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NUTRITION COMPETENCIES OF TUCK SHOP OWNERS IN RELATION TO NUTRITIONAL QUALITY OF PRODUCTS SOLD AT TSHWANE PRIMARY SCHOOL TUCK SHOPS

by

NZ du Piesanie (16001550)

Research project

Master in Consumer Science Hospitality Management

September 2021

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NZ du Piesanie (16001550)

Submitted in partial fulfilment for a master's degree in Consumer Science Hospitality Management

In the

Faculty of Natural and Agricultural Sciences

Department of Food and Consumer Sciences

Supervisor: Dr A. Pretorius

Co-Supervisor: Dr M. Hoffman

September 2021

PLAGIARISM INDEMNITY DECLARATION

DECLARATION OF ORIGINALITY

UNIVERSITY OF PRETORIA

I Nadine Zeta du Piesanie, 16001550 hereby declare that:

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ABSTRACT

Aims

This study aimed to determine the relationship between tuck shop owners' nutrition competency scores in terms of knowledge, skills and behaviour and the nutritional quality percentage scores (as measured by the South African Nutrient Profiling Model) of food and beverage products sold at quintile five public and private primary school tuckshops. The relationships between the nutritional quality percentage scores of products sold at tuck shops and nutrition-related training and policies, respectively, were also explored to add insight to the understanding of products sold in participating tuck shops.

Methodology

In this quantitative cross-sectional study, a total of 33 tuck shop owners from privately owned tuck shops situated across the Third Region of Tshwane, South Africa, were sampled using a stratified random sampling technique. A structured questionnaire was used to assess participants' nutrition competencies and their nutrition training, policy awareness, and implementation in their tuck shops. Observational checklists were used to capture nutrient contents of products sold in participants tucks shops, whereafter, the South African nutrient profiling model was used to calculate a nutritional quality percentage score, indicating the percentage of healthy food products. The relationship between these variables was determined using Pearsons correlation, while Chi-square statistics and independent t-tests were used to determine differences between tuck shops at quintile five and private primary schools

Results

Tuckshop owners' mean nutrition competency score was 77%, while 57% of food and beverage products sold in tuck shops were classified as unhealthy. No correlation (r=0,12; P=0,478) was found between nutritional quality percentage scores and nutrition competency scores. However, a statistical significant correlation (r=0,41; P=0.017) was found between nutrition-related policy implementation and nutritional quality percentage scores. Furthermore, a statistical significant correlation (r=0,40; P=0.021) was found between nutritional quality percentage scores and nutrition-related training.

Conclusion

Food and nutrition-related training of tuck shop owners to understand the nutritional needs of learners and implement policies to support a healthy school food environment characterised by the availability of healthy food products may contribute to improved health, growth and development while reducing the risk of NCDs in learners.

Keywords: Nutrition competencies, nutritional quality, primary school tuck shops, school food environment

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ABBREVIATIONS

WHO	World Health Organization
UP	University of Pretoria
DBM	Double Burden of Malnutrition
NCDs	Non-Communicable Diseases
SAFBDG	South African Food-Based Dietary Guidelines
COVID-19	Coronavirus Disease 2019
NNSS	National Norms and Standards for School Funding
NSNP	National School Nutrition Program
DoH	National Department of Health
DoHSA model	South African Department of Health nutrient profiling model
SANPM	South African Nutrient Profiling Model
FSA	Food Standards Agency
FSANZ	Food Standards Australia New Zealand

CHAPTER 1

THE STUDY IN PERSPECTIVE

This chapter provides the introduction and background, the problem statements, a justification for conducting the study, its aim and objectives, the conceptual framework, and an outline of the report.

1.1 Introduction and background

South Africa faces both the consequences of nutritional deficiencies and nutritional excesses. This is due to the simultaneous manifestation of under, and over-nutrition called the double burden of malnutrition (DBM). The DBM in terms of undernutrition presents itself in the form of stunting, wasting, nutrient deficiencies, and underweight. While on the other side of the DBM spectrum, overnutrition presents itself in the form of nutrient deficiencies, overweight and obesity (Nugent, Levin, Hale & Hutchinson, 2020; Popkin, Corvalan & Grummer-Strawn, 2019; Tydeman-Edwards, Van Rooyen & Walsh, 2018).

In South Africa, high levels of infectious diseases and increased risk of non-communicable diseases (NCDs) accompany this DBM, thus crippling the health systems (Prentice, 2018). NCDs are the leading cause of death globally (Indongo & Kazembe, 2018; Sheik, Evans, Morden & Coetzee, 2016). It commonly refers to four broad categories of chronic diseases, namely: cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes. NCD is caused by modifiable risk factors such as unhealthy diets, obesity, and a sedentary lifestyle (Hill, Draper, De Villiers, Fourie, Mohamed, Parker & Steyn, 2015; World Health Organization, 2018). Overweight and obesity in both adults and children were found to be the main NCDs risk factors (Korff, 2018; Nguyen, De Villiers, Fourie & Hendricks, 2017). Obesity/overweight has reached alarming rates among children where 27% of girls and 9% of boys are overweight/obese in primary schools in South Africa (Ganie & Peer, 2016; Wrottesley, Pedro, Fall & Norris, 2019; Zambuko, 2018).

South Africa is undergoing a nutrition transition, which is caused by the change in diets from traditional to more Westernised due to urbanisation. Urbanisation has caused rapid changes in the food systems, leading to increased availability and affordability of foods with poor nutritional quality (Hawkes, Harris & Gillespie, 2017; Nortje, Faber & De Villiers, 2017; Pirgon & Aslan, 2015; Popkin *et al.*, 2019; Pradeilles, 2015).

Poor nutritional quality refers to foods high in saturated and trans fats, sugar, and salt but is low in protein, fibre and micronutrient content, such as ultra-processed foods and fast foods, i.e., typical Westernised diets (Hawkes *et al.*, 2017; Nortje *et al.*, 2017; Pirgon & Aslan, 2015; Popkin *et al.*, 2019; Pradeilles, 2015). Ultra-processed foods are typically defined as energy-dense products high in sugar, saturated fats, and salt while low in dietary fibre, protein, vitamins and minerals. They are formulations of food substances that are often modified by chemical processes using flavours, colours, emulsifiers, and other cosmetic additives to create hyper-palatable, easy to consume, low-cost products (Gibney, 2019; Monteiro, Cannon, Levy, Moubarac, Louzada, Rauber, Khandpur, Cediel, Neri & Martinez-Steele, 2019).

These diets generally do not align with the South African Food Based Dietary Guidelines (SAFBDG) and consequently are associated with the development of childhood obesity which may increase risk of NCDs during adulthood (Al-Mahrouqi, 2019; Hawkes *et al.*, 2017; Tydeman-Edwards *et al.*, 2018). Urbanisation has also caused an increase in sedentary lifestyles among South African school learners (Stupar, Eide, Bourne, Hendricks, Iversen & Wandel, 2012; Wrottesley *et al.*, 2019). These changes in dietary and activity habits that have developed as a result of nutrition transition and urbanisation have caused an obesogenic school food environment among learners (Nugent *et al.*, 2020; Popkin *et al.*, 2019; Stupar *et al.*, 2012; Tydeman-Edwards *et al.*, 2018; Wrottesley *et al.*, 2019). An obesogenic environment is the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations and is a major factor that may influence the eating behaviour and habits of learners (Baril, 2008; Dasi, Selvaraj, Kulkarni & Pullakhandam, 2019; Kohler, Christensen, Roy, Kilgo & Bryan, 2013; Lake & Townshend, 2006). The changes in this school food environment, i.e. decreasing nutritional quality of available and affordable foods in schools, may have negative consequences on children's eating habits and, ultimately, their nutritional status (Hawkes *et al.*, 2017; Ma & Wong, 2018). These consequences result in an increased risk of long term health consequences such as overweight or obesity, and NCD (Birch & Anzman, 2010; Morshed, Becker, Delnatus, Wolff & Iannotti, 2016; Saravia, González-Zapata, Rendo-Urteaga, Ramos, Collese, Bove, Delgado, Tello, Iglesia, Gonçalves Sousa, De Moraes, Carvalho & Moreno, 2018).

In South Africa, a school tuck shop is defined as a small business that is either privately or school owned and run from within the school premises. These small businesses offer a variety of food and beverage products for sale to learners and staff before, during or after school (Bekker, Marais & Koen, 2017; Nortje *et al.*, 2017; Wiles, Green & Veldman, 2013). There is currently no legislation in place that regulates the nutritional quality of products sold in South African primary school tuck shops, and consequently, decisions by tuck shop owners are driven by popularity and profits

(Govender, Naicker, Napier & Singh, 2018; Kim, Hong, Yun, Ryou, Lee & Kim, 2012a; Kruger & De Villiers, 2011). Many tuck shops in South African primary schools provide a minimal variety of healthy food products and instead provide a large variety of calorie-dense, low nutritional quality (unhealthy) foods that support the obesogenic school food environment (Drewnowski, 2017; Lehmann, Charles, Vlassopoulos, Masset & Spieldenner, 2017; Morshed *et al.*, 2016; Rayner, 2017; Wrottesley *et al.*, 2019). Primary school learners are still young and very impressionable and do not yet have the level of nutrition knowledge required to make informed decisions about their diets and wellbeing. Thus, they are easily influenced to desire and purchase/consume certain products due to the marketing, availably, and affordability (Chen & Yang, 2014; Hawkes *et al.*, 2017; Ma & Wong, 2018; Nortje *et al.*, 2017).

In South Africa, nutrition and food-related policies have predominantly focused on issues pertaining to food insecurity, dietary diversity, micronutrient deficiency control programmes, breastfeeding and child feeding practices. The South African nutrition policies have not kept up to speed with the rapid nutrition transition towards unhealthy diets. South Africa has, however, implemented the first sugar-sweetened beverage tax called the Health Promotion Levy in April 2018. This tax has a fixed 2,1-cent tax rate for every 1 gram of sugar beyond 4g/ml and is now said to stand at 11% of the price per litre (Essman, Taillie, Frank, Ng, Popkin & Swart, 2021). Regulation R733 is another policy in South Africa that requires clear labelling of all packaged products containing non-nutritive sweeteners. A mandatory upper sodium limit in processed food categories was implemented in June 2016. Regulation 127 of 2011 prohibits foods that contain more than 2g of trans fat per 100g of fat or oil (Frank, Thow, Ng, Ostrowski, Bopape & Swart, 2021).

Furthermore, in 2014 the South African Department of Health (DoH) published a draft regulation R429, which aimed to prohibit/restrict the advertisement of unhealthy food or non-alcoholic beverages to children (aged explicitly from 0 to 18 years). Stipulations of the timeslots whereby the marketing may not occur, the type of health messages used in advertisements, and the banning celebrity endorsements and promotions of unhealthy food were also included. In 2015 the draft food and marketing regulations were followed by the Strategy for the Prevention and Control of Obesity in South Africa which further aimed to ensure ethical and responsible marketing of food products. However, the draft regulations have still not been legislated, neither has a monitoring/enforcement framework for implementation been developed, which consequently still exposes children to the marketing of unhealthy food products (Hofman, Erzse, Kruger, Karimi & Mayii, 2020; Kelly, Vandevijvere, Ng, Adams, Allemandi, Bahena-Espina, Barquera, Boyland, Calleja & Carmona-Garcés, 2019).

The nutritional quality of foods available to consume in the food environments, including the school environments, is determined and can be regulated in South Africa using one of the various tools available, called nutrient profiling (Faber, de Villiers, Hill, van Jaarsveld, Okeyo & Seekoe, 2019; Martinez-Perez & Arroyo-Izaga, 2021; Poinsot, Vieux, Dubois, Perignon, Méjean & Darmon, 2020). Nutrient profiling is a method of evaluating the healthiness of food through classifying or ranking foods according to their nutritional composition. The purpose of nutrient profiling is to assess the nutritional value of foods, promote health and prevent diseases (Drewnowski, Amanquah & Gavin-Smith, 2021; Poon, Labonté, Mulligan, Ahmed, Dickinson & L'Abbé, 2018). Nutrient profiling models provide a scientific rationale for labelling, regulatory, educational and tax initiatives while also providing a benchmark for product reformulation (Drewnowski *et al.*, 2021). Currently, the application of nutrient profiling models includes aiding in the development of food and nutrition policies, implementing restriction of food marketing to children, determining which food products to sell in schools, establishing regulations of health/nutrition claims and supporting the consumer in making healthier food choices (Drewnowski, 2017; Drewnowski *et al.*, 2021; Poon *et al.*, 2018). The UK Food Standards Agency (FSA)/Ofcom model and the WHO-Euro nutrient profiling models are the most well-known models developed for regulating unhealthy food marketing to children. Chile uses nutrient profiling (Ofcom model) to improve their school food environment by prohibiting unhealthy foods with the front-of-pack warning label from being sold and marketed in or around school grounds. Nutrient profiling can also be used to evaluate the quality of foods being sold and guide the consumer in selecting healthier food products. A study done in Vienna, Austria has also demonstrated the benefits of utilizing nutrient profiling (Ofcom model) to regulate the availability of unhealthy foods in their primary schools (Missbach, Pachschwöll, Kuchling & König, 2017). It is recommended that South Africa use the South African Nutrient Profiling Model (SANPM) to regulate the marketing and sales of unhealthy products to children (Frank *et al.*, 2021; Rayner, 2017; Wicks, Wright & Wentzel-Viljoen, 2016).

The South African nutrient profiling model determines the nutritional quality of foods based on the food's nutrient composition per 100g of food or 100ml of non-alcoholic beverage by allocating a final nutrient profile score. These scores are determined by using a set of algorithms allocating various points for fat (g), sugar (g), energy (kJ), protein (g), sodium (g), fibre and fruit, vegetable, nut, and legume (g) contents, which is then calculated to achieve a final nutrient profile score. Foods and beverages that fall within a specific nutrient profile scoring range for their product category can thus be classified as healthy/high in nutritional quality or unhealthy/ low in nutritional quality (Bursey, Wiles & Biggs, 2021; Faber *et al.*, 2019; Poinsot *et al.*, 2020; Rayner, 2017).

Previous studies have shown that the best way to increase the availability of healthy products sold in tuck shops was to educate tuck shop owners regarding the nutritional quality of ingredients, provide resources to aid in the promotion of healthier foods and overcome barriers to the sales of healthy foods (Azizan, Papadaki, Su, Jalaludin, Mohammadi, Dahlui, Nahar Azmi Mohamed & Majid, 2021). The most common barrier was identified as the misconception about the loss in income of providing healthy foods for sale (Faber, Laurie, Maduna, Magudulela & Muehlhoff, 2014; Naidoo, Coopoo, Lambert & Draper, 2009; Nortje *et al.*, 2017; Wiles *et al.*, 2013). This is supported by a later study indicating that tuck shops that were regulated by implemented policies set out by knowledgeable owners, under the guidance of their schools, offering products higher in nutritional quality, had to have led to positive attitudes, healthy eating behaviours, and healthier food choices among primary school children (Bekker *et al.*, 2017; Bevans, Sanchez, Teneralli & Forrest, 2011; Teo, Chin, Lim, Masrom & Shariff, 2021). The study suggested that these positive attitudes/choices among primary school learners were primarily due to exposure to these healthy products in the school environments from a younger age. These positive changes were said to be because primary school learners are still in the developmental stage of their food habits, behaviour, and attitudes (Bekker *et al.*, 2017; Belancová, 2015; Nortje *et al.*, 2017).

It is thus postulated that tuck shop owners can be empowered to create a healthier food environment for primary school children through addressing their current nutrition competencies. Nutrition competency refers to an individual's ability to adequately demonstrate multiple attributes in order to obtain, understand and interpret basic nutrition-related information in a way that will enhance overall health and wellbeing (Azizan *et al.*, 2021; Benn, 2014; Fisher, Erasmus & Viljoen, 2019; Krause, Sommerhalder, Beer-Borst & Abel, 2018; Lawlis, Coates, Clark, Charlton, Sinclair, Wood, Devine & Torres, 2019).

Nutrition competencies can be determined using the nutrition dimension section of a food literacy scale, which measures an individual's nutrition competencies in terms of their nutritional knowledge, skills, and behaviours. It can be used to indicate an individual's competencies in addressing health and wellbeing by incorporating questions regarding the selection, preparation and consumption of health-promoting foods and practices (Kadi & Mosa, 2017; Poelman, Dijkstra, Sponselee, Kamphuis, Battjes-Fries, Gillebaart & Seidell, 2018; Rosas, Pimenta, Leal & Schwarzer, 2020; Santos, Nogueira, Patarata & Mayan, 2008). This measurement tool is relatively new, and thus very little to no research has been performed making use of it in the context of the school food environment (Fisher *et al.*, 2019). Therefore, there is a need for further investigation whether nutrition competencies of tuck shop owners may be related to the nutritional quality of products sold in the school food environment.

1.2 Research problem statement

In low- to middle-income countries such as South Africa, the DBM has become an increasing challenge, with high prevalence of overweight and obesity among children (Adom, De Villiers, Puoane & Kengne, 2020; De Villiers, Steyn, Draper, Hill, Gwebushe, Lambert & Lombard, 2016; Desalew, Mandesh & Semahegn, 2017; Mamba, Napoles & Mwaka, 2019; Sedibe, Pisa, Feeley, Pedro, Kahn & Norris, 2018). Urbanisation and the nutrition transition has caused children to grow up in an obesogenic school food environment characterised by the availability of products that are high in saturated and trans fats, sugar, calorie, and salt content while simultaneously being low in micronutrients, proteins, fibre, fruits and vegetables content (Ganie & Peer, 2016; Trübswasser, Verstraeten, Salm, Holdsworth, Baye, Booth, Feskens, Gillespie & Talsma, 2021; Wrottesley *et al.*, 2019; Zambuko, 2018).

These school food environments are conducive to unhealthy eating habits among learners, thus leading to greater risk of overweight, obesity and NCD as adults (Desalew *et al.*, 2017; Indongo & Kazembe, 2018; Mamba *et al.*, 2019; Sedibe *et al.*, 2018). Children can be influenced to make healthier food choices through improving the nutritional quality of products sold in school tuck shops (Bekker *et al.*, 2017; Joseph, 2019; Nortje *et al.*, 2017; Wiles *et al.*, 2013). However previous, yet limited evidence suggests that nutrition competencies of tuck shop owners may influence the availability of healthy food and beverage products sold in school tuck shops (De Villiers *et al.*, 2016; Nguyen *et al.*, 2017; Nortje *et al.*, 2017; Payán, Sloane, Illum, Farris & Lewis, 2017; Shi, Grech & Allman-Farinelli, 2018; Teo *et al.*, 2021; Wethington, Finnie, Buchanan, Okasako-Schmucker, Mercer, Merlo, Wang, Pratt, Ochiai & Glanz, 2020; Wiles, Green & Veldman, 2011; Wrottesley *et al.*, 2019).

Furthermore, currently, there is no legislation in place that regulates the nutritional quality of products sold in South African primary school tuck shops, and consequently, decisions by tuck shop owners may be driven by popularity and profits (Erzse, Christofides, Stacey, Lebard, Foley & Hofman, 2021; Govender *et al.*, 2018; Kruger & De Villiers, 2011; Nortje *et al.*, 2017; Rooyakkers, 2015).

No known previous studies have been done to assess this relationship between food literacy of tuck shop owners and food and beverage items sold in tuck shops in South Africa. Understanding tuck shop owners' nutrition competencies in relation to the nutritional quality of products sold in tuck shops at primary schools could lead to an improved school food environment. In addition, exploring the formal nutrition training and implementation of regulatory policies could add insight into the nutritional behaviour of tuck shop owners. These could contribute to addressing the

challenges related to the DBM (Faber *et al.*, 2014; Mawela & van den Berg, 2018; Molotja, Maliwichi & Jideani, 2020; Nguyen *et al.*, 2017; Walsh, Dannhauser & Joubert, 2003; Wiles *et al.*, 2011; Wrottesley *et al.*, 2019).

1.3 Contribution of the study

Academic Contributions: Research on school tuck shops is limited, and most studies have primarily focused on food consumption by learners, rather than the functioning of the tuck shop and potential barriers to implementing health promotion initiatives, more so in low- to middle-income countries such as South Africa (Claasen, Van Der Hoeven & Covic, 2016a; Maccarrone-Eaglen & Schofield, 2018; Marraccini, Meltzer, Bourne & Elizabeth Draper, 2012; Wiles *et al.*, 2011). Therefore, this study aims to contribute to the body of knowledge regarding the nutritional quality of available products to purchase at tuck shops, as well as the nutrition competencies of the tuck shop owners. It may provide insight into tuck shop owners' current knowledge and food practices while potentially highlighting areas of concern or needing intervention (Pacific, Martin, Kulwa & Petrucka, 2020; Wiles *et al.*, 2011).

Societal Contributions: Research has shown that school-based interventions are the most effective and efficient way to promote lifelong healthy behaviours among children. Providing learners with a healthy school environment through the sales of healthier food and beverage products can thus influence learners to make healthier food choices (Naidoo *et al.*, 2009; Stupar *et al.*, 2012; Wiles *et al.*, 2011). This study is limited primarily to the school food environment and does not address children's nutrition knowledge, activity levels, nutrition knowledge of their families, or eating practices at home. Despite the limitations, role players can use this study to guide intervention strategies for their tuck shop owners to overcome barriers to healthy eating practices in the school food environment and address the societal concern of DMN and NCD among primary school children.

Political Contribution: The rising burden of chronic NCDs has implications for the demand for health care services, which places a heavy burden on the health care system (Indongo & Kazembe, 2018; Sheik *et al.*, 2016). More so now, due to individuals who have NDC being more at risk for the COVID-19 (World Health Organization, 2020). Therefore, this study could contribute to the development of school tuck shop policies and guidelines to be implemented to safeguard children from DBM. Therefore, addressing the consequent heavy burden on the South African health care systems by preventing the risks of increased NCDs of children in adulthood (Greenberg, 2017; Mohamed, 2016; Prentice, 2018).

1.4 Aim and objectives of the study

This research study aims to determine the relationship between the nutrition competency score of tuck shop owners and the nutritional quality of food and beverage products sold at quintile five public and private primary schools of the Third Region of Tshwane.

1.5 Objectives

Primary objectives:

At quintile five public and private primary schools in Third Region of Tshwane, assess and describe the:

1. Nutrition competency (as a dimension of food literacy) score of tuck shop owners in terms of nutritional knowledge, skills, and behaviour.

2. Nutritional quality (as measured by the SANPM nutrient profiling model and expressed as a percentage score) of food and beverage products sold at tuck shops.

3. Relationship between the nutrition competency score of tuck shop owners and nutritional quality percentage score of food and beverage products sold.

