recruitment of participants is the sole responsibility of yourself;
- Voluntary nature of the potential participants decision to consent to participate should be strictly observed;
- You should not disclose a potential participant's decision to participate or otherwise to any other party;
- Permission does not compel, in any sense, participation of staff members or students in your research.

Senior Director: Institutional Planning and Quality Enhancement
Mr I. Mokhele
08/09/2021