Secondary objective:

At quintile five public and private primary schools in the Third Region of Tshwane, explore the relationship between:

1. Nutrition-related training and the nutritional quality percentage score of food and beverage products sold at tuck shops
2. Nutrition policies at schools and the nutritional quality percentage score of food and beverage products sold at tuck shops

1.6 Conceptual framework

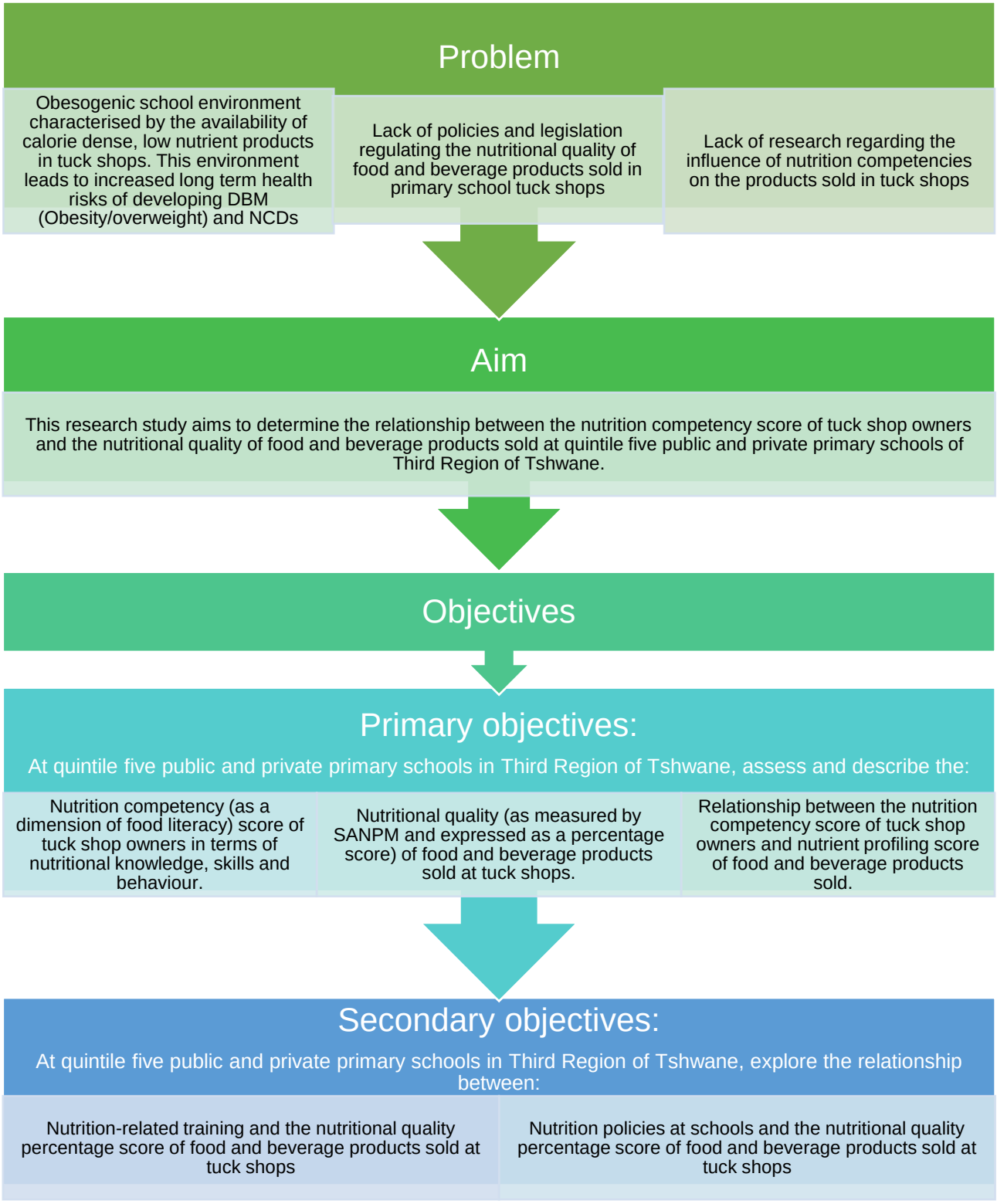

FIGURE 1: CONCEPTUAL FRAMEWORK

1.7 Outline of the report

Chapter 1: Provides the introduction and background, the problem statements, a justification for conducting the study, its aim and objectives, the conceptual framework, and an outline of the report.

Chapter 2: Provides an overview of essential concepts based on previous literature. School food environments, food literacy relating to nutrition dimension, nutrient value, the nutritional quality of foods sold, nutrition-related policies, and essential nutrients required for children will be conceptualised and discussed based on current literature available.

Chapter 3: Describes the research methodology used and covers the research design. The operationalisation of the main concepts of the study is described, as is the study area, the unit of analysis and the sample and sampling techniques. Measuring instruments, methods of data collection, and data analysis techniques. The code of ethics adhered to when doing this study, and the reliability and validity are detailed.

Chapter 4: Presents the results obtained from the research procedures.

Chapter 5: Presents, interprets, and discusses the results obtained from the research procedures followed.

Chapter 6: Conveys the significant conclusions drawn from the study and offers recommendations and suggestions for future studies.

1.8 Definition of terms

Tuck shop: A privately owned small business run from within the school premises that offer food and beverage products for sale to learners and staff before, during or after school (Nortje *et al.*, 2017; Wiles *et al.*, 2011).

Tuck shop owners: In the context of this study refers to an individual who privately owns and runs a tuck shop situated on the premises of a primary school characterised as high in socioeconomic standing (quintile five and private schools) (Nortje *et al.*, 2017).

Quintile five schools: Public schools that are the most economically advantaged and is categorised as higher in socioeconomic status, as determined by measures of average income, unemployment rates, and general literacy level in the school's geographical area (Department of Basic Education, 2004).

Private schools: Also called "independent schools" that are funded by school fees, parent governing bodies, and are privately governed. These schools are considered economically advantaged with a higher socioeconomic status (Department of Basic Education, 2004).

School food environment: Refers to all the spaces and infrastructures inside the school premises where learners can obtain food and beverages through buying or feeding schemes (O'Halloran, Eksteen, Gebremariam & Alston, 2020).

Eating habits: Are conscious, collective, and repetitive behaviours, which leads individuals to select, consume, and use certain food and beverage products, or diets in response to social and cultural influences (Rivera Medina, Briones Urbano, de Jesús Espinosa & Toledo López, 2020).

Nutrition Competency: In the context of this study relates to an individual's knowledge, skills and behaviours regarding the cooking method, health properties, identification of healthy food

	substitutes, essential nutrients, nutrition recommendations (SAFBDG), and whether unhealthy food contributes to obesity/overweight (O'Malley, 2019).
Nutrition competency score:	Represents an individual's nutrition competency in terms of their nutrition-related knowledge, skills, and behaviours, as measured by the nutrition dimension section of a food literacy measurement scale.
Nutrient profiling:	This is a transparent method of evaluating the healthfulness of foods by assessing the nutritional quality of foods/beverages according to their nutrient composition and energy content per 100g/ml (Drewnowski *et al.*, 2021; Poon *et al.*, 2018).
Nutritional quality:	This is a measure of a well-balanced ratio of the essential macro and micronutrients in food and beverage products concerning the nutrient requirements of the individual. It is the value of food and beverage products for individuals' physical health, growth and development. In this study it is measured using the DoHSA model (Drewnowski *et al.*, 2021; Fulgoni, Keast & Drewnowski, 2009; Nijman, Zijp, Sierksma, Roodenburg, Leenen, Van den Kerkhoff, Weststrate & Meijer, 2007).
Macronutrients:	Are carbohydrates, proteins (including essential amino acids), fats (including essential fatty acids), macro minerals, and water needed in larger amounts by the body (World Health Organization, 2021).
Micronutrients:	These are vitamins and minerals needed by the body in tiny amounts (World Health Organization, 2021).
Healthy foods:	In this study refers to foods and beverage products that are characterised as higher in nutritional quality reflected by a favourable nutrient profiling score (meeting the health/nutrition claims) by using the SANPM calculator on the DoH website (National Department of Health, 2020; Poon *et al.*, 2018).

Unhealthy foods: In this study refers to foods and beverage products that are characterised as lower in nutritional quality reflected by an unfavourable nutrient profiling score (not meeting health/nutrition claims) by using the SANPM calculator on the DoH website (National Department of Health, 2020; Poon *et al.*, 2018).

School policy: Are intervention strategies and guidelines set in place by the school, governing bodies or tuck shop owners themselves aimed at reducing the growing burden of chronic diseases associated with obesity and overnutrition, as well as nutritional disorders associated with poverty and undernutrition (Nguyen *et al.*, 2017; World Health Organization, 2006).

Products sold in tuck shops: In this study, products sold refers to food and beverage products available for purchase in the participants privately owned tuck shops at the point of visitation by the researcher (Kanter, Reyes, Vandevijvere, Swinburn & Corvalán, 2019).

1.9 Conclusion

This chapter provided a background to the study and outlined its content that discusses the implications of the nutrition transition, urbanisation, tuck shop owners' nutrition competencies and the DBM in South African primary schools. It includes a statement of the problem, the research objectives, the conceptual framework, research justification and sets the scope of the study. The next chapter discusses the relevant literature, which explores the school food environment, nutrition-related policies, nutrition competencies regarding food literacy and the nutrient profiling process.

CHAPTER 2

LITERATURE REVIEW

This chapter provides an overview of essential concepts based on previous literature. School food environments, food literacy relating to nutrition dimension, nutrient value, the nutritional quality of foods sold, nutrient profiling, nutrition-related policies, and essential nutrients required for children will be conceptualised and discussed based on current literature available.

2.1 School food environment

The food environment can be broadly defined as food stores, restaurants, schools, and worksites. The community food environment is food outlets in the community that consist of formal and informal vendors outside of the school's premises, whereby learners have access to various food and beverage products on their way to school. The school food environments are places that provide learners with food options such as vending machines, cafeterias, school lunches, and tuck shops. According to studies, children consume most of their nutrient intake during school hours (Bekker *et al.*, 2017; McKinnon, Reedy, Morrissette, Lytle & Yaroch, 2009). It was shown that, on average, primary school learners consume 40% to 50% of their meals at school (Micha, Karageorgou, Bakogianni, Trichia, Whitsel, Story, Peñalvo & Mozaffarian, 2018; O'Halloran *et al.*, 2020; Sanigorski, Bell, Kremer & Swinburn, 2005).

Due to urbanisation, nutrition transition, and the lack of primary school children's decision-making competencies, children are highly susceptible to adopting obesogenic behaviour in this environment (Wrottesley *et al.*, 2019). The school environment strongly influences children's eating habits due to the long hours and large amounts of kilojoules consumed during school hours. These influences are evident, as indicated in a 2010 study showing that, when primary school learners gained access to school tuck shops, they consumed more kilojoules-dense foods lacking quality nutrients (Long, Henderson & Schwartz, 2010; Ma & Wong, 2018). In addition, a 2019 systematic review of South African learners' eating habits found that the regular consumption of breakfast and packed lunch boxes had decreased with children purchasing more food items at school tuck shops (Wrottesley *et al.*, 2019).

Thus, the school food environments play a crucial role in shaping children's lifestyles and food habits. It is said to be the ideal venue for implementing health and nutrition type interventions. These interventions could help shape primary school children's nutrition-related perceptions and promote healthier eating habits and behaviours (Bekker *et al.*, 2017; Cetateanu, 2014; Micha *et al.*, 2018; Sanigorski *et al.*, 2005; Stupar *et al.*, 2012).

2.1.1 The importance of breakfast

According to various studies, breakfast is often viewed as the most important meal of the day. While research may show some inconsistencies in the evidence for the adult population, it does, however, provide favourable evidence among the youth (Giménez-Legarre, Flores-Barrantes, Miguel-Berges, Moreno & Santaliestra-Pasías, 2020). Various studies have acknowledged the value and benefits of eating a healthy morning breakfast among school-going children. They have also indicated the prominent role that breakfast plays in the maintenance of healthy diets and eating habits, which could lead to the promotion of optimal childhood growth and development (Dorothea, Meike, Romy, Tibor & Jürgen Michael, 2017; Godin, Patte & Leatherdale, 2018; Hochfeld, Graham, Patel, Moodley & Ross, 2016; Rampersaud, 2009). Regular breakfast consumption by children has been shown to reduce the risk of obesity/overweight and chronic diseases, improve and maintain cognition, and improve nutrient adequacy (Dorothea *et al.*, 2017; Giménez-Legarre *et al.*, 2020; Jerling, Botha & Tee, 2015; Tee, Botha & Jerling, 2015).

Despite these known potential benefits, the prevalence of breakfast skipping among primary school learners has increased in recent years. Research shows that many factors contribute to skipping breakfast meals, such as time restrictions, household food insecurity, and the lack of general cooking skills among parents/guardians (Godin *et al.*, 2018; Kupka, Siekmans & Beal, 2020). Skipping breakfast is not only detrimental to children's long term physical health but also encourages poor future eating habits. Research shows that lifestyle and behavioural habits picked up during childhood remain throughout adulthood (Dorothea *et al.*, 2017; Godin *et al.*, 2018; Jerling *et al.*, 2015). Other unfavourable and ill-health outcomes identified with skipping breakfast include decreased physiological and scholiastic achievements and higher risks of diabetes and obesity (Temple, Steyn, Myburgh & Nel, 2006a).

In overweight and obese children, skipping breakfast was correlated with higher blood glucose levels, triglycerides and incredibly low lipoprotein cholesterol (Dorothea *et al.*, 2017). Findings from a 2006 study shows that 15-20% of South African school children did not consume breakfast before school (Godin *et al.*, 2018; Jerling *et al.*, 2015; Rampersaud, 2009).

In comparison, findings from a later 2015 study showed a marginal increase of 13-36% of South African children who skipped breakfast daily (Jerling *et al.*, 2015).

For many South African children, especially those from low-income households, the school food environment may be the only venue that provides them with two of the three meals daily (Sanigorski *et al.*, 2005; Temple, Steyn, Myburgh & Nel, 2006b). These meals are generally provided by school tuck shops or the National School Nutrition Programme (NSNP), which provide around 30% of the daily recommended dietary allowance to learners attending quintiles 1-3 schools. For those learners who skip breakfast, it means that high fat, high sugary snacks that are consumed mid-morning at first break often forms part of their first meals of the day (Sedibe *et al.*, 2018). It is for this reason that tuck shop owners are heavily encouraged to prioritise the sales of healthier nutritious snack items in their school tuck shops (Department of Basic Education, 2008; Prioreschi, 2020).

2.1.2 Lunchboxes

Typically, school lunchboxes are broadly defined as food brought from home to be consumed by school learners during school lunch hours and after school prior to sporting events. In South African studies done, these lunchboxes were generally found to contain foods that are low nutritional in value, namely: hotdogs, white bread sandwiches, sweets, chocolates, fizzy drinks, crisps, biscuits, and cakes (Abrahams, De Villiers, Steyn, Fourie, Dalais, Hill, Draper & Lambert, 2011; Hlambelo, 2013; O'Halloran, Eksteen, Polayya, Ropertz & Senekal, 2021; Sanigorski *et al.*, 2005).

A 2017 study done in Bloemfontein, South Africa, found that 60-80% of learners brought lunchboxes to school; however, only 24% of children attending poorly resourced schools brought lunch to school (Bekker *et al.*, 2017; Shisana, 2013). Unfortunately, of the learners who did bring lunches to school, very few of them reported having a variety of fresh fruits or vegetables in their lunchboxes (Bekker *et al.*, 2017). A later 2020 study conducted across schools in the Eastern Cape found that only 12% of learners had brought a lunch box to school, while 71% of learners reported bringing money to school to spend it at the school tuck shop (Okeyo, Seekoe, de Villiers, Faber, Nel & Steyn, 2020). Furthermore, other various studies done across various schools in South Africa found that around 51% of children took money to school, instead of lunch, intending to purchase food items from the school's tuck shop as their lunchtime meal choice (Faber *et al.*, 2019; Faber *et al.*, 2014; Okeyo *et al.*, 2020; Sedibe *et al.*, 2018; Shisana, 2013; Wiles *et al.*, 2011).

2.1.3 School feeding programs

The National Norms and Standards for School Funding (NNSSF) is a program that has been created in hopes of improving equity in the funding of education by ranking each school into one of five quintiles. The quintile ranking is thus based on the unemployment and literacy rate of the community in which the schools are situated. A Quintile 1 ranking indicates a poor/impoverished school, while Quintile 5 indicates a wealthy/affluent school. The NNSSF believe that schools in lower quintiles (1 and 2) should receive more state funding than those in higher quintiles. The implementation of quintile schools has not been as effective as initially predicted, as funds have not been equally distributed to the quintiles, according to the poverty scores of said school. However, some schools are classified as non-poor schools (quintiles 4 and 5) with learners from poor areas. Thus, this targeting approach excludes them from the benefits of the program. These scores are retrieved using weighted household data on the income dependency ratios (unemployment rate) and level of education within the specific community (literacy rate) (Department of Basic Education, 2008; Faber *et al.*, 2014; Nguyen *et al.*, 2017; Qila & Tyilo, 2014; Roux, 2013; White & van Dyk, 2019).

Working closely with the NNSSF, the National School Nutrition Program (NSNP) was created to provide school learners in lower quintiles access to healthy school lunches and education. The program covers all primary school learners' grades one to seven of quintiles 1-3. Although many children have greatly benefitted from this program, numerous studies have identified an array of weaknesses such as irregular distribution, expired food products, poor quality foods and beverages, lack of variety, food being stolen by caretakers or teachers, corruption by government officials and lack of sufficient monitoring (Department of Basic Education, 2008; Faber *et al.*, 2014; Nguyen *et al.*, 2017; Qila & Tyilo, 2014). In a 2014 study, it was found that food provided to learners by the NSNP lacked fruits and vegetables, was low in nutrient content and did not supply children with their daily nutritional needs (Faber *et al.*, 2014).

2.1.4 Differences in school quintile food environments

Literature indicates that while there is a difference in the amount of funding different ranked schools received from the government, little to no differences were found in how school tuck shops operate. According to research done in Cape Town primary school tuck shops, no apparent connection between the economic status of the school and the number of healthy items sold could be found. It was further found that across the board, all schools, including private school tuck shops, sold items that they believed best suited to fit primary school learners' needs (Adom *et al.*, 2020; Erzse *et al.*, 2021; Maccarrone-Eaglen & Schofield, 2018; Temple *et al.*, 2006a).

It can thus be assumed that regardless of the quintile ranking, all school tuck shops would sell similar type products, i.e., affordable, high in sugar, saturated fat and sodium and energy-dense type products. It was noted in this study that the larger a tuck shop facility was, the larger the variety offered; however, this was not strictly linked to school socioeconomic statuses (Adom *et al.*, 2020; Maccarrone-Eaglen & Schofield, 2018; Marraccini, 2011; Payán *et al.*, 2017).

Regardless of the tuck shop size, it was found that most tuck shops were profit-driven. Thus, the tuck shop owners would sell products they knew would be appealing to the learners, as it served as their primary source of income. One of the most significant differences noted between the quintile and private schools was that higher socioeconomic schools/tuck shop owners were more open-minded about implementing healthier tuck shop policies to contribute to an overall healthier school food environment.

They also wanted to play a more active role in brainstorming ideas for healthier change, moving away from pre-packaged foods and sweets and more towards healthier homemade meals (Maccarrone-Eaglen & Schofield, 2018; Marraccini, 2011; Ngqangashe, 2019; Payán *et al.*, 2017).

2.1.5 School tuck shops

School tuck shops are usually profit-driven small businesses run from within school grounds. They generally offer food products for sale to children and teaching staff (Bertrand, 2019; Letlape, Mokwena & Oguntibeju, 2010). It is found that most tuck shops in South Africa provide foods that are high in kilojoules, saturated fats, sugar, salt, and low in vitamin, mineral, and dietary fibre content (Bekker *et al.*, 2017; Scott, Schaay, Schneider & Sanders, 2017; Sedibe *et al.*, 2018). These types of items sold in school tuck shops have become the main factor in many interventions as these meals and snacks consumed by the learners during and after school hours provide them with a large percentage of their nutrient intakes for the day (Bekker *et al.*, 2017; Wrottesley *et al.*, 2019).

In this study, school tuck shops refer to on-site tuck shops where children can voluntarily purchase food items of their choice with money provided by parents/caregivers. Tuck shop owners make these food items available at a reasonable price and offer essential meal solutions to primary school children of different socioeconomic groups. Tuck shops in South Africa can either be controlled by schools or privately owned. In schools that do not have a tuck shop on-premises, learners rely on outside, informal, venders, and school feeding programs to provide them with food options. These informal vendors are usually members of the community that sell food items to learners before, after and during school lunch break hours (Faber *et al.*, 2019; Ma & Wong, 2018; Nortje *et al.*, 2017).

Primary school children are still young and very impressionable. They do not yet have the level of nutrition knowledge required to make informed decisions about their diets and wellbeing. Compared to the previous generation, children are faced with purchasing decisions and various choices involving portion size and quality of foods to purchase and consume from a younger age. Many of these decisions and purchases take place without guardian/parental supervision. As a result, these learners are more inclined to make unhealthier food choices due to the absence of a guardian/parental figure. Consequently, learners are put at greater risk for nutrient deficiencies, overweight/obese, developing NCDs later on in life and developing poor eating habits and preferences (Chen & Yang, 2014; Hawkes *et al.*, 2017; Ma & Wong, 2018; Nortje *et al.*, 2017; Prioreschi, 2020; Wiles *et al.*, 2013; Wiles *et al.*, 2011). A 2018 study further emphasises this as it highlighted the importance of not only the quality and frequency of food items sold in tuck shops, but also the portion sizes, as these play significant roles in the creation of an obesogenic school food environment (Govender *et al.*, 2018).

Lunch breaks are the only time during school hours provided to children to purchase and consume meals (Nortje *et al.*, 2017; Rideout, Levy-Milne, Martin & Ostry, 2007). As children want to use their allocated break times to not only eat and socialise with friends but also to participate in physical activities, therefore, they tend to prefer foods that are convenient and easy to eat on the go (Sharma, Moon, Bailey-Davis & Conklin, 2017). Children also have been found to behave in response to the environment. Thus, they will prefer to purchase unhealthy foods and snacks with a low nutrient profile (unhealthy), as that may be the only option available to purchase, thus preventing them from making healthier food choices (Abrahams *et al.*, 2011; Chen & Yang, 2014).

Findings from two different provinces in South Africa that sampled primary school learners attending different socioeconomic schools indicated that 72.9% of the learners purchased food from the school food environment (Govender *et al.*, 2018; Holdsworth & Landais, 2019). Learners who did not bring packed lunch from home would either not eat anything during the school day or buy food from school tuck shops (Abrahams *et al.*, 2011; Gresse, Nomvete & Walter, 2017).

In another study, 80.1% of learners from primary and secondary schools in South Africa reported purchasing food from the school tuck shop at least once a week (Ma, Blake, Barnes, Bell & Liese, 2018; Marraccini *et al.*, 2012). The most frequent products purchased in South African school tuck shops was potato chips, pies, cakes (muffins, doughnuts, and biscuits), chocolates, sausage rolls, and soft drinks. These popularly purchased food items are low in nutritional quality and high in kilojoules, sugar, fat, and salt, and promote an obesogenic environment (Claasen *et al.*, 2016a; Naidoo *et al.*, 2009; Payán *et al.*, 2017; Siobhan, Eksteen, Gebremariam & Alston, 2020; Stupar *et al.*, 2012; Tempels, Blok & Verweij, 2020; Tydeman-Edwards *et al.*, 2018; Wrottesley *et al.*,

2019). Furthermore, it was reported that those learners who participated in the study typically ate fruits and vegetables less than three times per week. In addition to the lack of nutrient-dense food intake, it was observed that 40% of the learners were also getting little to no physical activity each week (Govender *et al.*, 2018; Joseph, 2019; Naidoo *et al.*, 2009).

In a 2006 study done in primary schools in Limpopo, it was found that an average of R8.70 was spent daily at tuck shops. Girls were found to be the most inclined within the demographic to purchase food items at the school's tuck shop. They were also found to be the most likely not to bring food to school either, as 75.3% indicated that they had not brought food to school and hence planned to purchase their lunch at the school tuck shops (Temple *et al.*, 2006a; Wiles *et al.*, 2011).

In a later 2013 study, it was found that there was no increase in the amount spent at tuck shops, as leaners still spent an average of R8.38 daily. This study found that a minimum amount of R1 and a maximum amount of R40 was spent. Learners who had made frequent purchases at the school tuck shop was found to have spent on average R1 more than those who were not frequent buyers (Bekker *et al.*, 2017; Wiles *et al.*, 2013).

Two other South African tuck shop studies indicated that 85% of Johannesburg and 69% of Cape town school learners shopped at the school tuck shops daily (Bekker *et al.*, 2017; Wiles *et al.*, 2013). Learners indicated that they would spend around R6 and R10 at nutritionally regulated tuck shops, while R11-R20 would be spent at a conventional tuck shop. It was found that the mean average spent at school tuck shops is R7 at first breaks and R9 at second breaks. The learners who frequently purchased tuck shop items for lunch would spend slightly more money on Fridays and be given a maximum amount of R20 to spend by their parents daily (Bekker *et al.*, 2017; Wiles *et al.*, 2013; Wiles *et al.*, 2011). Finally, a recent 2020 study in the Eastern Cape reported that 71% of the learners brought money to school, whereby the amount varied between R1 to R30. The average amount spent daily at school tuck shops was reported to be R6.38 (Okeyo *et al.*, 2020). Compared to other counties, a study was done across the various middle to high-income areas in New Zealand, whereby school learners were observed to demonstrate similar purchasing habits as those from South African schools. Approximately 95% of New Zealand learners reported that they purchased food regularly from the school tuck shops (Bi-hussein, Blair, Henderson, Jackson, Lawn, Stachyshyn, Sycamore, Whitford & Williams, 2017; Neely, Walton & Stephens, 2016). It was reported that the reason for the sale of unhealthy food products was due to the high demand and sales volume for it. Tuck shop owners reported feeling reluctant to stock healthier foods or adopt healthier food policies, as children may not buy healthier foods. They also believed selling healthier foods would be more expensive to stock, as they believe healthy food may not sell and will need to be thrown away, resulting in greater losses (Azizan *et al.*, 2021; Bekker *et al.*,

2017; Naidoo *et al.*, 2009; Wiles *et al.*, 2013). In addition, tuck shop owners fear that they may fail to make a sufficient profit. This is especially a problem in lower-income communities, as this small business may be their only source of income for their households (Bekker *et al.*, 2017; Nortje *et al.*, 2017; Wrottesley *et al.*, 2019).

However, this may not be the case, as studies have shown that school tuck shops that have introduced nutritional changes had no negative financial implications (Naidoo *et al.*, 2009). Furthermore, they reported that learners continued to purchase food and beverage products as usual at the school tuck shops even after their original choices were unavailable (Azizan *et al.*, 2021; Bekker *et al.*, 2017; Naidoo *et al.*, 2009; Wiles *et al.*, 2013). Tuck shop owners are encouraged to improve their nutrition knowledge. It was found that having a better knowledge and understanding of children's nutrition's and relevant policies regarding improved nutritional needs, facilitated healthy dietary behaviours and improved food choices (Department of Basic Education, 2008; Marraccini *et al.*, 2012; Ronto, Ball, Pendergast & Harris, 2016a; Vidgen & Gallegos, 2011). It thereby also aided in the increased availability of healthy food products that were appealing to children (Department of Basic Education, 2008; Marraccini *et al.*, 2012; Ronto *et al.*, 2016a; Vidgen & Gallegos, 2011).

Furthermore, the DoH and Basic Education encourage tuck shops to familiarise themselves with and implement the SAFBDG as well as the NSNP to aid in guiding their decisions based on the type of foods to be made available in tuck shops (Bekker *et al.*, 2017; Department of Basic Education, 2008; Marraccini *et al.*, 2012; Ronto *et al.*, 2016a; Vidgen & Gallegos, 2011).

2.1.6 Factors influencing school food environment

According to research, school learners are easily influenced to desire to purchase/consume certain products by marketing, availably, and affordability (Chen & Yang, 2014; Hawkes *et al.*, 2017; Ma & Wong, 2018; Nortje *et al.*, 2017; Wiles *et al.*, 2013). Understanding the various factors that influence children's eating behaviours are imperative in promoting good health and preventing increased risks of DBM and NCDs (Wiles *et al.*, 2013). School tuck shop's environment can be defined by the following: availability, accessibility, affordability, accommodation, and acceptability (Caspi, Sorensen, Subramanian & Kawachi, 2012; Pitt, Gallegos, Comans, Cameron & Thornton, 2017).

2.1.6.1 Availability

Availability in a food environment is commonly defined as the adequacy of a healthy food supply, i.e., the number and type of places and foods to buy (Caspi *et al.*, 2012; Pitt *et al.*, 2017). This refers both to the availability of shops and products within a given setting (Carducci, Oh, Keats,

Gaffey, Roth & Bhutta, 2018). Currently, foods available in South African tuck shops have poor nutritional quality and are energy-dense, high in fat and sugars, thus tempting learners to make unhealthy purchases.

The availability of these unhealthy food products could result in an increased intake of energy which could then result in learners becoming overweight or obese, thus promoting an obesogenic environment in school (Morshed *et al.*, 2016; Wiles *et al.*, 2013; Wrottesley *et al.*, 2019).

According to the Department of Basic Education's tuck shop guidelines, tuck shop owners should be efficient at providing a variety of healthy snacks throughout the entire school day to provide children with adequate time to make healthier purchases. They also encourage the tuck shop to be run by the owners themselves and control the accessibility and quality of snacks available by example, only allowing a maximum of two food providers per school (Department of Basic Education, 2008).

2.1.6.2 Accessibility

Accessibility may refer to the geographic location of the food supply as well as the ease of getting to that location (Carducci *et al.*, 2018; Caspi *et al.*, 2012; Valdez, Ramirez, Estrada, Grassi & Nathan, 2016). School tuck shops provide easy access to unhealthy food with low nutritional quality. Studies show that children's food choices, purchases, and behaviour are driven by the availability and accessibility of foods (Bruening, Eisenberg, MacLehose, Nanney, Story & Neumark-Sztainer, 2012).

In a 2018 study, learners were asked if they would purchase and consume healthier food products if the school provided better accessibility and availability of these products. It was found that 81% of school learners responded favourably, saying they would purchase healthier food products had they been made available and accessible in school tuck shops (Bekker *et al.*, 2017; Ma & Wong, 2018). It can thus be said that tuck shops that regulate the accessibility and availability of different types of foods and beverages may help limit the access to unhealthy foods during school hours (Bekker *et al.*, 2017; Carducci *et al.*, 2018; Ma & Wong, 2018).

Thus, school tuck shops' availability and accessibility of unhealthy foods play a supporting role in creating obesogenic behaviour (Chen & Yang, 2014; Morshed *et al.*, 2016; Wrottesley *et al.*, 2019). Better availability and accessibility to healthier nutrient-dense foods and beverages would allow children to make healthier food choices, improve diet and eating practices, increase academic productivity and reduce the risk of overweight/obesity and NCD (Amin, Panzarella, Lehnerd, Cash, Economos & Sacheck, 2018a; Carducci *et al.*, 2018; Ma & Wong, 2018).

2.1.6.3 Affordability

Affordability refers to the cost of food as well as the perceived worth relative to the price (Carducci *et al.*, 2018; Caspi *et al.*, 2012). Affordability has been reported as the second most crucial factor regarding food choices among children. The South African Department of Basic Education has set appropriate cost guidelines for tuck shop owners to use to ensure that the food provided is priced reasonably (Department of Basic Education, 2008; Marraccini *et al.*, 2012).

Tuck shop owners are also to be informed about the labelling of food products and these pricing policies. However, these guidelines are not strictly enforced; thus, tuck shop owners may not even be aware of them (Department of Basic Education, 2008; Marraccini *et al.*, 2012).

2.1.6.4 Acceptability

Acceptability refers to the individual's attitudes about various attributes of their food environments and whether or not the foods meet their personal standards (Caspi *et al.*, 2012; Ma & Wong, 2018; Naidoo *et al.*, 2009). Chen and Yang (2014) found that food available in the food environment influences primary school children's food choices, attitudes, and behaviours. Learners are susceptible to impulsive food behaviours and demonstrate little to no self-control when it comes to the consumption of available unhealthy foods. Studies have also shown that should both healthy and unhealthy foods be available; children will most likely choose the unhealthier options (Amin *et al.*, 2018a; Begley, Paynter & Dhaliwal, 2018; Chen & Yang, 2014; Wiles *et al.*, 2013; Yuen, Thomson & Gardiner, 2018).

2.1.6.5 Accommodation

Accommodation refers to the ability of the food supplier to adapt to the needs of the consumer. Factors of accommodation are the store's trading hours and payment options (Caspi *et al.*, 2012). School tuck shops should have the opportunity to provide their services within set opening times. School tuck shops are encouraged to provide an adequate amount of time to allow learners to purchase and consume products; this includes children's staying in aftercare (Department of Basic Education, 2008; Ma & Wong, 2018; Marraccini *et al.*, 2012; Morshed *et al.*, 2016; Sharma *et al.*, 2017).

The South African Department of Basic Education has developed guidelines for tuck shop owners to improve the school food environment. These guidelines were developed to promote the availability of healthy food alternatives to school learners. They also recommend that tuck shops make use of the available nutrient profiling tool in combination with food prices in order to provide learners with foods and beverages that are affordable and healthy (Adiele, Morgan & Carolyne,

2018; Department of Basic Education, 2008; Faber *et al.*, 2019; Wicks, Wright & Wentzel-Viljoen, 2020).

2.1.7 COVID-19 and children's nutrition status

The COVID-19 virus is from part of the Coronaviruses that are enveloped RNA viruses distributed broadly among humans, other mammals, and birds. These viruses cause respiratory, enteric, hepatic, and neurologic diseases (Cucinotta & Vanelli, 2020; Zar, Dawa, Fischer & Castro-Rodriguez, 2020; Zhu, Zhang, Wang, Li, Yang, Song, Zhao, Huang, Shi & Lu, 2020).

In February 2020, the WHO declared the COVID-19 virus a pandemic, and various precautions and measures were taken to limit the spread of the virus (Marivate & Combrink, 2020). The pandemic has caused significant morbidity and mortality, straining health care systems economies and closing school districts (Rundle, Park, Herbstman, Kinsey & Wang, 2020).

The closure of schools during this time has caused challenges for learners relating to food and physical activity. Due to the spread of the virus, food insecurity has increased, which has been linked to an increased risk of the DBM (Prioreschi, 2020; Van Lancker & Parolin, 2020). Studies done in 2020 have highlighted that due to the increase in food insecurity, children are now at a higher risk of becoming overweight or obese due to households stocking up on ultra-processed foods, such as calorie-dense comfort foods (Prioreschi, 2020). This was evident in the beginning months of the virus outbreak as many supermarkets reported that consumers emptied the shelves of items such as noodles, chips, soda, cereals, sweets, and ready prepared meals. In addition, social distancing has reduced opportunities for physical activities, especially among those living in small apartments or large households (Kinsey, Kinsey & Rundle, 2020; Knebusch, Williams, Yordi Aguirre, Weber, Rakovac & Breda, 2021; Rundle *et al.*, 2020).

At the other end of the spectrum, the closure of schools caused by the virus has severed learners from critical education and health resources. The closure of schools has significantly impacted children living in poverty, as they relied on school food environments for their daily nutritional needs (Joob & Wiwanitkit, 2020; Masonbrink & Hurley, 2020; Pérez-Escamilla, Cunningham & Moran, 2020; Van Lancker & Parolin, 2020). It was estimated that more than 368 million learners worldwide are currently missing out on school meals which could have detrimental consequences on their health and nutrition (Dunn, Kenney, Fleischhacker & Bleich, 2020; Pérez-Escamilla *et al.*, 2020; Van Lancker & Parolin, 2020). In South Africa, it was estimated that nine million school children from both primary and secondary schools did not have access to the daily meals provided by the NSNP while schools were closed (Prioreschi, 2020). The COVID-19 virus has made accessibility and availability of food more challenging for many worldwide.

It has disrupted the movement of farmworkers, causing a greater shortage of availability and accessibility to staple foods and fresh produce (Pérez-Escamilla *et al.*, 2020; Zar *et al.*, 2020). The school closures have also affected the tuck shop owner operating within schools as they have now lost their source of income during the crisis, especially at schools in lower socioeconomic areas. Due to the pandemic, many school tuck shops may be forced to close indefinitely due to schools adopting a more online base learning and fear of the increased spread of the virus (Khambule, 2020; Kruger, Legodi, Tsolekileiii, Browneiv & van Rensburg, 2020; Pérez-Escamilla *et al.*, 2020).

In addition, further losses are predicted to be made with regards to school tuck shops as many families' breadwinners have lost their jobs or experienced pay cuts, which may cause them to be less inclined to provide their children with money to spend at the tuck shops once schools completely reopen (Chitimira & Hamadziripi, 2021; Dunn *et al.*, 2020; Pérez-Escamilla *et al.*, 2020; Prioreschi, 2020; Van der Berg, Zuze & Bridgman, 2020).

2.1.8 Barriers to the sales of healthy food and beverages

School tuck shops are generally viewed as profit-driven small businesses and are said to make the majority of their income by selling unhealthy items high in energy, saturated fats, sugars, and salts. These food and beverage products are usually characterised by their low protein, vitamins, minerals and dietary fibre content (Bekker *et al.*, 2017; Hawkes, Ruel, Salm, Sinclair & Branca, 2020; Naidoo *et al.*, 2009; Neumark-Sztainer, French, Hannan, Story & Fulkerson, 2005). Due to various barriers, tuck shop owners are somewhat reluctant to sell healthier food options to the school learners. The barriers to selling more healthier food options included perishability of fresh produce, children's preferences for unhealthier foods, fear of losing income, and higher cost of stocking healthier food items (Bekker *et al.*, 2017; Buru, Emeto, Malau-Aduli & Malau-Aduli, 2021; Claasen *et al.*, 2016a; Faber *et al.*, 2014; Naidoo *et al.*, 2009; Nortje *et al.*, 2017; Teo *et al.*, 2021; Wiles *et al.*, 2013).

Healthier food options that are nutrient-dense and low in sodium, saturated fats and sugars are perceived by tuck shop owners as less profitable, unpopular items. The owners often view healthier options such as salad rolls, salads, or home-cooked meals as more tedious to prepare and make available than unhealthy ready-packaged processed foods such as pies, burgers, and fries due to the lack of proper storage, space, time and skills required (Bekker *et al.*, 2017; Neumark-Sztainer *et al.*, 2005; O'Halloran *et al.*, 2021). In addition to the lack of time, tuck shop owners are also wary of the additional costs involved when providing fresh fruits and vegetables due to the high perishability and storage costs (Bekker *et al.*, 2017; Kim, Budd, Batorsky, Krubiner,

Manchikanti, Waldrop, Trude & Gittelsohn, 2017; Neumark-Sztainer *et al.*, 2005; O'Halloran *et al.*, 2021).

Although it is not only the availability of these food products that contribute to the encouragement of poor eating habits among learners but also the behaviours of parents/guardians, as many parents view school tuck shops as an opportunity to treat their children (Buru *et al.*, 2021; Govender *et al.*, 2018; Hawkes *et al.*, 2020; Wiles *et al.*, 2011).

Over 80% of primary schools that participated in a 2011 study in Pietermaritzburg had not implemented a monetary restriction at the tuck shops. Tuck shop owners reported that 63.6% of learners would purchase more than one item from the school tuck shop daily. Most learners that purchased more than one item would purchase a combination of snacks and carbonated drinks. The lack of monetary restrictions thus gave learners full rein to spend large sums of money on various unhealthy food and beverage products (Wiles *et al.*, 2011).

Many school tuck shop owners are reluctant to implement monetary restrictions due to the fear of losing profit. A 2020 systematic review of primary school tuck shops worldwide found that many tuck shop owners were somewhat despondent when schools implemented policies only allowing the sales of sweets on certain days. They had perceived the restriction as a major limitation to their business and feared the loss of profit (Bertrand, 2019; O'Halloran *et al.*, 2020; Wiles *et al.*, 2011). Another barrier identified was the lack of available facilities to be used to offer children healthier food options and the lack of heating facilities available for learners to make use of, e.g., microwave ovens (Marraccini *et al.*, 2012; O'Halloran *et al.*, 2021; Wiles *et al.*, 2011).

Most tuck shop owners also perceived the sales of healthier food options as more costly, as even purchasing something like fruit-based beverages were reported to have cost them more than regular carbonated drinks. They also reported that learners often opted to buy the cheaper options made available and would be reluctant to spend more money on the healthier food option as they prioritised quantity of total food items bought over quality (Bertrand, 2019; Govender *et al.*, 2018; Marraccini *et al.*, 2012; Wiles *et al.*, 2011).

Currently, no legislation in South Africa specifies what food and beverage products can and cannot be sold in primary school tuck shops. This is specifically a problem for children who have access to both school tuck shops and the surrounding vendors, as controlling food sales by vendors proves as another challenge and barrier to the promotion of healthier eating habits among learners (Govender *et al.*, 2018).

Although learners purchased mostly unhealthy food items at tuck shops, a majority of them indicated wanting a healthier balanced diet and access to a balance of both healthy and unhealthy foods in school tuck shops (Bekker *et al.*, 2017; Faber *et al.*, 2014).

In a study done, the following reasons behind the food items chosen for purchase by primary school learners were identified, 60,3% said they bought their favourite foods, 57.8% said the food chosen made them feel healthy, 56.5% indicated that the food items bought at tuck shops were forbidden at home, and 54% said that their friends influenced the purchases they made (Adiele *et al.*, 2018).

A 2021 systematic review of literature relating to school nutrition policies implementation of schools worldwide indicated the benefits of implementing policies that restrict the sale of fast foods/ultra-high processed foods near and in schools (World Health Organization, 2021). A study conducted in 2019 at various primary schools across South Australia found that the regulation of nutrition in and around school leads to positive eating habits among learners. The lack of unhealthy foods available discouraged them from purchasing and consuming unhealthy foods. Similar studies among primary school learners in New Zealand and California showed similar results, although initial acceptability and adoption of these policies were low. Furthermore, in Norway, a 2015 study evaluating the effects of providing primary school learners with complimentary fruits and vegetables found that the overall consumption of fruits and vegetables increased while unhealthy products decreased. Similar results were observed in a Dutch study among primary school learners across the Netherland, whereby the consumption of unhealthy products decreased while fruits and vegetables increased due to the schools' free daily fruits and vegetables. The systematic review concluded that healthier food policies were more widely accepted among learners from primary schools compared to secondary schools and that policies should be implemented gradually as they were more readily accepted by learners if implemented slowly (Bere, te Velde, Småstuen, Twisk & Klepp, 2015; Bere, Veierød & Klepp, 2005; Farrell, Moore, Warin & Street, 2019; Goh, Bogart, Sipple-Asher, Uyeda, Hawes-Dawson, Olarita-Dhungana, Ryan & Schuster, 2009; Stok, de Ridder, de Vet, Nureeva, Luszczynska, Wardle, Gaspar & de Wit, 2016; Street, Sisnowski, Tooher, Farrell & Braunack-Mayer, 2017; Tak, Te Velde & Brug, 2007; World Health Organization, 2021)

In a 2009 study done at primary schools that introduced gradual nutritional changes in their schools' tuck shops in KwaZulu-Natal, it was found that there were no negative financial implications to tuck shop owners' profits. Researchers also noted that the school learners continued to buy the food and beverage options available despite their original choices being unavailable.

According to reports, these alternatives appeared to be gladly accepted by learners; however, it should be noted that, similar to international studies, learners were slow to adopt the new changes. The interventions success was largely due to the gradual intervention efforts whereby tuckshops gradually increasing the availability of healthy products while reducing unhealthy products until the whole tuck shop consisted of majority healthy products and minimal unhealthy products (Naidoo *et al.*, 2009; Payán *et al.*, 2017; Stok *et al.*, 2016).

The school food environment is dynamic and opportunistic, in constant flux, posting various challenges in estimating food availability, accessibility, and affordability (Carducci *et al.*, 2018). Learners dietary patterns, preferences, and habits have been negatively impacted by the economic climate of food, as convenience foods are made to be more inexpensive as compared to healthier food options (Carducci *et al.*, 2018). Schools are thus encouraged to implement restrictions with regard to the total sum of money a learner spends during a single visit to the tuck shop. Furthermore, they are also urged to restrict the number of unhealthy items available for sale (Wiles *et al.*, 2011).

2.1.9 Food and nutrition policies in the school food environment

According to the South African Department of Basic Education (2008), tuck shops in schools may be leased out and run by private owners upon submitting a successful application. Tuck shop owners will have to adhere to the stipulated rules and conditions in their leasing agreement (Department of Basic Education, 2008; Marraccini *et al.*, 2012).

South Africa has an NSNP with guidelines introduced in 2014 that every tuck shop owner is encouraged to follow. According to these national guidelines set up by the DoH and Basic Education, every tuck shop operator must sign a service agreement with the school; have a copy of the SAFBDG; encouraged to sell healthy foods and beverages such as fruit, roasted nuts; only sell drinks such as milk, 100% fruit juice, and water; and fried, processed food items should be avoided. The SAFBDG was introduced in South Africa in 2003 and then later revised in 2012. This guideline manual also includes good tuck shop practices, as well as guidelines to best products to sell (Devereux, Hochfeld, Karriem, Mensah, Morahanye, Msimango, Mukubonda, Naicker, Nkomo & Sanders, 2018; Pandor, 2004). Currently, in South Africa, there is no legislation in place to stipulate which food and beverage items can and cannot be sold to learners (Govender *et al.*, 2018). These guidelines do not form part of the leasing agreement. This may be problematic in the sense of controlling the nutritional quality of snacks being made available and sold, which was evident in a 2017 study done in KwaZulu-Natal (Department of Basic Education, 2008; Kadi & Mosa, 2017; Marraccini *et al.*, 2012).

Studies have shown that school tuck shops continue to provide food items low in nutritional quality despite guidelines provided by the DoH and Basic Education (Faber *et al.*, 2014; Nortje *et al.*, 2017; Wiles *et al.*, 2011).

The Department of Basic Education encourages school tuck shop owners to keep a database of all foods and beverages sold on the school premises as well as to hold meetings whereby the different nutritional values of items being sold can be discussed. Other guideline-recommended to tuck shops was to sell soup during winter months, provide 100% unsweetened fruit juices, sell fresh fruits and vegetables, and limit the sales of processed snacks (Department of Basic Education, 2008).

They have also strongly recommended that tuck shop owners pay careful attention to the Glycaemic index (GI), food additives and further encourage them to sell products that do not contain high amounts of salts, sugar, colourants, or preservatives as these types of snacks may lead to hypertension, cardiovascular diseases, and kidney diseases later on in life. In addition, it may also cause learners to be hyperactive and lead to a lack of concentration in classrooms (Almoraie, Saqaan, Alharthi, Alamoudi, Badh & Shatwan, 2021; Department of Basic Education, 2008; Weihrauch-Blüher & Wiegand, 2018).

External stakeholders also provide many primary schools assistance in making and implementing healthier tuck shop policies and interventions. Some of these programs include the South Africa Heart and Stroke Foundation's tuck shop intervention program, Heath kick, Making the Difference Educational Programme, Woolworths Healthy Tuck Shop Guide, Vitality schools' program, and healthy tuck shop guidelines from Discovery Health. These programmes recognise tuck shops as a barrier to encouraging a healthy lifestyle and thus aim to aid them in providing a healthier school food environment (Kim, Hong, Yun, Ryou, Lee & Kim, 2012b; Marraccini *et al.*, 2012; Nortje *et al.*, 2017). School-based programs constitute the best setting to promote healthy eating habits and physical activity strategies as children spend most of their time at school and consume at least one meal and several snacks at school daily (Claasen *et al.*, 2016a; Katsagoni, Apostolou, Georgoulis, Psarra, Bathrellou, Filippou, Panagiotakos, Sidossis, Health & Sciences, 2019; Mamba *et al.*, 2019).

2.2 Food literacy

Food literacy is a multidimensional notion that encompasses everything involving food-related knowledge, skills, and behaviours. It has also been described as the everyday life of an individual associated with navigating the various food environments as well as ensuring regular food consumption, consistent with nutrition recommendations (Amin *et al.*, 2018a; Ronto, Ball, Pendergast & Harris, 2017; Vidgen & Gallegos, 2014). Food literacy highlights the interconnectivity between food, health and the environment while simultaneously creating a better understanding of food, nutritional requirements and cooking skills (Perry, Thomas, Samra, Edmonstone, Davidson, Faulkner, Petermann, Manafò & Kirkpatrick, 2017; Ronto, Ball, Pendergast & Harris, 2016b; Truman, Lane & Elliott, 2017).

Food literacy comprises three primary constructs: knowledge, skill, and behaviour, whereby smaller attributes/dimensions fall under (Ronto *et al.*, 2016b; Truman *et al.*, 2017). Food Literacy takes a more comprehensive view of food and nutrition-related behaviours by educating individuals about where foods come from and how to prepare them in an enjoyable manner (Amin, Panzarella, Lehnerd, Cash, Economos & Sacheck, 2018b; Truman *et al.*, 2017; Vidgen & Gallegos, 2014).

A study done in Australia suggested that creating a healthy food environment that supports healthy dietary behaviours can be achieved by providing nutritional education to those responsible for food distribution in the food environment (Ronto *et al.*, 2017; Tysoe & Wilson, 2010). It was concluded that increasing an individual's food literacy early on in life may encourage them to engage in healthier, more positive dietary behaviours (Amin *et al.*, 2018a; Vaitkeviciute, Ball & Harris, 2015b; Vidgen & Gallegos, 2014).

2.2.1 Food literacy measurement tool

Previous studies done showed tuck shop owners who were nutritionally competent were more open to implemented nutritional programs and guidelines and regulating their tuck shops to offer greater availability of healthy food items (Bekker *et al.*, 2017; Lessa, Cortes, Frigola & Esteve, 2017; Lucarelli, Alaimo, Mang, Martin, Miles, Bailey, Kelleher, Drzal & Liu, 2014; Nortje *et al.*, 2017; Wiles *et al.*, 2013). These nutrition competencies can be determined using a food literacy scale (Rosas *et al.*, 2020; Vidgen & Gallegos, 2011).

Food literacy in a South African context is a term used to describe individuals' knowledge, skills, and behaviour to meet their food and nutritional needs (Amouzandeh, Fingland & Vidgen, 2019; Fingland, Thompson & Vidgen, 2021; Fisher *et al.*, 2019; Truman & Elliott, 2019; Vidgen, 2016).

Individuals with high food literacy generally follow diets with higher nutritional quality and live an overall healthier life (Block, Grier, Childers, Davis, Ebert, Kumanyika, Laczniak, Machin, Motley & Peracchio, 2011; Poelman *et al.*, 2018). According to Fisher *et al.* (2019), the nutrition dimension, as measured using the literacy scale, indicates consumers' competencies in addressing health and well-being by incorporating competencies such as selecting, preparing, and consuming health-promoting foods and practices.

Food literacy can be used as a tool to assess individuals' nutrition competencies, among others, which can then be used to develop and create nutrition-related policies to address the complex health concerns (Higgs, 2015; Marraccini *et al.*, 2012; Palumbo, Adinolfi, Annarumma, Catinello, Tonelli, Troiano, Vezzosi & Manna, 2019; Ronto *et al.*, 2016a; Worsley, 2002). The food literacy scale allows for objective nutrition competencies testing regarding food sources, nutritional aspects of foods, and other theoretical apprehensions (Rosas *et al.*, 2020). Objective knowledge involves the actual amount of factual information stored in an individual's memory (Spiteri Cornish & Moraes, 2015).

This knowledge is gained from formal education and based on facts. This information is generally obtained from experts in the field of nutrition, and this information is factual and evidence-based (Lawrence, Pelly & Rocks, 2016).

A South African food literacy tool developed by Fisher *et al.* (2019) tests individuals' nutritional knowledge, skills, and behaviour by assessing their competencies regarding the cooking methods, health properties, essential nutrients, nutrition recommendations (SAFBDG), identification of healthy food substitutes and whether unhealthy food contributes to obesity/overweight. The food literacy scale consists of 6 portions (dimensions), whereby only the nutrition dimension portion of the food literacy scale was used in this study.

This tool has not yet been used before, and this study will be the first study in South Africa to access the relationship between food literacy and the quality of food and beverage products sold in tuck shops using the tool (Fisher *et al.*, 2019).

2.2.2 Nutrition dimension

A South African definition for food literacy as a construct, as well as its subcomponents and related domains, was developed using the Delphi methodology (Fisher *et al.*, 2019). The use of the Delphi method is a good way to seek consensus from a sample of experts in a specific field of study. Perspectives from various expert stakeholders in the food industry that have a close relationship with food and nutrition daily were obtained (Fisher *et al.*, 2019).

Using the perspectives of these various experts, they were able to develop a South African definition for food literacy and develop and validate a food literacy scale from the definition using Rasch modelling with a sample of adult South Africans (Fisher *et al.*, 2019). Rasch measurement modelling offers a vigorous analysis of the internal construct validity of measures (Tennant & Conaghan, 2007). The Rasch model assumes that item responses are governed by a person's position on the underlying trait and item difficulty. The model makes no allowance for deliberate or unconscious dishonesty, guessing, or any other variable that might impact the responses provided (Tennant & Conaghan, 2007).

This definition and measurement instrument can be employed to determine individuals' food literacy levels and indicate any shortcomings in terms of specific sub-components such as nutrition. This tool can be used to aid in providing valuable guidelines, identify shortcomings, and facilitate food and nutrition education, interventions and training that will improve the wellbeing of societies (Fisher *et al.*, 2019). This food literacy scale thus allows for measuring an individual's nutrition competencies within the nutrition dimensions. Competency is defined as a set of related knowledge, skills, abilities and behaviour of an individual to carry out a job effectively (Clemow, Wagner, Marshallsay, Benau, L'Heureux, Brown, Dasgupta, Girten, Hubbard & Gawrylewski, 2018; Moyo, Ali & Dudley, 2019; Truman *et al.*, 2017).

Nutrition competencies in this study refer to the individual's knowledge, skills and behaviour about the nutrient content of foods, understanding the source and form of these nutrients, as well the role of nutrients in improving health (Pendergast, Garvis & Kanasa, 2011; Spiteri Cornish & Moraes, 2015; Vaitkeviciute *et al.*, 2015b; Worsley, 2002). As measured by the food literacy scale, the nutrition dimension can be defined as the relationship between diet and disease and comparing foods in terms of differences in nutrients. It is the nutrition-related competencies about daily serving requirements, weight, health improvement, and weight loss (Hendrie, Cox & Coveney, 2008; Lin, Hang, Yang & Hung, 2011; Mötteli, Barbey, Keller, Bucher & Siegrist, 2016; Rosas *et al.*, 2020; Truman *et al.*, 2017). It can also assess the individuals' nutrition competencies about accessing, appraising, and applying nutrition-related information to make decisions concerning their health care, disease prevention and promote and maintain an improved quality of life (Rosas *et al.*, 2020; Truman & Elliott, 2019; Vaitkeviciute *et al.*, 2015b).

The nutrition dimension section of this scale consists of 25 dichotomous questions aimed at assessing the individual's knowledge, skills and behaviours regarding food and nutrition-related topics. Research shows that people who lack nutritional knowledge about the daily serving requirements of different food groups also lack knowledge about the relationship between nutrition and disease.

This lack of competency in individuals who contribute to children's dietary needs may be causing an obstacle to children having healthy balanced diets and good food habits (Fisher *et al.*, 2019; Hirvonen, Hoddinott, Minten & Stifel, 2017; Lin *et al.*, 2011; Mamba *et al.*, 2019; Tennant & Conaghan, 2007; Wrottesley *et al.*, 2019). Children's food handlers need to have the correct knowledge, skill and behaviour about nutrients and the types of nutrient deficiencies among children to ensure that children receive a balanced diet that is high in nutrients (Dumont, Butcher, Foulkes-Taylor, Bird & Begley, 2021; Molotja *et al.*, 2020).

Primary school children's diets should consist of high-quality protein sources, essential fatty acids (omegas 3 & 6), and micronutrients. It was found that among South African primary school children, the daily intakes of vitamins A, C, niacin, vitamin B6, folate, calcium, iron, and zinc are the essential micronutrients in children's diets, and that is not being met (Anwar, Hardinsyah, Aries & Navratilova, 2018; Banfield, Liu, Davis, Chang & Frazier-Wood, 2016; Corkins, Daniels, de Ferranti, Golden, Kim, Magge & Schwarzenberg, 2016).

Food handlers are encouraged by the DOH to follow and implement the SAFBDG in their tuck shops to address nutritional related public health problems and influence learners to make healthier food choices (Audain, 2014; Majija, 2018; Vorster, 2013).

A study done in 2013 stated that the best way to increase the availability of high nutritional quality food is to educate tuck shop managers regarding quality and quantity of ingredients, proved resources to aid in the promotion of healthier foods in tuck shops and overcome barriers to the sales of healthy foods (Audain, 2014; Siobhan *et al.*, 2020; Wiles *et al.*, 2013). According to studies, many tuck shop owners are not informed of what to sell and have no awareness of the consequences of the sales of unhealthy food products on learners' health (Letlape *et al.*, 2010; Santos *et al.*, 2008). Tuck shop owners may not be knowledgeable or aware of the certain guidelines available to them, i.e., the NSNP and SAFBDG, to aid them in making decisions about what foods to be made available and sold in their tuck shops (Naidoo *et al.*, 2009).

It is shown that tuck shop owners who are competent about healthy food products and policies and use these competencies to regulate their tuck shops influence learners to make better-eating behaviours and healthier food choices (Bekker *et al.*, 2017; Teo *et al.*, 2021). Other studies done stated that increased nutrition competencies among school food handlers influenced the accessibility to healthy food, thus potentially increasing the availability and accessibility, leading to healthier food habits among learners (Kadi & Mosa, 2017; Kim *et al.*, 2012a; Teo *et al.*, 2021).

2.2.3 Nutrition knowledge

Nutrition knowledge forms part of one of the main constructs of nutrition in the food literacy model. Good nutrition knowledge is imperative for healthy living and lifestyle choices. It is needed not only to make healthy purchase decisions but also to prepare adequate balanced meals that will nourish the body and provide the necessary daily nutritional requirements. Nutrition knowledge can also be a valuable tool in intervention programs to provide a baseline in addressing nutritional needs in the population (Chung, 2017; De Villiers *et al.*, 2016; Hirvonen *et al.*, 2017; Pillai, Liang, Thwaites, Sharma & Goldsmith, 2019; Truman & Elliott, 2019; Walsh *et al.*, 2003).

According to research, having poor nutrition knowledge can be detrimental and affect an individual's food choices, dietary interventions and compromise the individual's health. Poor nutritional knowledge can also compromise the purpose of intervention programs such as the NSNP. Failure to acquire adequate nutrition knowledge among food handlers may jeopardise addressing nutrient deficiencies and the increased risk of DBM in primary schools (Chung, 2017; Kadi & Mosa, 2017; Katsagoni *et al.*, 2019; Teo *et al.*, 2021).

Tuck shop owners are expected to have good nutrition knowledge relating to general food practices, food types, labelling, and basic nutritional requirements for the children they serve/sell foods and beverages to (Chung, 2017; Kadi & Mosa, 2017; Katsagoni *et al.*, 2019; Teo *et al.*, 2021).

Researchers have found that there has been a substantial increase in the purchasing of convenient, unhealthy, away from home foods over the past decades. These food types have negatively affected the nutritional quality of primary school children's diets and have made it more difficult to meet dietary requirements (Chung, 2017; Kadi & Mosa, 2017; Legbara & Selepe, 2017; Ronto *et al.*, 2017). Nutrition knowledge can be enhanced using various media, such as the food pyramid, the SAFBDG, and nutrition manuals. The food pyramid communicates nutrition information and translates the daily dietary standards and recommendations into a simple, easy-to-read, and understand nutrition education tool. It is a tool that can be used by nutrition experts and easily adapted to fit various individuals' nutritional needs. Another helpful tool used to increase an individual's nutrition knowledge is the SAFBDG. This tool comprises locally available nutritious foods that can assist food handlers in formulating good purchase decisions and menus designed for school learners. Using these tools to advance nutrition knowledge will aid in the individuals culinary understanding, meal formation, increased dietary quality and healthier purchasing decisions (Hirvonen *et al.*, 2017; Kadi & Mosa, 2017; Ovca, Jevšnik, Kavčič & Raspor, 2018; Worsley, 2002).

Being educated and aware of the macro and micronutrients contributes to one's overall health by minimising poor nutritional diets and habits. It leads to overall healthier behaviour that will assist in reducing the risks of onset chronic diseases while sustaining a healthy lifestyle. Dietary education is effective in understanding both the dietary requirements as well as body weight control (Chung, 2017; Kadi & Mosa, 2017; Reeve, Thow, Bell, Soti-Ulberg & Sacks, 2021; Ronto *et al.*, 2017).

Nutrient profiling is a helpful tool developed that takes on a behavioural nutritional approach that does not dictate what to eat and what not to eat. It is a tool that aims at educating the users about the overall nutritional quality of food, leaving the final consumption choices up to them (Alrige, Chatterjee, Medina & Nuval, 2017; Palumbo, 2016).

2.3 Nutrition profiling

Nutrient profiling of foods is defined as the ranking/categorising of foods based on their nutrient composition (Drewnowski & Fulgoni, 2008; Rayner, 2017). It is the assignment of foods based on their nutrient density. Nutrient profiling is used as a tool to indicate the nutritional quality of food products to help fight against and prevent disease, more specifically NCDs (Lehmann *et al.*, 2017; Maillot, Darmon, Darmon, Lafay & Drewnowski, 2007; Naidoo *et al.*, 2009).

Nutrient dense foods are foods that contain a substantial number of vitamins and minerals that contain relatively few kilojoules. Examples of nutrient-dense foods are lean meats, whole grains, enriched grains, and fruits and vegetables (Drewnowski & Fulgoni, 2008). In Queensland, Australia, many schools use the 'traffic system' to categorise foods into 'green' healthy foods, 'amber' less healthy foods, and 'red' least healthy foods as a way to restrict and prohibit the sale of unhealthy 'red' products in their canteens/tuck shops. Schools in New Zealand have reported adopting a similar approach to determining what foods to sell in and around their school premises. It has been recommended that schools in South Africa adopt a similar approach when creating school policies and guidelines for tuck shop owners (Labonté, Poon, Gladanac, Ahmed, Franco-Arellano, Rayner & L'Abbé, 2018; Lucas, Patterson, Sacks, Billich & Evans, 2017).

2.3.1 Nutrient profiling models

Nutrient profiling models rate the nutritional quality of foods based on the food's nutrient composition. This helps determine the nutrient density of the foods and indicates foods that contain more nutrients than kilojoules and are low in fat, sugar, and salt. These model have provided a way for evaluating nutrition and health claims scientifically (Drewnowski, 2017; Lehmann *et al.*, 2017; Lobstein & Davies, 2009; Lockyer, Cade, Darmon, Flynn, Gatenby, Govindji, Quick, Raats, Rayner & Sokolović, 2020; Rayner, 2017; Roodenburg, 2017; Wicks,

2017). Nutrient profiling models promote a diet rich in lean protein, fibre, vitamins, and minerals, whereas nutrients such as free sugars, saturated fat, and sodium should be limited (Hess & Slavin, 2017).

Some have defined certain nutrient profiling models as ‘a set of algorithms that place foods into a continuum of healthiness’ (Rayner, Scarborough & Kaur, 2013; Scarborough, Arambepola, Kaur, Bhatnagar & Rayner, 2010; Wicks, 2017). Nutrient profiling can also be considered a systematic and transparent process for developing a criterion to classify food as healthy or unhealthy. Due to certain nutrient profiling models' ability to classify foods as more or less healthy, it can be used to form the scientific base that informs food policies (Rayner *et al.*, 2013; Scarborough *et al.*, 2010; Wicks, 2017). The manner in which the various nutrient profile models have been constructed varies considerably. Some models classify foods using across-the-board criteria, in which food is categorised into a limited number of food categories, while others, like category-specific models, place foods into categories and subcategories to determine the nutrient profiling. The use of various models will differ depending on the aim and use (Scarborough *et al.*, 2010; Wicks, 2017; Wicks *et al.*, 2016).

In South Africa, the South African nutrient profiling model (SANPM) is used. This model is based on the UK Food Standards Agency and adapted by FSANZ. The SANPM model was adopted by the DoH in 2012 to be used as a first screening step for health claims in South Africa (Wicks, 2017; Wicks *et al.*, 2016). This model has been thoroughly tested and validated. The DoHSA model is a modified version of the SANPM and is suggested to be used for regulating the marketing of foods to children (R429). This model is a scoring model that uses across-the-board nutrient criteria as well as a category scoring system. This model first classifies foods using SANPM (across-the-board scoring model) and then categorises them using the UK FSA traffic light criteria (Department of Basic Education, 2008; Faber *et al.*, 2019; Wicks *et al.*, 2016). This model is used in South Africa to reduce the impact of obesity and NCDs on children. The SANPM model on the DoH website has been tested and validated using five different methodologies to assess the applicability to the South African situation; it was found to be the most appropriate and reliable tool in determining the healthiness of food/beverage items in South Africa (National Department of Health, 2020; Poon, 2018; Townsend, 2010; Wicks *et al.*, 2020).

The DoHSA model was the stricter model than the SANPM, as it excluded foods with the following additives: non-nutritive sweeteners, fructose, fluoride and aluminium. The reason behind the exclusion of non-nutritive sweeteners was due to aid in the fight against childhood obesity (Wicks *et al.*, 2016).

Below Table 1, indicates the differences between the DoHSA model and the SANPM (Wicks, 2012).

TABLE 1: DIFFERENCES BETWEEN SOUTH AFRICAN NUTRIENT PROFILING MODELS (Wicks *et al.*, 2016)

Model	Type	Classification criteria	Nutrient to limit according to the model	Nutrients to encourage according to the model
SANPM	Scoring model	Across-the-board scoring criteria	Energy, saturated fats, total sugars, and salt/sodium	Protein, fruits, vegetables, legumes, and nuts
DoHSA model	Scoring and threshold model	Across-the-board scoring criteria	Energy, saturated fats, total sugars, salt/sodium, non-nutritive sweeteners, added fluoride, and aluminium	Protein, fruits, vegetables, legumes, and nuts

SANPM: South African Nutrient Profiling Model
DoHSA model: South African Department of Health nutrient profiling model

The DoHSA model classifies foods as follows:

First and foremost, it identifies whether the food passes the SANPM criteria or not. If it does, then the next step is to determine if the food contains any additives such as fructose, added non-nutritive sweetener, fluoride or aluminium. Finally, one can determine the nutrient levels/scores of the food and beverage items per 100g/ml using the UK Food Standard Agency Criteria (Wicks, 2017).

The scoring of the food items is done by first categorising food items in one of three categories. Category 1 items are all beverages, excluding milk, and items in this category need to have a score below one to be considered healthy. Category 2 is all food items other than those included in categories one and three. Milk, evaporated milk, and dried milk are included in Category 2. For a food product to be considered healthy in this Category, a final score of below four needs to be obtained (Jenneson, Greenwood, Clarke, Hancock, Cade & Morris, 2020; Wicks, 2017). Category 3 includes food items such as cheese, processed cheese with a calcium content of below 320mg/100g, edible oils, edible oil spreads, margarine, and butter. To be considered healthy in this category, a final score of below 28 needs to be obtained. Once food items are categorised, baseline points are awarded to the products energy, saturated fat, total sugar, and sodium composition per 100g/ml. Next, the protein and fibre points are determined per 100g/ml, followed by the calculation of the vegetable points (if applicable). Finally, the total score of the food item is calculated to determine the healthiness. The DOH calculator automatically allocates points and calculates the final score of the food/beverage items nutrient compositions (Department of

Education, 2021; Drewnowski, 2017; Hess & Slavin, 2017; Maillot *et al.*, 2007; Rayner, 2017; Wicks *et al.*, 2020).

This can be seen as indicated in Table 2 below.

TABLE 2: NUTRIENT PROFILING CATEGORIES (NATIONAL DEPARTMENT OF HEALTH, 2020)

Category	Food items included	Scoring criteria to meet health claims
Category 1	All beverages excluding milk	Products with a final score of less than one meet health claim criteria
Category 2	All products (including milk, evaporated milk, and dried milk) not included in categories one and three Cheese and processed cheese products with a calcium content of less than 320mg per 100g	Final scores of less than four meet health claim criteria
Category 3	Cheese and processed cheese with a calcium content of more than 320mg per 100g All edible margarine and oil spreads Butter and edible oil	A final score less than 28 meets health claim criteria

WHO recommends that the NP models be used in combination with a country's FBDG. Thus the South African nutrient profiling model permits "healthy" foods within the food groups that the SAFBDGs promote (Wicks *et al.*, 2016; Wicks *et al.*, 2020). The DoH has also made its nutrient profiling calculator available online for ease of access for anyone who would like to evaluate their diets or food products to judge its healthiness. The SANPM can thus assist policy makers in creating policies to promote better health in school tuck shops by guiding tuck shop owners to restricting products that are deemed as unhealthy by the nutrient profiling model (National Department of Health, 2020; Wicks *et al.*, 2016; Wicks *et al.*, 2020). A study done in 2018 recommended that schools implement strategies for nationally regulated tuck shops to advance healthier eating practices among children.

It also recommended educating tuck shop owners regarding appropriate quality and quantities of ingredients used and consider using nutrient profiling tools to aid in the choices of food and beverage products sold to learners (Adiele *et al.*, 2018; Wiles *et al.*, 2011).

2.3.2 Nutrient density

Nutrients are essential for human health. Nutrients are chemical substances obtained from food and used in the body to provide energy, support growth, maintain and repair body tissue, and provide structural materials and regulatory agents. Nutrients may also reduce the risks of some diseases, including NDCs. The correlation between nutrients and dietary patterns has implications in the prevention and development of NCD, such as cardiovascular diseases, cancer, diabetes, and respiratory diseases (Lockyer *et al.*, 2020; Scaglioni, De Cosmi, Ciappolino, Parazzini, Brambilla & Agostoni, 2018; Whitney & Rolfes, 2018).

Nutrient dense foods can be described as foods and beverages that provide individuals with vitamins, minerals and other substances that contribute to adequate nutrient intake. Adequate nutrient intake may have positive health effects, especially those nutrients that are low in solid fats, added sugars, refined starches and sodium. Nutrient density is further explained as an indicator of the nutrients in foods that have not been diluted by the addition of kilojoules from saturated fats, sugars, or refined starches. An example of nutrient dense foods are all the fruits and vegetables, whole grains, seafood, eggs, legumes, unsalted seed and nuts, fat-free/low-fat dairy products and lean meats and poultry (Lockyer *et al.*, 2020; Maillot *et al.*, 2007).

Essential components of human diets consist of calorie intake, protein, vitamins A, B6, C, D, E, thiamine, riboflavin, niacin, folic acid, calcium, magnesium, iron (Du Plooy, Schönfeldt & Hall, 2018a; Saravia *et al.*, 2018; Sinyolo, Ndinda, Murendo, Sinyolo & Neluheni, 2020). Primary school children need between 6700-8400 kilojoules a day, approximately 1,5 cups of fruit, 2-2,5 cups of vegetables, 150g grains, 3 cups of dairy/milk products, 46g meat/fish/beans/legumes/meat alternatives (Anwar *et al.*, 2018; Banfield *et al.*, 2016; Corkins *et al.*, 2016). However, children in South Africa, on average only consumer a combined serving of 2,5 servings of fruits and vegetables daily, while protein and macronutrients are generally eaten in excess (Du Plooy, Schönfeldt & Hall, 2018b; Sinyolo *et al.*, 2020; Tydeman-Edwards *et al.*, 2018; Wrottesley *et al.*, 2019). This rise in prepacked food consumption may also be responsible for declining fruit and vegetable consumption (Dasi *et al.*, 2019).

Research has stressed the importance of including high-quality protein, essential fatty acids, iron, zinc, vitamin A and calcium in children's diets. These nutrients are essential for childhood growth and development as well as to support a lean body and muscle mass later on in their adult lives (Berg, 2019; Bonku & Yu, 2020; Corkins *et al.*, 2016; Dasi *et al.*, 2019; Kupka *et al.*, 2020; Whitney & Rolfes, 2018). Currently, in South Africa, it has been reported that 44% of children are deficient in vitamin A, 45% in zinc, 15% in iodine and 10% iron (Prioreschi, 2020).

Diets lacking in these essential nutrients could be the main reason underlying the DBM among children. In South Africa, 16% of children between the ages of one year to nine years were identified with stunting, while 5,4% of all South African children between the age of three years to 16 years were found to be underweight (Caleyachetty, Thomas, Kengne, Echouffo-Tcheugui, Schilsky, Khodabocus & Uauy, 2018; Department of Basic Education, 2008; Nguyen *et al.*, 2017; Prioreschi, 2020; Tydeman-Edwards *et al.*, 2018). Stunted children have a higher risk of becoming overweight or obese due to the obesogenic environment caused by urbanisation. They are thus susceptible to increased risk of NDCs in adulthood, such as type 2 diabetes, hypertension, cardiovascular diseases, certain cancers, arthritis, and other disorders in adult life (Bekker *et al.*, 2017; Berg, 2019; Tydeman-Edwards *et al.*, 2018; World Health Organization, 2006). Overweight and obesity is clinically defined as an individual having excessive fat accumulation that may impair health. In contrast, undernutrition is defined as micronutrient deficiencies, underweight, stunting, and wasting of individuals (Popkin *et al.*, 2019; Prentice, 2018; Whitney & Rolfes, 2018).

The most common technique used to identify overweight or obesity and underweight is BMI-for-age measurement in children. According to the World Health Organisation (WHO), BMI for children can be determined by a child's weight and length/height, along with using a reference table or a calculator on the WHO webpage. A Z-score can be determined after plotting the BMI for age on the graph. Z-score lines on the growth charts are numbered positively (1, 2, 3) or negatively (-1, -2, -3). A Z-score of 3 indicates that the child is obese, while the other side of the spectrum -3 indicates that the child is severely wasted (Khan, Raine, Donovan & Hillman, 2014; World Health Organization, 2007; World Health Organization, 2008).

The consequences of childhood obesity and overweight have been associated with a myriad of unfavourable physical and psychological health outcomes. The physical health consequences of obesity are often long-term issues that manifest later in life. These issues could include diabetes, hypertension, dyslipidaemia, fatty liver, menstrual abnormalities, gallstones, sleep apnoea and orthopaedical disorders, to name a few (Gibson, Allen, Davis, Blair, Zubrick & Byrne, 2017; Klingberg, Draper, Micklesfield, Benjamin-Neelon & van Sluijs, 2019; Tydeman-Edwards *et al.*, 2018).

Psychological health problems associated with overweight and obesity include social stigmas, low self-esteem, low body esteem, low overall quality of life, reduced school performance, depression, anxiety, behavioural problems, decreased cognitive functioning, attention deficit hyperactivity disorder, disordered eating, and loneliness (Gibson *et al.*, 2017; Klingberg *et al.*, 2019; Tydeman-Edwards *et al.*, 2018).

There is also an economic cost to overweight and obesity, namely direct costs of medical bills, prescriptions, accidents, and indirect costs of low productivity and job absenteeism (Gibson *et al.*, 2017; Klingberg *et al.*, 2019).

Childcare centres such as schools and daycares fulfil two-thirds of a child's daily nutritional needs. It is imperative for children's long term and short-term health statuses that they are provided with nutrient dense, healthy meals. Studies have shown that fatigue, reduced immune responses, long term developmental issues, and increased risk of contracting NCD are all short-term health effects of missed meals (Adiele *et al.*, 2018; Hochfeld *et al.*, 2016; Kadi & Mosa, 2017).

A study done showed that, on average, fruits and vegetable consumption among primary school children were very low, as only 30% of boys and 37% of girls reported eating fruits and vegetables daily. This study has also stated that the proportion of children eating fruits and vegetables regularly decreased with age (Hawkes *et al.*, 2017; Kern, Auchincloss, Robinson, Stehr & Pham-Kanter, 2017; Kohler *et al.*, 2013; World Health Organization, 2006).

This was supported by another study that showed that over half the learners (51%) ate less than one fruit portion a day, while 29% ate less than one vegetable serving a day. It was found that the majority of the population consumed predominantly cereal and starch-based diets that consisted of a low intake of animal products, fruits, vegetables and key essential micronutrients (Faber *et al.*, 2014; Kadi & Mosa, 2017; Maunder, Nel, Steyn, Kruger & Labadarios, 2015).

Despite the increase in healthy diets and nutrition in adulthood, South African adolescents remain a major cause for concern. A majority of South African adolescents lifestyles have been shown to consist of high consumption of foods containing high levels of saturated fats, salts and sugars while having low levels of exercise and daily physical activities (Letlape *et al.*, 2010). Most households in South Africa lack variety in their diets and prefer to purchase affordable foods such as bread, maize, tea, and sugar. They tend to avoid more expensive food options such as fresh fruits and vegetables; these choices drastically increase the risk of micronutrient deficiencies (Hochfeld *et al.*, 2016; Lockyer *et al.*, 2020; Maunder *et al.*, 2015).

Due to urbanisation and the nutrition transition, many children are being raised in an obesogenic school environment. This is owed to the increase in cheap calorie-dense convenience foods available to households. Children who lack adequate macro and micronutrients have been shown to have decreased performance in schools as undernourishment impairs their abilities to concentrate, learn and attend school regularly (Wicks *et al.*, 2016).

Good health and nutrition are needed for concentration and optimal school performance. Poor dietary choices such as overconsumption of poor nutrient-dense foods could also lead to developing conditions such as iron deficiencies (anaemia) and dental caries (Wicks *et al.*, 2016). Currently, the food and beverage items available at primary school tuck shops are characterised by low nutrient density, which as a result could encourage the development of childhood overweight and obesity (Adiele *et al.*, 2018; Letlape *et al.*, 2010). Nutritional support from the school food environment could be valuable in increasing dietary diversity, general nutritional statuses and encouraging healthier eating habits and balanced diets (Department of Basic Education, 2008; Kadi & Mosa, 2017; Qila & Tyilo, 2014).

The nutrient density of the foods items in tuck shops can be assessed using a tool called nutrient profiling. This tool takes the energy (kJ), saturated fat (g), total sugars (g), sodium (mg), fruit, vegetable, nut and legume content (as %), fibre(g) and protein (g) content into consideration per 100g/ml. Based on these amounts, scores are allocated to the food item to indicate whether or not it is healthy. This can also aid in indicating whether or not children's dietary needs are being met through the food sold and consumed, thus reducing the risks of the DBM (Alrige *et al.*, 2017; Drewnowski, 2017; Hess & Slavin, 2017).

It is thus vital that the school environment where children spend most of their time during the week focuses on enhancing their food system to improve the availability and access to diverse diets rich in nutrients (Alrige *et al.*, 2017; Dasi *et al.*, 2019; Hess & Slavin, 2017; Lockyer *et al.*, 2020). Tuck shop owners should be encouraged to make use of the tools available to aid them in not only increasing their nutrition knowledge but also guiding them in the choices of foods to make available for purchase (Lessa *et al.*, 2017; Letlape *et al.*, 2010).

2.3.3 South African Food Based Guidelines

The main goal of the SAFBDG is to aid in the prevention of nutrition-related diseases using a food-based approach through the inclusion of a variety of foods specific to that population, to improve nutrient intake and food choice. SAFBDG must reflect; the nutritional situation of the country: must be in plain, simple and easy to understand language; provide practical advice for local customs, dietary patterns, economic condition, and lifestyles: and be based on accurate scientific evidence

and up to date. Food in this guideline must also be affordable and accessible (Du Plooy *et al.*, 2018a; Vorster, Badham & Venter, 2013).

The current ten SAFBDG are: Enjoy a variety of foods; Be active; Make starchy foods part of most meals; Eat plenty of vegetables and fruit every day; Eat dry beans, split peas, lentils, and soya regularly; Have milk, maas or yoghurt every day; Fish, chicken, lean meat or eggs can be eaten daily; Drink lots of clean, safe water; Use fats sparingly. Choose vegetable oils rather than hard fats; Use sugar and foods and drinks high in sugar sparingly (Department of Basic Education, 2008; Nguyen *et al.*, 2017; Vorster *et al.*, 2013).

These guidelines should be adopted and implemented by tuck shop owners and food handlers in the school environment to provide children with a better-quality nutrient profile in schools. For example, according to SAFBDG, children should eat plenty of fruits and vegetables daily. Thus, if food tuck shop owners are knowledgeable about these guidelines and implement them in their tuck shop by stocking more readily available fruits and vegetables for children, this initiative could provide primary school children with protection against the risk of NCDs. Nutrient profiling can be used to inform/guide schools in creating policies that support the SAFBDG, to create a healthier school food environment that safeguards against obesogenic environments (Drewnowski & Fulgoni, 2008; McColl, Lobstein, Brinsden & Organization, 2017; Nguyen *et al.*, 2017; Nortje *et al.*, 2017; Tydeman-Edwards *et al.*, 2018).

2.4 CONCLUSION

This chapter explored the multidimensionality of food literacy and nutrient profiling. It also analysed and discussed the different contributing factors within the school food environment, the current school food policies and the South African based guidelines. The next chapter explains the methodology adopted for this study.

CHAPTER 3

DESIGN AND METHODOLOGY

This chapter presents a detailed description of this studies research design and methodology. The research design and techniques used to achieve the research objectives were discussed and justified, and each technique was evaluated. The data collection techniques, sampling procedures, selection of participants, and data analysis were also described and discussed. Measures were taken to ensure the objectivity and trustworthiness of the study were also specified in the final section of this chapter.

3.1 Research design

The study was non-experimental with a cross-sectional, analytical design incorporating quantitative research methods. Research designs can either be experimental, non-experimental or semi-experimental. Non-experimental research can be descriptive, observational or analytical, which means that it does not involve experiments in the process of data collection, but instead describes a situation or phenomenon simply as it stands, or describes a relationship between two or more variables, all without any interference from the researcher (Asenahabi, 2019; Kumar, 2018). Non-experimental research can further be broken into three groups: survey design, casual comparative design and correlation design. Survey design involves a critical observation of events, subjects, objects, and ideas without attempting to control the conditions of the phenomenon by generally making use of questionnaires or structured interviews (Asenahabi, 2019).

In comparison, correlational research uses correlational statistics to measure and describe the degree of association among variables or sets of scores (Asenahabi, 2019). This survey design allowed the researcher to observe and describe the nutrition competencies of tuck shop owners and products sold in quintile five and public primary school tuck shops. At the same time, the analytical/correlation design allowed for the statistical analysis of the data to determine the relationship between these competencies on the nutritional quality of products sold in their tuck shop, as well as to explore the relationship between nutrition-related training and policies, and the nutritional quality percentage score of food and beverage products sold at tuck shops.

Quantitative data describes attributes in a population of interest and explains relationships in numerical forms (Kumar, 2019). A quantitative data research method was followed using structured questionnaires and observational checklists for data collection.

Cross-sectional research is when collecting the data is done in a single point of time using different groups of respondents with a similar variable that is to be tested but share other characteristics, such as gender or ethnicity (Kumar, 2019). This study investigated tuck shop owners in the Third Region of Tshwane‘s nutrition competencies, nutrition-related training and policy awareness by use of a structured questionnaire. An observatory checklist was used to collect information regarding the different types of food and beverages sold in the tuck shops. Nutritional information from the product labels was captured to determine the nutrient profiling score.

Data were collected within a short timeframe during the first quarter of 2021 (April/May) in tuck shops at selected quantile five public and private primary schools situated across the Third Region of Tshwane, South Africa.

3.2 Research methodology

3.2.1 Study setting

Participants were selected from privately owned tuck shops from public quintile five and private primary schools located in this geographical area of the Third Region of Tshwane, Gauteng.

FIGURE 2: TYPICAL EXTERIOR OF A PRIMARY SCHOOL TUCK SHOP (Curro, 2021)

According to the Department of Basic Education, there are 354 primary schools in Tshwane (Department of Education, 2021). The Tshwane Gauteng Education Departments are divided into three districts and seven regions. Due to Tshwane being such a large city area, this study focussed on collecting data from private and quintile five public primary school tuck shops across the Third Region of Tshwane. This region was selected as it contained the largest number of primary schools within the same socioeconomic area. Stats SA has characterised the Third Region of Tshwane’s population group as higher in socioeconomic status compared to the rest of the regions (Stats SA, 2011).

Due to this characterisation, it was expected that areas that fall within this region would contain more primary schools with a higher socioeconomic status (Cameron & Krynauw, 2001; Lombard & Olivier, 2000; Stats SA, 2011).

FIGURE 3: TYPICAL INTERIOR OF HIGHER SOCIOECONOMIC SCHOOL TUCK SHOP (Anon, 2021)

The researcher selected the sample from quintiles five and private schools due to the homogeneity of their higher socioeconomic standing compared to quintile 1-4 schools. Higher socioeconomic schools generate the bulk of the schools funding from school fees, whereas lower quintile schools receive a large bulk of their funding from the government. It is expected that these schools would have a greater likelihood of having tuck shop facilities as compared to quintile 1-4 schools, whose learners heavily rely on the NSNP's school feeding scheme to provide their daily meals (Berry, Biersteker, Dawes, Lake & Smith, 2013; Cameron & Krynauw, 2001; Lombard & Olivier, 2000; Smith, Adams, du Randt, Degen, Gall, Joubert, Müller, Nqweniso, Pühse & Steinmann, 2020; Stats SA, 2011). Furthermore, it was anticipated that schools from a higher socioeconomic group would have greater access to resources, and as a result, would accommodate a greater variety of food and beverage items sold (Faber *et al.*, 2014; Nortje *et al.*, 2017). In addition, many schools in the lower quintile rankings were found to simply not have school tuck shops due to the COVID-19 virus straining on their already limited resources, hence the exclusion of this group from the study (Chitimira & Hamadziripi, 2021; Khambule, 2020; Kruger *et al.*, 2020; Prioreschi, 2020; Van der Berg *et al.*, 2020).

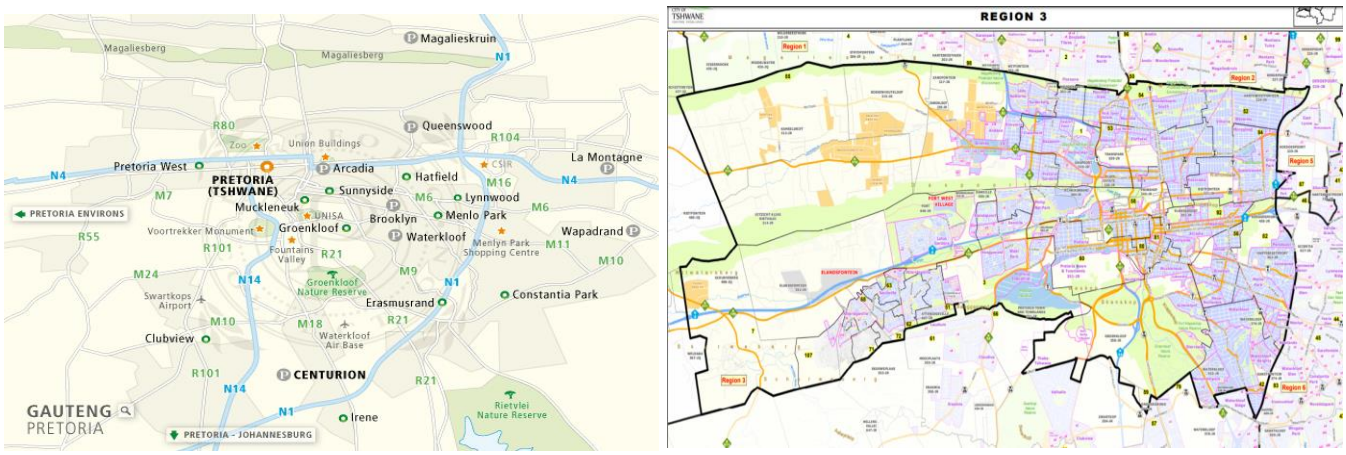

FIGURE 4: MAPS OF TSHWANE, REGION THREE (DEPARTMENT OF EDUCATION, 2021)

3.2.2 Study population

Creswell (2017) defines a population as a specific group of individuals who have similar characteristics. The smallest entity included in a study is the unit of analysis, while the population is the collective of all of those units (Creswell & Creswell, 2017). The population of this study was tuck shop owners, who privately own a tuck shop in either public quintile five or private primary schools situated across the Third Region of Tshwane, Gauteng, South Africa. There were no restrictions on demographics such as race, gender, household income, education level, or population group, as this information was used as background information to describe the population. The reasoning behind the choice of selecting primary school tuck shop owners as sample population was due to research indicating that primary school learners may not have the knowledge and expertise to make informed decisions regarding health and nutrition at their age. In addition, primary school learners are also still establishing dietary habits and food preferences during this age. Therefore, it is up to their guardians and food providers to furnish these learners with food and beverage products that are conducive to a healthy eating environment and habits (Chen & Yang, 2014; Hawkes *et al.*, 2017; Ma & Wong, 2018; Nortje *et al.*, 2017).

Inclusion and exclusion criteria define who can be included or excluded from the study sample. The inclusion criteria identify the study population in a consistent, reliable, uniform and objective manner. The exclusion criteria include factors or characteristics that make the recruited population ineligible for the study (Garg, 2016).

Inclusion criteria for this study are as follows:

1. Privately owned Tuck shops (formal/informal vendor) on school premises of:

1.1 Public primary schools classified as quintile five according to the Department of Basic Education

1.2 Or independent and private primary schools

2. Schools situated within the Third Region of the city of Tshwane

Exclusion criteria for this study are as follows:

1. Formal/Informal vendors situated around/nearby the school premises
2. Secondary, combined, and intermediate schools
3. School within quintiles 1-4
4. School without a tuck shop on their premises
5. Schools with tuck shops not operating due to COVID -19

3.2.3 Sampling technique and sample size

A multi-stage sampling approach was used due to the size of Tshwane. A smaller group of the Third Region of the bigger Tshwane population was purposefully selected using non-probability sampling. Purposive sampling is a deliberate choice of participants due to the qualities they possess. The researcher decided what needs to be known based on the aims and objectives of the study and sets out to find individuals who can and are willing to provide the information by virtue of knowledge or experience (Kumar, 2018; Palinkas, Horwitz, Green, Wisdom, Duan & Hoagwood, 2015). This sampling was adopted due to the fact that the researcher needed to select a specific group to meet the research aims; thus, the selection was made according to known characteristics (Palinkas *et al.*, 2015), which in this instance refers to tuck shop owners from private and quintile five primary school tuck shops across the Third Region of Tshwane. While the sample might not represent the bigger Tshwane population due to the nature of non-probability purposive sampling, it represents the tuck shops situated at schools in a higher socioeconomic area of the Third Region of Tshwane (Kumar, 2019).

Stratified sampling is often used where there is a great deal of variation within a population. Its purpose is to ensure that every stratum is adequately represented (Kumar, 2019; Taherdoost, 2016). Schools from the Third Region of Tshwane were divided into two strata using stratified random sampling, private schools and public schools that fell into the fifth quintile.

While it was expected that strata would differ from each other due to quintile five and private schools being run by different entities, both schools, however, fell within the same socioeconomic status and thus had a homogeneous population, as it was anticipated that some quintile five tuck shop's may have sold similar foods and beverage products as private school tuck shops and vice vera.

According to the Department of Basic Education school master list, there are 16 private/independent schools and 19 quintile five public schools, i.e., a total of 35 schools meeting the inclusion criteria in this selected Region of Tshwane. Of the 35 schools, a total sample size of 33 school tuck shops was randomly selected, 16 private and 17 quintile five from each stratum.

The quality of this study was ensured by sampling all the higher socioeconomic schools within the Third Region of Tshwane. It was noted that a sample size too small might not be a true representative of the population, and one too big may be resource exhausting. A sample size of 33 with a power analysis of 85% at a P-value of 0.05 was determined using the statistical programs IBM SPSS Statistics V26 and G*Power 3.1.9.4 from the selected population. Research indicated that a minimum sample size of 30 had been considered sufficient and appropriate for a study of this nature following the general sampling rule of thumb for relational type studies (Aaker, 2010; Altunışık, Coşkun, Bayraktaroğlu & Yıldırım, 2004; Cohen, Manion & Morrison, 2013; Delice, 2010; Gall, Borg & Gall, 1996; Guthrie, 2010; Kumar, 2019; Noordzij, Tripepi, Dekker, Zoccali, Tanck & Jager, 2010; Taherdoost, 2016).

A sample of 16 school tuck shops was randomly selected from private school (Independently run) schools and 17 from public (Government-run) quintile five schools using the Department of Basic Education's Schools master list (Department of Education, 2021).

3.2.4 Data collection methods

Data collection was done in one phase using a food literacy questionnaire (Addendum C) that was distributed to each participant. The data collection process took place during the months of April/May 2021. Consent to participate in the study was requested from the primary school tuck shop owners identified to meet the inclusion criteria (Addendum A). The study's aims and objectives were communicated to the prospective participants. Once the names and telephone numbers or emails of prospective participants were received, the researcher contacted the participants to describe the study, set out what they would be required to do, and asked if they were interested in participating. An appointment was made and confirmed in advance for the research to visit the tuck shop.

The researcher presented the participant with a hard copy of the questionnaire while visiting the tuck shop to capture their response. The questionnaire contained a cover letter that was composed by the Department of Consumer and Food Science (Addendum C), stating the intention of the questionnaire.

Furthermore, a consent form (Addendum A) was attached to the cover letter to obtain formal consent from the tuck shop owners to participate in the study. All questions were asked in English.

In addition to the questionnaire, the researcher also visited each of the 33 primary school tuck shops and recorded what food and beverage products were made available for purchase using checklists (Addendum D) based on and adapted from previous studies (Bekker *et al.*, 2017; Wiles *et al.*, 2011). The questionnaires were distributed to the tuck shop owners the same day as the visit, whereby completion was done with no interference from the researcher. The procedure and protocol followed by the researcher on the day of the tuck shop visit were as follows and indicated in Figure 5 below.

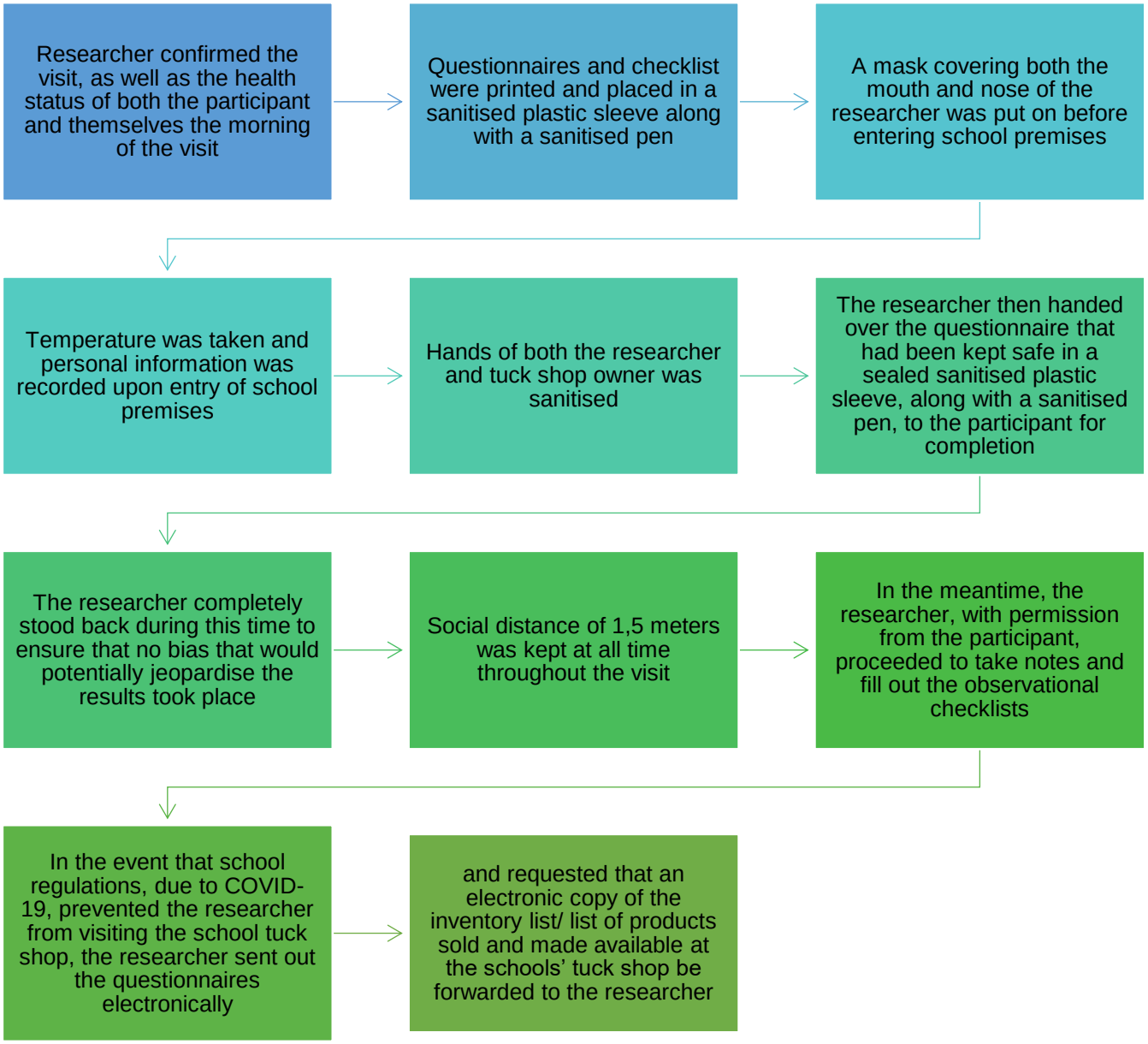

FIGURE 5: FLOWCHART OF COVID COMPLIANCE AND TUCK SHOP VISITS PROTOCOL

Nutritional information such as energy (kJ), saturated fat (g), total sugar (g), sodium (mg), fruit, vegetable, nut and legume content (as a %), fibre (g) and protein (g) amount per 100g of food or beverage was needed to determine the nutritional quality of food products sold in participating tuck shops. Checklists used to capture the nutrition information were already furnished with pre-existing nutritional data of typical food and beverage items sold in primary school tuck shops as recorded in previous studies (Bekker et al., 2017; Wiles et al., 2013).

The nutritional information of products sold at tucks shops that were not on the checklists (addendum B and D) was then captured and recorded from product labels. If the nutritional information was not indicated on the labels, the Condensed Food Composition Tables for South Africa (SAFOODS, 2018) was used to obtain the data. In the cases where food/meals were made on-site and provided to learners, the participants were asked to provide thorough details about the types or brands and the weight or volume of ingredients used to prepare the menu items and the relevant cooking methods. Once this information was obtained, the researcher then manually calculated the nutrition values of the meal/food items based on the information provided using Condensed Food Composition Tables for South Africa (SAFOODS, 2018).

3.2.5 Measuring instruments

Nutrition competency questionnaire

The questionnaire (Addendum C) was divided into sections to gather information towards the study's objectives, and each section used a specific measurement scale.

Section A of the questionnaire addressed the tuck shop owners' demographics.

Section B consisted of closed-ended questions addressing tuck shop owners' nutrition competencies, using the nutrition dimension section of a validated South African food literacy measurement scale (Fisher *et al.*, 2019). This scale measured the level of competency of tuck shop owners by allocating a point for the question/statement that was correctly identified (Addendum J) within each section of the questionnaire (knowledge, skills, and behaviours). These points were used to calculate a final score within each section, as well as a final overall competency score. The final score of which was then calculated as a total percentage indicating the tuck shop owner's nutrition competency.

Section C consisted of closed and opened ended questions addressing food and nutrition policies that were used or implemented in the tuck shops, as seen in Table 3 below. This section investigated the tuck shop owner's awareness and implementation of nutrition-related policies. These generic questions were obtained and adapted from previous literature (Department of Basic Education, 2008; Kadi & Mosa, 2017; Ronto *et al.*, 2016b).

This section consisted of seven questions, of which five are closed-ended, and two are open-ended, as seen in Table 3 below. Participants were asked to indicate their awareness and implementation of certain nutrition-related policies and guidelines, as well as to indicate which parties were involved in setting up the policies that dictated what food and beverage products were allowed to be sold.

Questions relating to factors that were taken into consideration when choosing what food and beverage products to sell in their tuck shops were also asked. Lastly, a question related to any nutrition training received was also included (Addendum C).

TABLE 3: DESCRIPTION OF TYPE OF QUESTIONS IN THE NUTRITION COMPETENCY QUESTIONNAIRE

	Number of Questions in each section	Question number	Closed-ended	Open-ended	Quantitative Categorical Nominal	Quantitative Categorical Ordinal	Quantitative Discrete Numerical
Section A: Demographic	7	Q 1 & 3 & 5	X		X		
		Q 2 & 6	x				X
		Q 4 & 7	x			X	
Section B: Nutrition Competency	25	Q 8- 32	x		X		
Section C: Policies	7	Q 33 & 34 & 35 & 36 & 38	x		X		
		Q 37 & 39		X	X		

Nutrient profiling: Measurement scale

The Nutrient profiling model tool on the South African DoH's website (http://respond.za.net/current.html) was used (Addendum E) to calculate the nutrient profile score of each food and beverage product (National Department of Health, 2020). Once the nutritional information of all food and beverage products were obtained, it was then categorised by the researcher according to the FSANZ model. Products were classified in the appropriate categories, as indicated in Table 4 below (National Department of Health, 2020).

TABLE 4: FOOD ITEM CATEGORIES AND NUTRIENT PROFILE SCORING CRITERIA (NATIONAL DEPARTMENT OF HEALTH, 2020)

Category	Food items included	Scoring criteria to meet health claims
Category 1	All beverages excluding milk	Products with a final score of less than one meet health claim criteria
Category 2	All products (including milk, evaporated milk, and dried milk) not included in categories one and three Cheese and processed cheese products with a calcium content of less than 320mg per 100g	Final scores of less than four meet health claim criteria
Category 3	Cheese and processed cheese with a calcium content of more than 320mg per 100g All edible margarine and oil spreads Butter and edible oil	A final score less than 28 meets health claim criteria

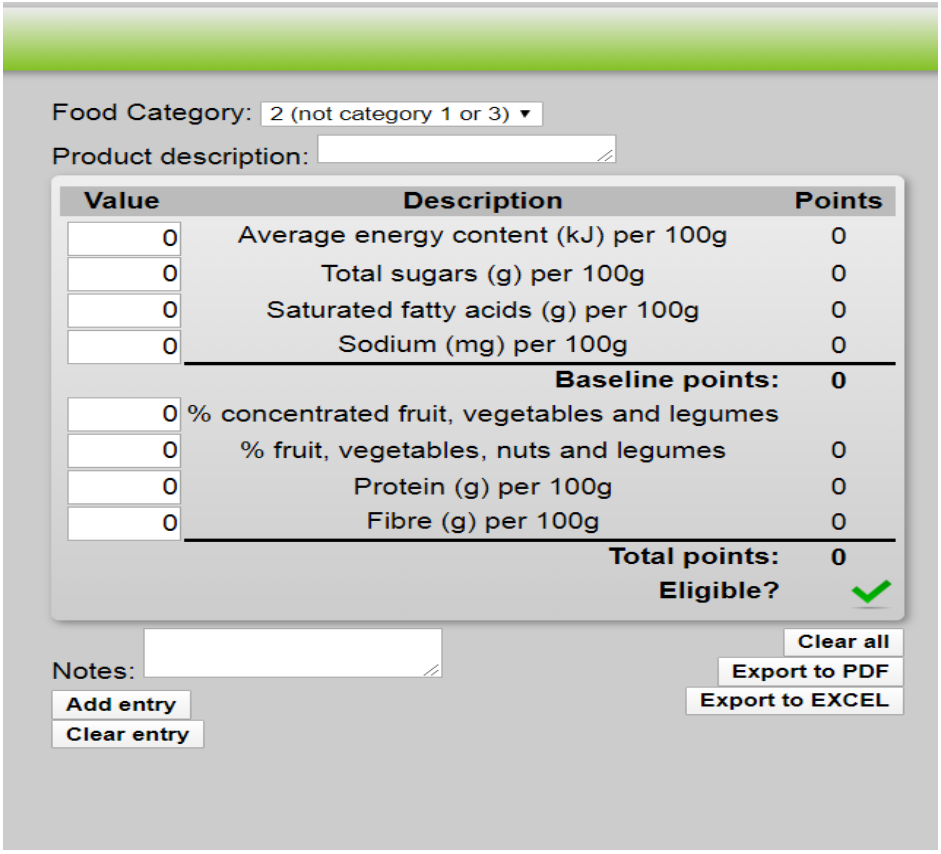

FIGURE 6: SANPM ONLINE NUTRIENT PROFILING CALCULATOR (NATIONAL DEPARTMENT OF HEALTH, 2020)

First and foremost, the correct category (Categories 1-3) for each product was pre-selected on the online calculator, as indicated in Figure 6 above. Next, the pre-captured nutrient compositions (protein, energy, saturated fats, total sugars, sodium, vegetable, fruit nut and legume content, and fibre) from the checklists (Addendum K) of each product was submitted into the calculator. The calculator then calculated the nutrient profiling score for each product, as well as indicated whether the final score was eligible to meet health/nutrition claims. Finally, using the final nutrient profiling scores as calculated by the online calculator, the average nutritional quality percentage scores could be determined. Once the nutrient profiling scores for the products sold by participating tuck shops has been calculated, the score was used to indicate whether or not they met health claims and was then coded by the researcher as either 'yes' (products that met the health claim according to the DoH nutrient profiling calculator as indicated via a green tick on the calculator) or 'no' (did not meet health claims as indicated by the red X by the calculator) (Addendum M).

Finally, the sum of products in each participating tuck shop that met the health claims (yes, coded products) was divided by the total amount of products sold in the participants tuck shops and then converted to a final percentage. This percentage score represented the nutritional quality

percentage score of the participating tuck shop, an example calculation of which is illustrated in Figure 7 below (data management section).

3.3 Validity

Validity is the ability of a measuring instrument to measure what the researcher has set to measure. It is the degree to which an instrument can measure what it has been predetermined to measure for appropriate analysis (Kumar, 2019). In this study, validity was achieved by employing expert reviews of content and face validity. A conceptual framework guides this research. The concepts of this study were described and explained in a comprehensive literature review, and this ensured theoretic validity.

Content validity is when the elements of the construct are represented by the measuring instrument used in the study (Kumar, 2019). Thus, the questionnaire needed to measure and represent all the questions necessary to study the problem. Content validity for this study was achieved with the help of a conceptualisation and operationalisation table. This was done to ensure that all significant dimensions and indicators were identified and represented in the questionnaire.

- **Content validity of the questionnaire:** the questionnaire used in this study was developed and validated by Fisher *et al*., (2019) to determine nutrition competency. The scale provided questions and themes that the researcher can use to study tuck shop owners' nutrition competencies. Content validity was tested and ensured during the development of the tool using Rasch Modelling, whereby it was tested on a sample of adult South Africans to ensure validity and reliability (Fisher *et al.*, 2019). This was done to ensure the scale used for measurement achieved the set objective of the study.
- **Content validity of the nutrient profiling model:** the SANPM model on the DoH website was tested and validated during the development of the tool, using five different methodologies to assess the applicability to the South African situation (National Department of Health, 2020). Content validity was tested and developed using the WHO guidelines. These validity tests were done during the development of the tool. Content validity was evaluated by examining the consistency between the nutrients/food components included in the models versus those considered by the WHO to be of immediate importance in promoting health and preventing disease (Poon *et al.*, 2018). It was concluded that the nutrient profiling model had good content and convergent validity, and it produced reliable food item classification which corresponded with the SAFBDGs and was supported by the views of nutrition experts in South Africa (Wicks, 2012; Wicks

et al., 2016; Wicks *et al.*, 2020). Content validity for this study was ensured by using the online calculator on the DoH website to determine the nutritional quality of available foods. Based on the evidence of the content validations done in previous studies, it was recommended as an excellent screening tool to assess the healthiness of various products (Poon, 2018; Wicks *et al.*, 2020). Content validity is also ensured as all data was retrieved from product labels and Condensed Food Composition Tables for South Africa (SAFOODS, 2018).

Face validity refers to a measurement procedure that appears to measure what it claims to measure (Kumar, 2019). This form of validity is used to ensure that there is a logical link between the measuring instrument (i.e., nutrition competency questionnaire and nutrient profiling model) and the set objectives of the study. The advantage of face validity is that if the respondents understand the aim of the questionnaire, the respondents read with more context, which could provide more accurate answers (Kumar, 2019).

- **Face validity of questionnaire:** to ensure face validity, the questionnaire had a cover letter (Addendum A) that explained this study's purpose. To avoid errors during the data collection, extra care was taken during the questionnaire's design, appearance, format, sequence, and wording. In addition, a pilot study was performed to ensure that questions were correctly interpreted.
- **Face validity for nutrient profile model:** To avoid error during the data collection, extra care was taken during the design of the observational checklists.

3.4 Reliability

Reliability indicates a measure of internal consistency and dependability to which the research can be repeated and still obtain the same results (Kumar, 2019). Reliability is defined as the capacity of a research tool to produce the same results or responses from different respondents (Kumar, 2019). Thus, it is important to collect information more than once with the same measuring instrument to compare results and determine the similarity. This research was carried out in a way that was reliable and valid, which ensured the study's credibility.

- **Reliability of the nutrient profiling model:** accuracy and reliability were achieved by using the online nutrient profiling model on the DoH's website to eliminate the possibility of human error. Accuracy and reliability of nutrient composition of food and beverage products were ensured by retrieving this information directly from product labels or from Condensed Food Composition Tables for South Africa (SAFOODS, 2018).

To further ensure the internal reliability of the nutrient profiling model, data obtained from the pilot study was evaluated and used to refine checklists and processes.

- **Reliability of the questionnaire:** to ensure internal reliability of the questionnaire, data obtained from the pilot study was evaluated and used to refine the questionnaire and protocols. Reliability was also ensured by collecting data on the same day, i.e., tuckshop owners completed the questionnaires while checklists were completed by the researcher simultaneously. In addition, during the time of the visit, the researcher completely stood back and did not interfere while questionnaires were being completed, which ensured that no bias took place that would have potentially jeopardised the results.

3.5 Pilot study

The researcher conducted a pilot study to ensure validity and reliability of the questionnaires, checklists and processes for the main study (Hassan, Schattner & Mazza, 2006). It also allowed the researcher the opportunity to identify any potential problem areas and insufficiencies in the research instruments and protocol prior to implementation of the full study (Hassan *et al.*, 2006).

A pilot study was conducted prior to the actual fieldwork and data collection. A sample of two primary school tuck shops was purposively selected in Tshwane Pretoria. The two schools selected and participated in the pilot study were not included as part of the main study sample. Primary school tuck shops in schools classified as higher in socioeconomic standing, with similar characteristics to the targeted group, were selected (Bell, Whitehead & Julious, 2018; Connelly, 2008; In, 2017). A sample size of two is considered appropriate, following the rule of thumb stated in Connelly (2008). The nutrition competency questionnaire (Addendum C) was tested to confirm that the questions were clear, unambiguous and appropriate for the study population. The pilot study also allowed for the practice of methods that were to be used in the main study, including observation and completion of checklists. The researcher recorded the time needed to complete the questionnaires and the length of time needed to complete the observational checklists.

Following the results of the test pilot, all measuring instruments were adjusted to be used in the main study to ensure reliability and validity. After the completion of the pilot study, no alterations were made to the questionnaire.

However, some simplification was needed to improve the flow of the checklists to allow for greater ease with capturing data. Furthermore, practical issues were identified, such as access to school premises and health protocols due to the outbreak of the COVID-19 virus. This encouraged the researcher to visit tuck shops and capture the data in person due to low response rates of online questionnaires during the time of the level five lockdown.

The pilot study also highlighted the importance of confirming dates in advance to ensure easier access to school grounds and to allow for higher response rates. Health protocols were also adjusted to ensure the safety of not only the researcher but also the participants.

3.5.1 COVID-19-related protocols used during visits

The procedure and protocol followed by the researcher on the day of the tuck shop visit were as follows. The researcher sanitised the questionnaire the morning of the visit and placed it into a protective plastic, along with a sanitised pen. No school premises were entered without a mask, which was worn at all times by the researcher to cover both their mouth and nose. Before entering the participant's tuck shop, the researcher sanitised their hands thoroughly and took extra caution to social distance a minimum of 1,5 meters from the participant. The researcher carried a potable sanitiser with them to each of the visits and was diligent with sanitising both their and the participant's hands before handing over the questionnaires. The researcher then handed over the questionnaire that had been kept safe in a sealed sanitised plastic sleeve, along with a sanitised pen, to the participant for use. While the participant was busy completing the questionnaire, the researcher proceeded to take notes and fill out the observational checklists with permission from the participant. The researcher was mindful of practising good social distancing and always stayed a minimum of 1,5 meters from the participant. The researcher was also mindful of sanitising their hands before and after picking up or touching any product in the participant's tuck shop. Once data was collected, and the completed questionnaire handed back, the researcher sanitised it once more and placed it back into the protective plastic sleeve. All school health and safety protocols were followed to ensure the participant and researcher's safety; these protocols included taking temperatures and filling out check-in books at security before entering the school premises. It is also to be noted that in the event that the researcher or participant had not been feeling well that the visit was rescheduled for another day.

3.6 Operationalisation

An operationalisation table is used as a guide on how the instruments will be used to achieve the objectives of the study

TABLE 5: CONCEPTUALISATION AND OPERATIONALISATION TABLE

SUB-OBJECTIVE	DIMENSIONS	INDICATORS	MEASUREMENT	DATA ANALYSIS
Primary objectives: At quintile five public and private primary schools in Tshwane Region 3, assess and describe the following:				
1.1 Nutrition competency score of tuck shop owners	Nutrition Knowledge, Skills and Behaviour	Nutritional requirements Nutrient composition Healthy food identification Food policies, SAFBDG	A hard copy Food Literacy Questionnaire was given to the participants to fill out during tuck shop visits Q. 1-31 (Addendum C)	Percentage values, mean values & descriptive statistics using SPSS
1.2 Nutritional quality of food and beverage products sold at tuck shops	Nutritional quality of Products (Category 1-3)	Nutrients (Protein, Carbohydrate, Saturated, fats, Sodium, Sugar, Fibre)	Observational Checklists (Addendum G) SANPM calculator on the DoH website (Addendum E)	Percentage values, mean values & descriptive statistics using SPSS
1.3 Relationship between the nutrition competency score of tuck shop owners and nutritional quality of food and beverage products sold.				Pearson's correlation
Secondary objective:				

At quintile five public and private primary schools in the Third Region of Tshwane, explore the relationship between:				
2.1 Nutrition-related training and the nutritional quality of food and beverage products sold at tuck shops	Training and Guidelines Nutritional quality of Products (Category 1-3)	Education Good Tuck shop Practises, SAFBDG	Hard copy Questionnaire given to the participants to fill out during tuck shop visits Q. 263-28 (Addendum C) SANPM online calculator (Addendum E)	Percentage values, mean values, Pearson's correlation, independent t-tests, and Pearsons Chi-square statistics
2.2 Nutrition policies and the nutritional quality percentage score of food and beverage products sold at tuck shops.	Policies and Guidelines Nutritional quality of Products (Category 1-3)	Policy awareness, Good Tuck shop Practises, SAFBDG	Hard copy Questionnaire given to the participants to fill out during tuck shop visits Q. 29-33 (Addendum C) Online SANPM calculator on DoH's website (Addendum E)	Percentage values, mean values, Pearson's correlation, independent t-tests, and Pearsons Chi-square statistics

3.7 Data management and analysis

3.7.1 Data management

During the analysis of the observations and questionnaires, unique numbers were assigned to the names of participants and the schools, which ensured anonymity.

Following the collection of quantitative data via the nutrition competency questionnaires and observational checklists, the following was implemented prior to data analysis:

- **Coding:**
    - Each question in the questionnaire was coded manually, using predetermined nominal codes on the questionnaire (Addendum J). Questions/statements were coded to reflect yes as the correct answer. Participants scored one point for each correct answer identified whereby total combined scores for each section knowledge, skills, and behaviour represents the participants final and total nutrition competency scores.
    - Each food and beverage product were coded using predetermined nominal codes (Addendum M). In this study, healthy food and beverage products that met the nutrition/health claims according to the online SANPM calculator available on theDoH's website (as indicated with a green tick) was codded as 'Yes' products and unhealthy food and beverages that had not met the nutrition claims according to the online SANPM calculator (as indicated with a red cross) and was codded as 'No' products. The sum of products coded as yes was divided by the total amount of products sold in the participants tuck shops and then converted to a final percentage. This percentage score represented the nutritional quality percentage score of the participating tuck shop, an example calculation of which is illustrated in Figure 7 below.
- **Data recording and safekeeping:** Once the questionnaires and checklists were completed, the researcher immediately recorded and transferred their responses to Qualtrics for safe keeping and ease of analysis. Qualtrics is a simple to use web-based survey tool to conduct survey research, evaluations, and other data collection activities. Capturing the data using an online platform also allowed for better organisation and immediate access to the data. The researcher assured privacy during data collection and only allowed participants to take part in the study if they completed and signed the relevant, informed consent form. The researcher was responsible for the safekeeping and securing of all records during and after the study.

- **Data capturing and preparation:** A Microsoft Excel spreadsheet was used for capturing data and can be seen in Addendum M for the nutritional competency questionnaire. Nutritional information obtained from the checklists and labels of food and beverage products sold in tuck shops was captured and illustrated (Addendum K) using a Microsoft Excel spreadsheet in a similar way as shown in Table 5 below, which has been adapted from literature (Wicks, 2012). Checklists were designed in such a way that products sold would already be captured within their respected nutrient profiling categories (Categories 1-3). In addition, categories were further broken up into sub-categories for ease of data collection. These sub-categories within the main categories were beverages, homemade meals, homemade confectionaries/sweets, snack items such as chips, and sweets/chocolates. Once all the nutritional data was obtained and categorised, it was measured using the online nutrient profiling calculator measurement tool (SANPM) to determine final modifying and baseline points, which indicated whether food and beverage products were considered as healthy or not (i.e., having met the nutrition/health claim or not).
- **Data cleaning:** Data were checked to identify possible errors, including inconsistencies, missing values, values out of a plausible range or disagreement within the answers to related questions.
- **Graphical display of data:** All collected data was initially graphically displayed to summarise variables. Frequency tables and histograms were used and simplified the identification of outliers and investigation of characteristics of the data.

TABLE 6: EXAMPLES OF FOOD AND BEVERAGE PRODUCT CLASSIFICATION BY THE NUTRIENT PROFILING MODEL

Food Name		Average energy		Saturated fatty acids		Total sugars		Sodium (mg)		Base line points	% Concentrated fvln		% fvln		Protein (g)		Fibre (g)		Final Score	Healthy ?
Category 1	Original quantity	100g/100 ml	Points	100 g	Points	100g	Points	100g	Points		%	Points	%	Points	100g	Points	100 g	Points		0- yes, 1- No
Beverages		(kj)																		
Powerade	500 ml	77	0	0	0	4.1	0	13	0	0	0	0	0	0	0	0	0	0	0	Yes
Boss Sports	500ml	91	0	0	0	4.5	0	30	0	0	0	0	0	0	0.4	0	0	0	0	Yes
Sparkling water	500ml	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	Yes
Still water	500 ml	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	Yes
Flavoured water	500 ml	98,8	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	Yes

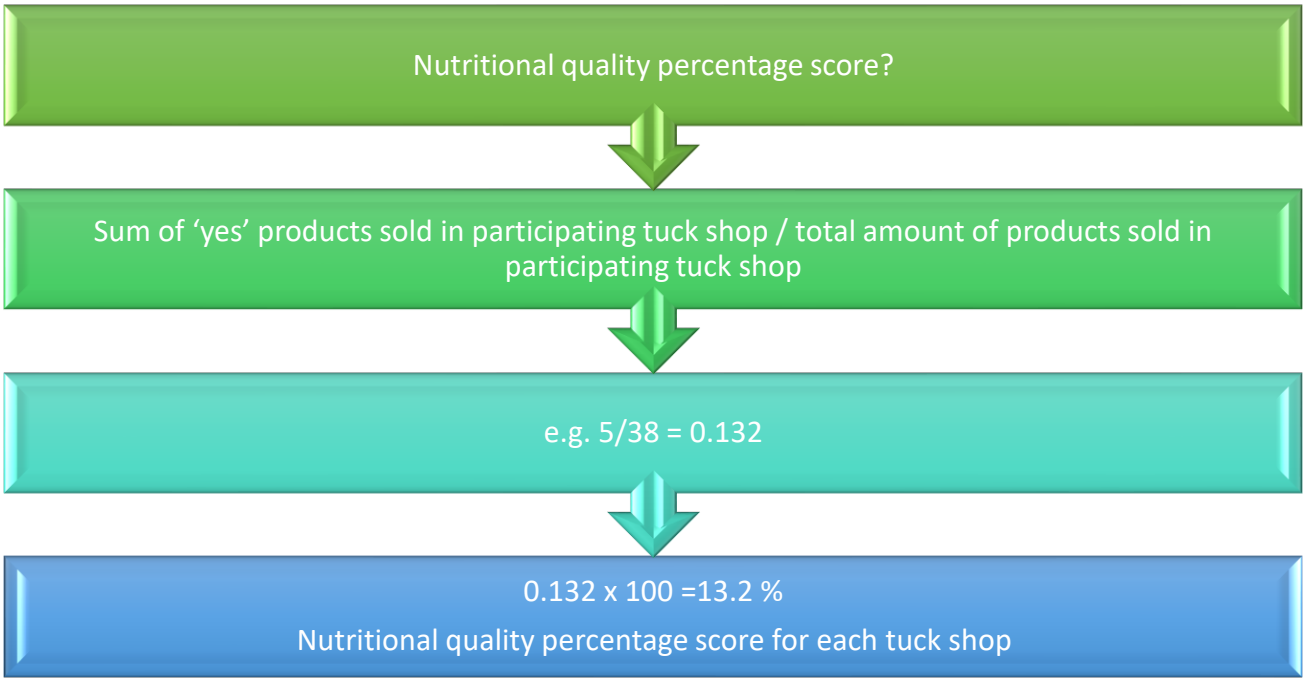

FIGURE 7: EXAMPLE OF NUTRITIONAL QUALITY PERCENTAGE SCORE CALCULATION

3.7.2 Data analysis

The statistical program IBM SPSS Statistics V26 (South Africa) was used to analyse the questionnaire's responses using descriptive and inferential statistics. All statistical analyses were performed using the SPSS program. The significance level was set at 0.05 for all analyses.

- **Descriptive statistics:** Descriptive statistics will help interpret and make sense of results to easily understand the key concepts by capturing and presenting data/results in terms of percentages and mean values (Kumar, 2019; Loeb, Dynarski, McFarland, Morris, Reardon & Reber, 2017). Descriptive statistics were used to summarise and describe data. Results from the questionnaire and observational checklists were presented in the forms of percentages, graphs, data distributions, and histograms where applicable. This information was tabulated and described using descriptive statistics (SPSS).
- **Inferential statistics:** Inferential statistics are used to go beyond describing the characteristics of the data. Allua and Thompson (2009) recommend inferential statistics for researchers who want to go beyond just describing their data but make generalisations and estimations using the results (Allua & Thompson, 2009).
    - **Pearson's correlation analysis:** to determine if a statistically significant relationship could be found between two continuous variables. This analysis was used to determine the relationship between the continuous variables and presented

as r- values at 0.05 level of significance. The Pearsons correlation was used to determine the relationships between:

- Nutrition competency scores and nutritional quality percentage scores
- Nutrition-related training and nutrition competency scores
- Nutritional quality percentage scores and nutrition-related training received
- Nutrition-related training and nutrition policy implementation
- Nutrition competency scores and the highest level of education
- Nutritional quality percentage scores and the highest level of education
- Nutritional quality percentage scores and nutrition policy implementation
- Nutritional quality percentage scores and types of nutrition policies implemented

- **The Chi-square statistic**: is a tool designed to analyse group differences when the dependent variable is measured at a nominal level (McHugh, 2013; Temple *et al.*, 2006a). Relationships between categorical and continuous variables were measured and presented as an X^2 at a 0.05 significance level. Contingency tables and the non-parametric Chi-square test for independence test (Pearson Chi-square) was used to measure the following relationships between categorical and continuous variables:
  - Nutrition-related training and nutrition-related policy awareness and implementation.
  - Nutrition-related training and decisions about what products to sell
- **Independent t-tests:** These tests are used to compare the means of two groups and can be used when the two groups under comparison are independent of each other. Mean differences between categorical and continuous variables were measured and presented at a 0.05 significance level. Independent t-tests were used to measure statistical differences between the following groups
  - Nutritional competency scores between demographic variables, namely: gender, income, education, the highest level of education
  - Nutritional quality percentage scores between demographic variables, namely: gender, income, education, the highest level of education

A summary of the tests used to analyse the data in the study can be found in Table 7

TABLE 7: DATA ANALYSIS TABLE

Objective	Variables required for the analysis	Statistical tests to be applied
Assess and describe the Nutrition competency (as a dimension of food literacy) score of tuck shop owners in terms of nutritional knowledge, skills, and behaviour.	Nutrition competency scores Demographic Variables	Descriptive statistics: Means, percentages, graphs, data distributions, and histograms Independent t-tests Pearson's Correlation analysis
Assess and describe the nutritional quality of food and beverage products sold at tuck shops.	Nutritional quality percentage scores as calculated by the SANPM calculator Demographic variables	Descriptive statistics: Means, percentages, graphs, data distributions, and histograms Independent t-tests
Assess and describe the relationship between the nutrition competency score of tuck shop owners and the nutritional quality of food and beverage products sold.	Nutritional quality percentage scores Nutrition competency scores	Pearson's Correlation analysis
Explore the relationship between nutrition-related training and nutritional quality of food and beverage products sold at tuck shops	Nutritional quality percentage scores Nutrition-related training variables Nutrition competency scores	Pearsons Chi-Square Pearsons Correlation analysis Independent t-tests
Explore the relationship between nutrition policies and the nutritional quality of food and beverage products sold at tuck shops	Nutritional quality percentage scores Nutrition-related policy variables Nutrition competency scores	Pearsons Chi-Square Pearsons Correlation analysis Independent t-tests

3.8 Ethical considerations

The participants involved in the study were protected, and an evaluation of the study was done to ensure it complied with ethics. Ethics can be defined as an acceptable set of principles and morals expected from a researcher towards study respondents. It seeks to make sure that the research is done in an acceptable manner and the respondents are not violated in any way. It seeks to make sure the study participants are protected from harm, aware of the expectations of the study and the intentions of them participating. The respondents must be assured of discretion and that the choice is continually available to participate or withdraw from the study at any time (Cohen *et al.*, 2013; Doyle & Buckley, 2014; Kumar, 2019).

Once the research proposal for this study was approved by the Department of Consumer and Food Sciences, it was submitted to the University of Pretoria's ethics committee for approval and approved (NAS189/2020) before data was collected (Addendum N). Consent for participation was requested from all participants, and concerns were addressed before the study proceeded (Addendum A). The data collection instrument did not require participants to disclose their identity, and their identity was not used on the results, which ensured their anonymity. The aims and objectives of the study were communicated to the participants for transparency. School governing bodies was approached to seek permission to conduct the study at the tuck shop on the school's premises.

3.9 Conclusion

In this chapter, attention was given to the design and the methodology of the research study. The study area and population were discussed, as well as the procedures for administering the research questionnaire and completing the checklists. The site visits and observations that were undertaken, as well as the data collection, was highlighted. Ethical considerations taken into account during the study have been stipulated, and some constraints that the researcher was faced with have been indicated. Therefore, this chapter provides the report on the procedures taken to determine tuck shop owners' nutrition competencies by exploring and discussing the products sold in their tuck shops and determining the tuck shop owner's competency and nutritional quality percentage scores of their tuck shops.

CHAPTER 4

PRESENTATION OF THE RESULTS

This chapter documented the results of this study as obtained from the statistical analysis of the responses given by the participants. The results were summarised in tables and graphs for straightforward interpretation and understanding. This chapter first presents the results and is then followed by Chapter 5, highlighting the discussion thereof.

4.1 Introduction

This section presents the results of the data gathered from the nutrition competency questionnaires and observations from the checklists. The results are categorised into four main sections, namely, demographic information of tuck shop owners, the nutrition competency scores of owners, the nutrient profiling scores of the food and beverages products that are sold and made available in primary school tuck shops and nutrition-related policies.

The results will thus be incorporated and presented in this chapter to reflect the specific research objectives.

4.2 Sample characteristics

This study sample included 33 tuck shop owners from across the Third Region of Tshwane. The distribution and representation of the participants between privately owned tucks shops at private and quintile five primary schools were seen to be reasonably equal as the researcher collected data from 16 private primary schools and 17 quintiles five public primary schools tuck shops.

4.2.1 Age and sex

Of the 33 participants, overall, 21,0% was male, and 78,0% was female. The majority of participants were around the ages of 55-64 (n=14), with the mean age category of 45 and 54 years. None of the participants was younger than 18 and older than 75 years of age, as indicated below in Figure 8.

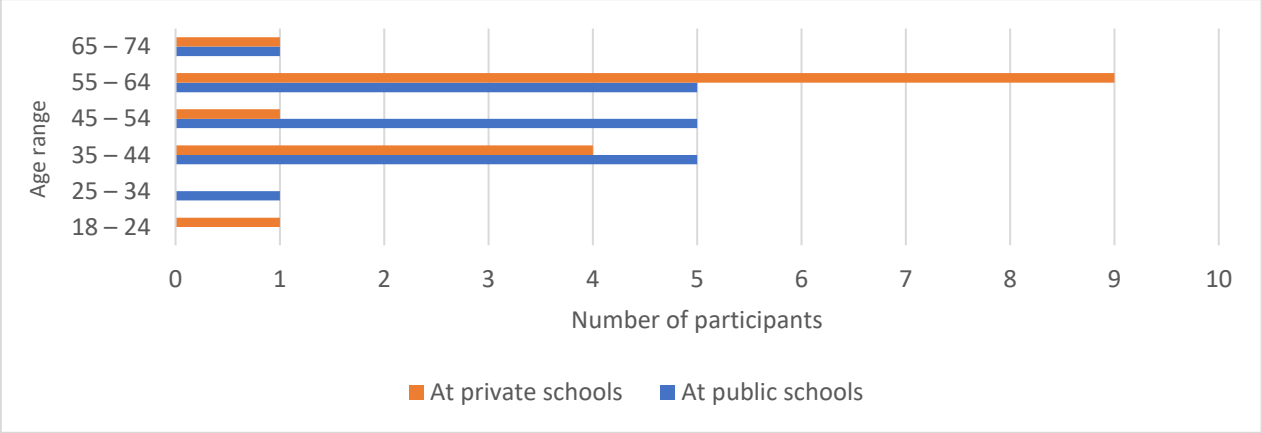

FIGURE 8: AGE DISTRIBUTION OF PARTICIPANTS AT PARTICIPATING TUCK SHOPS AT PRIVATE AND PUBLIC SCHOOLS (N=33)

4.2.2 Highest level of education

The highest educational level attained by the participants is indicated in Figure 9. All participants had attained some form of formal education, whereby post-matric qualification (excluding a bachelor's degree) was attained by 42,5% (n=14) of the participants and a bachelor's degree by 36,0% (n=12) of participants. As seen in Figure 9 below, most participants from participating private school tuck shops had a bachelor's degree, as opposed to participants from participating quintile five public school tuck shops, whose highest form of qualification was through post-matric certificates, short courses, or diplomas.

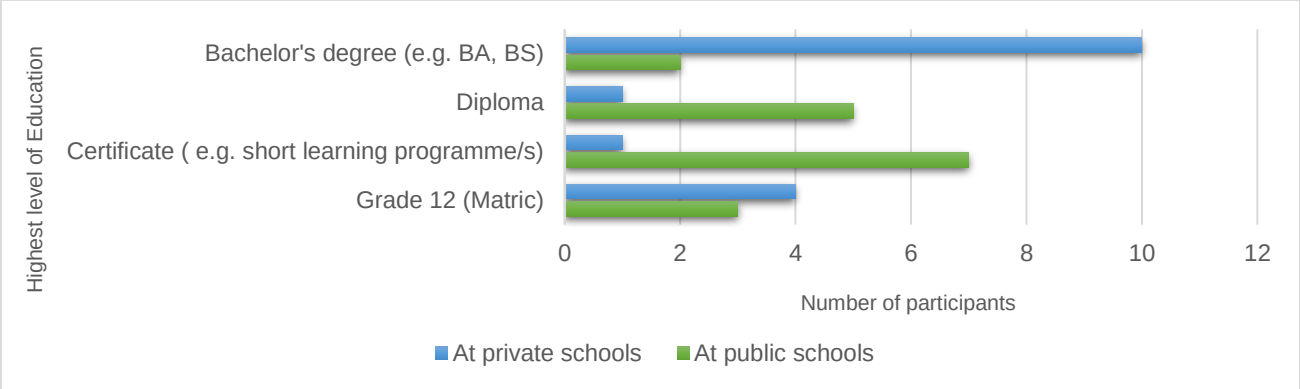

FIGURE 9: DISTRIBUTION OF HIGHEST LEVEL OF EDUCATION OF PARTICIPANTS AT PARTICIPATING PRIVATE AND PUBLIC SCHOOL TUCK SHOPS (N=33)

4.2.3 Household income

The average household size of the participants was a mean value of 4, whereby two-thirds of participants (n=22, 66,6%) had a household size of between 1 and 4 members, with only one participant having a large household size of more than 7 members.

As illustrated in Figure 10, more participants from participating public school tuck shops (n=5, 15,1%) fell within the high-income bracket of earning R307 201 and above, while only (n=3, 9,0%) of participants from participating private school tuck shops fell within the high-income bracket of earning R307 201 and above. Furthermore, only 24,2% (n=8) of participants fell within the medium to high-income group, while more than half of the participants (n= 21, 63,6%) fell within the low-income groups, only earning between R10000 and R19 999.

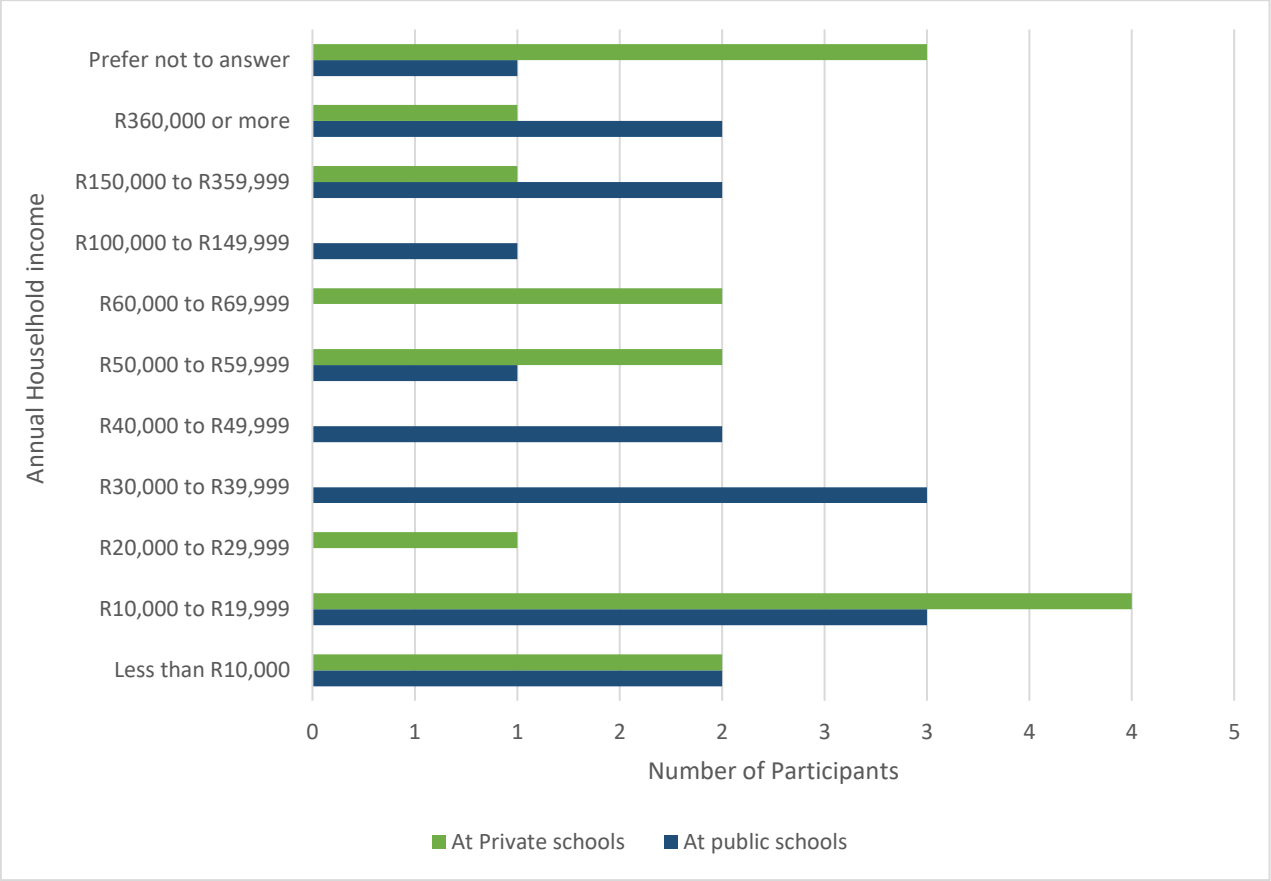

FIGURE 10: DISTRIBUTION OF ANNUAL HOUSEHOLD INCOME OF PARTICIPANTS AT PARTICIPATING PRIVATE AND PUBLIC SCHOOL TUCK SHOPS (N=33)

4.3 Nutrition competency scores of participants

This section presents a summary of the analysed quantitative results obtained from the nutrition competency questionnaire.

4.3.1.1 Nutrition competencies relating to participants' nutrition knowledge

According to the results of this study, the participants mean nutrition competency relating to nutrition knowledge was 81,8%. As seen in Figure 11 below. Participants were fairly knowledgeable about the macronutrients, as a mean of n=28 (84,8%) participants were able to identify the correct answers for protein (question 6) and carbohydrate (question 1, 2, 4, 7, 8, 10, 11, 14) related questions. At the same time, n=22 (66,6%) of the participants correctly answered the nutrition knowledgeable question related to the macronutrient fat (question 13). Figure 11 further illustrates that most participants lacked the nutrition knowledge pertaining to the identification of healthy micronutrients (question 3) in food and beverage products, indicated by two-thirds of the participants (n=24, 72,7%) who did not know that salt is, in fact, not harmful when consumed in moderation. While more than half (n=18, 54,5%) of the participants viewed all added colours (question 5) in food and beverages products as bad/harmful. Lastly, participants were most knowledgeable about general health and wellbeing (question 9, 12) as n=30 (92,4%) were identified the correct answers.

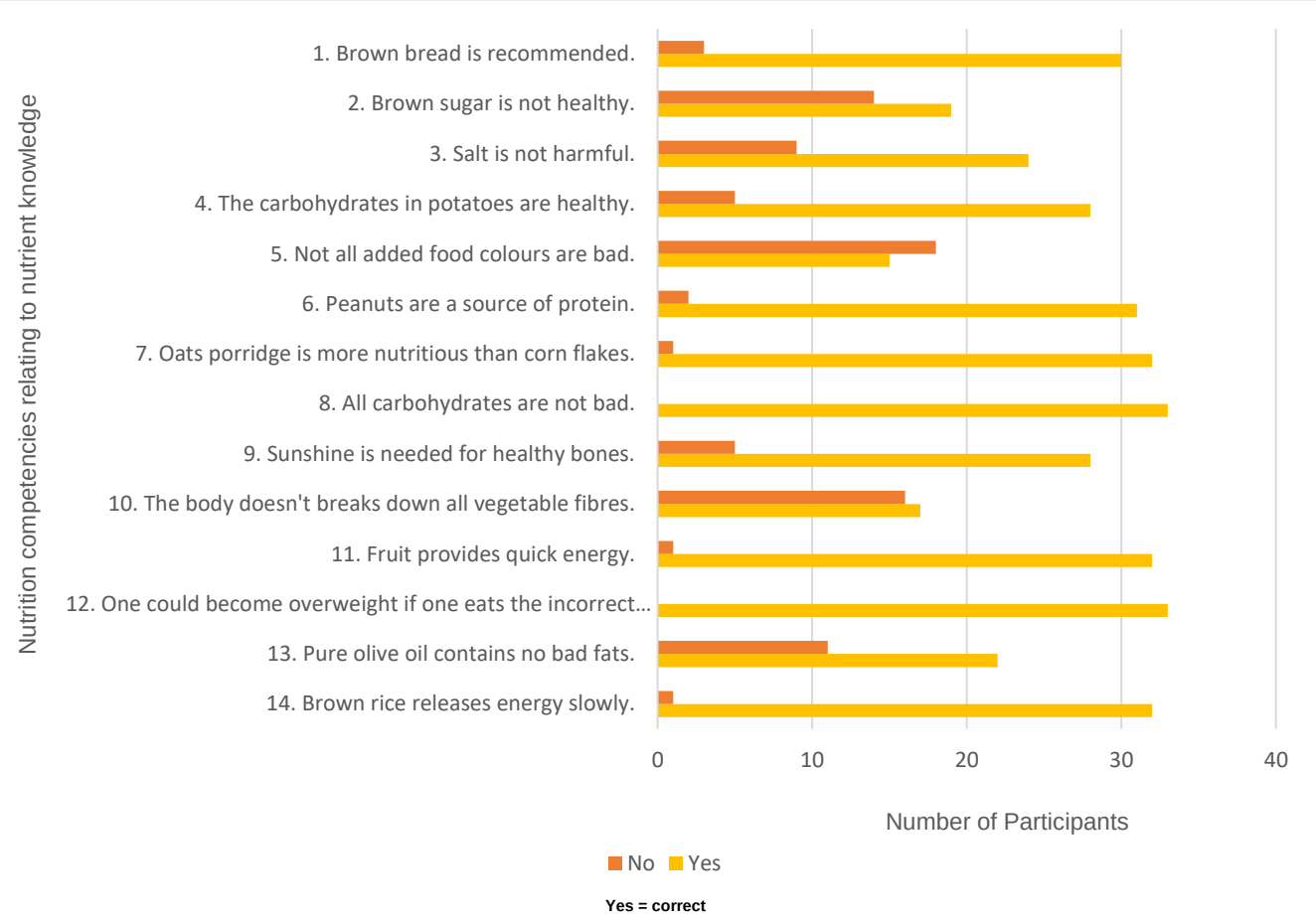

FIGURE 11: PARTICIPANT'S NUTRITION COMPETENCIES RELATING TO KNOWLEDGE OF NUTRIENTS (N=33)

A Pearson's correlation analysis was computed to assess the relationship between the nutrition competency scores of participants and their highest level of education. A positive correlation was identified (r=0,43, P=0,012).

TABLE 8: RELATIONSHIP BETWEEN TOTAL NUTRITION COMPETENCY SCORES AND HIGHEST LEVEL OF EDUCATION OF PARTICIPANTS (N = 33)

	Mean participants who received a post-matric qualification	Mean nutritional competency score[c] of food and beverage products sold	r[a]	P-value[b]
Total sample (N=33)	26	19,3 (77,2%)	0,43	0,012

[a] ***Pearson correlation coefficient***
[b] ***Level of statistically significance***
[c] ***Nutrition competency score out of 25***

As seen in Figure 12 below, mean nutrition competency scores were higher among participants who had reported having obtained a post-matric qualification (Mean=19,84, 79,8%), while those who only attained matric as their highest form of education scored a lower score (Mean=17,57, 70,2%). No other statistical differences (P>0.05) were found between nutritional competency scores of demographic variables using independent t-tests and Pearson's correlation analysis.

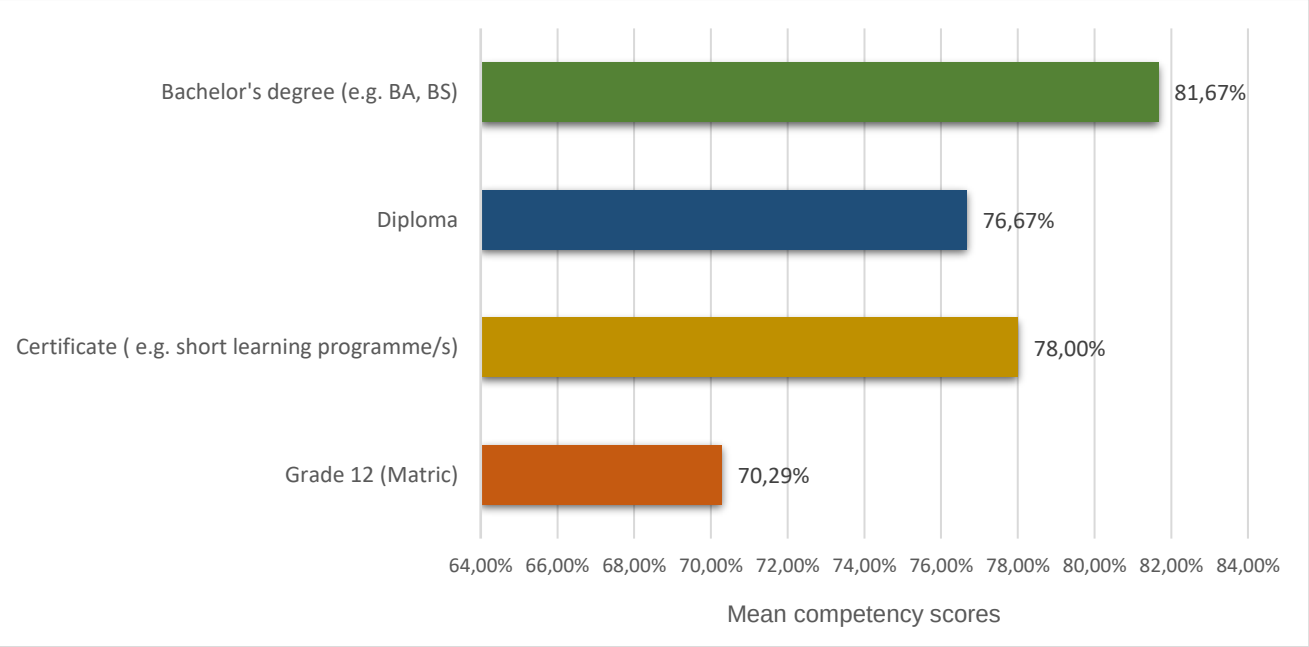

FIGURE 12: MEAN NUTRITION COMPETENCY SCORES BETWEEN HIGHEST LEVEL OF EDUCATION OF PARTICIPANTS

4.3.1.2 Nutrition competencies relating to participants nutrition-related skills

Participants managed to achieve an average nutrition competency score relating to skills of 80,0%. Most of the participants correctly answered the questions pertaining to the use of healthy fats (question 3) in cooking (n=27, 83,8%). However, when it came to skills pertaining to microwave cooking (question 1), participants had fewer skills in that particular area as indicated in Figure 13 below, whereby 48,5% (n=16) agreed with the statement, 'cooking vegetables in the microwave oven destroys the nutrients', while a little over half (n=17, 51,1%) of participants disagreed. Furthermore, almost all participants n=31 (93,9%), answered the question relating to vegetable cooking (question 5) correctly.

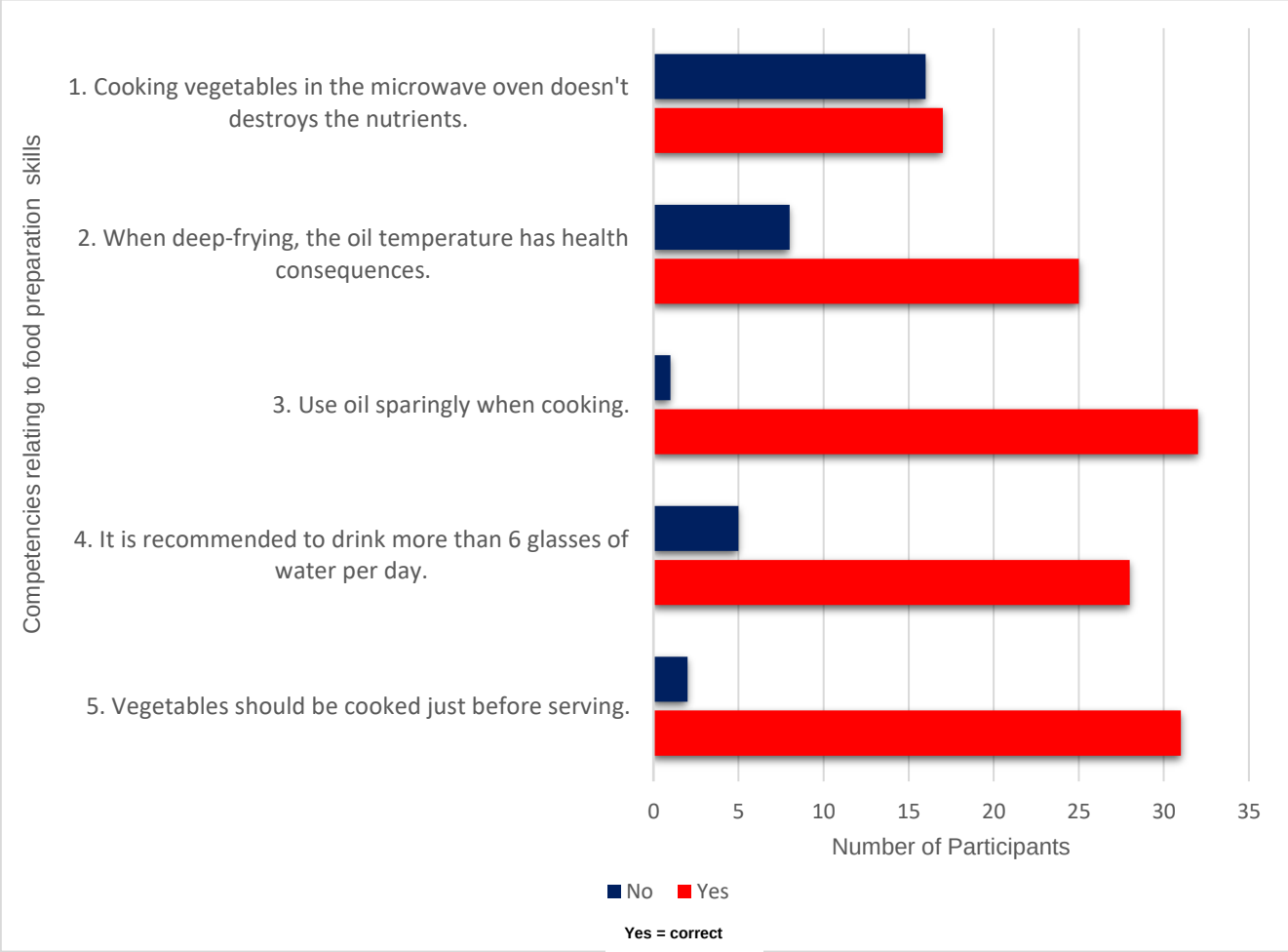

FIGURE 13: PARTICIPANT'S COMPETENCIES REGARDING NUTRITION-RELATED SKILLS (N=33)

4.3.1.3 Nutrition competencies relating to participants nutrition-related behaviour

As seen in Figure 14 below, the participants of this study achieved a mean nutrition competency score relating to nutrition-related behaviour of 87,8%. Participants (n=31, 93,9%) were able to correctly identify the importance of incorporating a variety of foods within their daily diets (question 4) and general healthy dietary habits (question 1, 2, 3, 6) as indicated by the correctly answered questions in Figure 14 below.

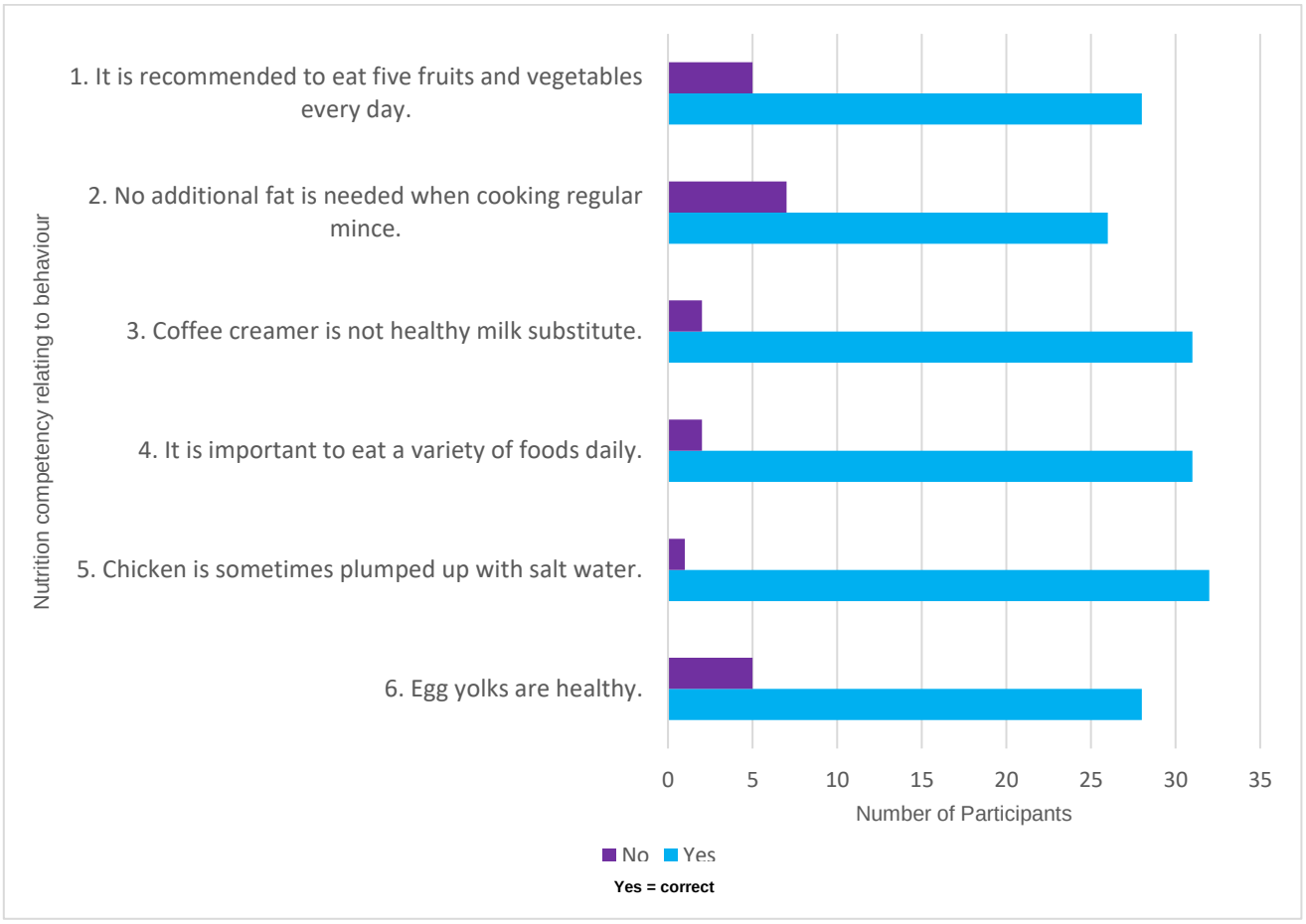

FIGURE 14: PARTICIPANTS NUTRITION COMPETENCIES RELATING TO NUTRITION BEHAVIOUR (N=33)

4.3.2 Total nutrition competency scores of participants

As seen in Figure 15 below, 18,1% (n=6) of participants achieved a mean nutrition competency score of 19 out of 25 (76,0%). More than half of the participants (n=27, 81,8%) managed to score a nutrition competency score of 72,0% (18/25) and above. The lowest nutrition competency score was reported as 56,0% (n=14) and was achieved by only one participant. Most participants achieved an overall nutrition competency score of between 72,0% (n=18) and 80,0% (n=20). The nutrition competency scores for participants from participating private school tucks shops was 19,6/25 (78,0%), while competency scores of participants from participating public quintile five school tuck shops average scores were 19,0/25 (76,0%).

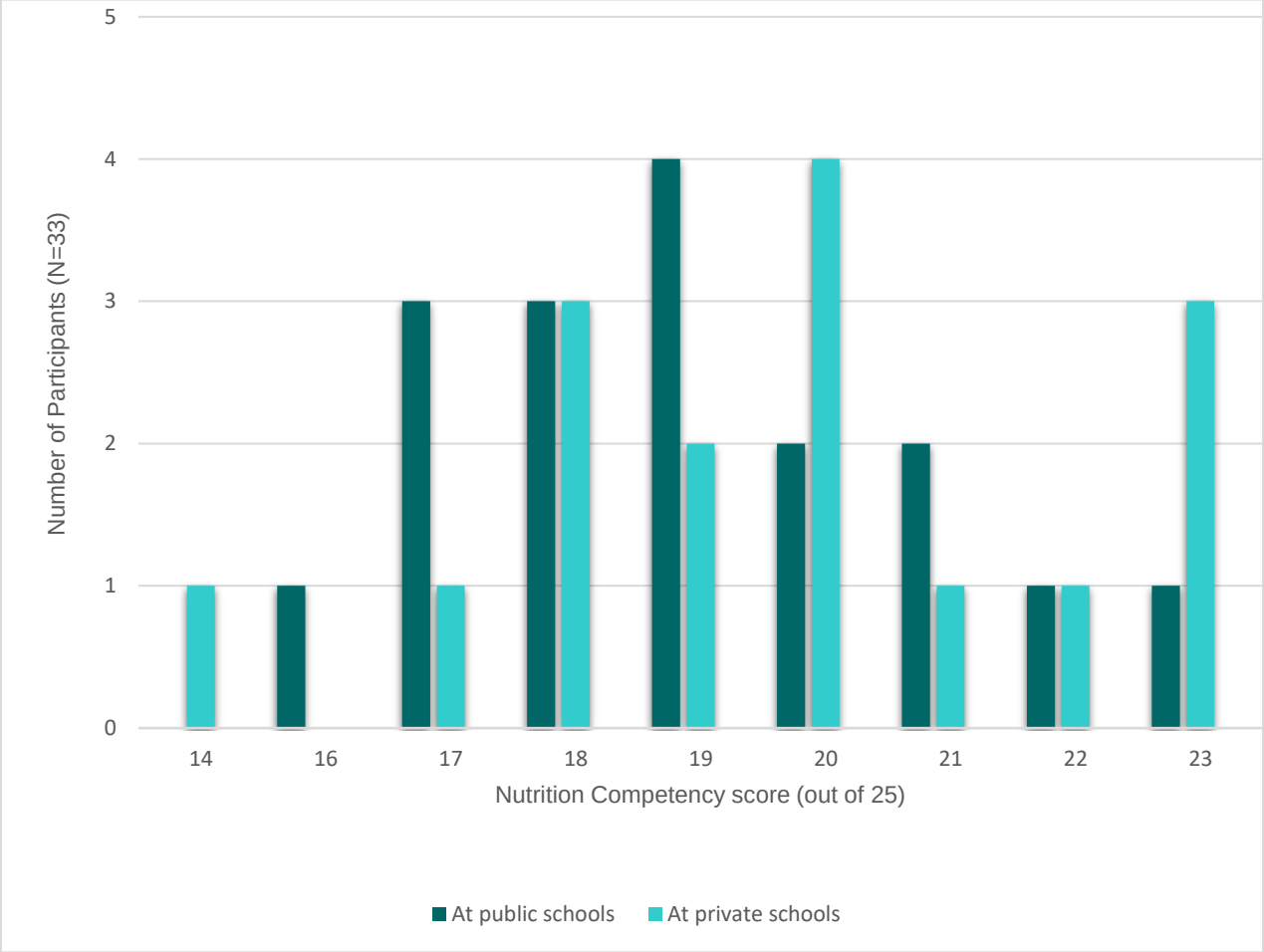

FIGURE 15: DISTRIBUTION OF NUTRITION COMPETENCY SCORES OF THE PARTICIPANTS (N=33)

4.4 Nutritional quality of food and beverage products sold in participating tuck shops

4.4.1 Nutritional quality percentage score, types and variety of foods and beverage products sold in participating tuck shops

Table 9 below illustrates the number of healthy and unhealthy products, as well as the nutritional quality percentage score achieved at each participating tuck shop. A total of 198 various products was found to be sold in the various participating tuck shops (the extensive results of nutrient profiling analysis using SANPM can be seen in Addendum E). The mean total of different food and beverage products sold in a tuck shop was 50, of which 26,0% (mean=13) was made up of beverages (Category 1) and 74,0% (mean=37) food products (Category 2).

As seen in Table 9 below, no Category 3 products were reported to be sold at the time of the researcher's visits to the participating tuck shops. A mean of 19 different types of healthy products were sold across the various nutrient profiling categories in participating primary school tuck shops. The total number of healthy types of beverage products (Category 1 products) sold in the participating tuck shops were n=19 (69,2%), and it was further found that beverages contributed an overall 47,0% to the total nutritional quality percentage scores of the participating tuck shops. Whereby food and snack products (Category 2 products) were found to make up the remaining 53,0% of products sold participating tuck shops. The mean healthy food products (Category 2 products) sold in participating tuck shops were n=10 (27,0%).

TABLE 9: NUTRITIONAL QUALITY PERCENTAGE SCORES, VARIETY AND TYPES OF PRODUCTS SOLD AT PARTICIPANTS' TUCK SHOPS (N=33)

Mean Nutritional quality percentage score of each tuckshop (%)	Variety and types of different healthy food and beverage products sold[a]	Percentage of healthy food and beverage products sold	Variety and type of different unhealthy food and beverage products[b]	Percentage of unhealthy food and beverage products	Variety and type of different Category 1 products (beverages) sold[c]	Variety and type of different Category 2 products (Food items) sold[c]	Variety and type of different products sold in tuck shop
13,2	5	13,2	33	86,8	8	30	38
17,4	4	17,4	19	82,6	7	16	23
23,8	5	23,8	16	76,2	1	20	21
25	18	25	54	75	15	57	72
25,4	18	25,4	53	74,6	18	53	71
26,3	15	26,3	42	73,7	16	41	57
26,3	15	26,3	42	73,7	14	43	57
26,9	28	26,9	76	73,1	20	84	104
29,3	17	29,3	41	70,7	14	44	58
29,7	19	29,7	45	70,3	16	48	64
30,4	21	30,4	48	69,6	15	54	69

32,2	19	32,2	40	67,8	12	47	59
32,3	21	32,3	44	67,7	18	47	65
35,1	26	35,1	48	64,9	17	57	74
36,4	16	36,4	28	63,6	11	33	44
36,6	15	36,6	26	63,4	10	31	41
36,8	14	36,8	24	63,2	11	27	38
40,9	36	40,9	52	59,1	30	58	88
46,4	13	46,4	15	53,6	8	20	28
47,2	17	47,2	19	52,8	15	21	36
47,3	26	47,3	29	52,7	14	41	55
48,3	29	48,3	31	51,7	22	38	60
48,5	33	48,5	35	51,5	21	47	68
53	35	53	31	47	16	50	66
53,2	25	53,2	22	46,8	13	34	47
56,6	30	56,6	23	43,4	15	38	53
56,8	21	56,8	16	43,2	15	22	37
57,5	23	57,5	17	42,5	12	28	40
57,5	23	57,5	17	42,5	10	30	40
60,8	31	60,8	20	39,2	17	34	51
68,8	11	68,8	5	31,3	6	10	16
69,2	9	69,2	4	30,8	2	11	13
95,0	19	95,0	1	5,0	12	8	20

[a] Healthy products, those with a final nutrient profiling scores that met the health claims requirement within their respected categories according to the DoH nutrient profiling calculator and was coded as 'Yes' product (addendum F)
[b] Unhealthy products, those whose final nutrient profiling scores did not meet the health claims within their respected categories according to the DoH nutrient profiling calculator and was coded as 'No' products (addendum F)
[c]Category 1 products are products classified by the SANPM model as beverages (excluding milk products)
[d]Category 2 products are products classified by the SANPM model as all products (including milk, evaporated milk, and dried milk) not included in categories one and three. As well as cheese and processed cheese products with a calcium content of less than 320mg per 100g

Figure 16 below features a summary of the various products sold in participating primary school tuck shops, as sub-categorised under their respective nutrient profiling categories. These sub-categories included beverages, homemade meals, homemade confectionaries/sweets, snack items such as chips, and sweets/chocolates. Of the 198 different food and beverage products sold in participating tuck shops, 24,2% (n=48) was made up of beverages, 33,8% (n=67) homemade food products, 16,1% (n=32) snack items such as chips and biscuits and 25,2% (n=50) sweets and chocolates (Addendum F).

As indicated in Figure 16 below, the most considerable portion of products sold in participating tuck shops was made up of sweets and chocolates (26,2%), with the second-largest portion being beverages (25,2%). Fruits and vegetables were shown to make up the smallest portion of participating tuck shops.

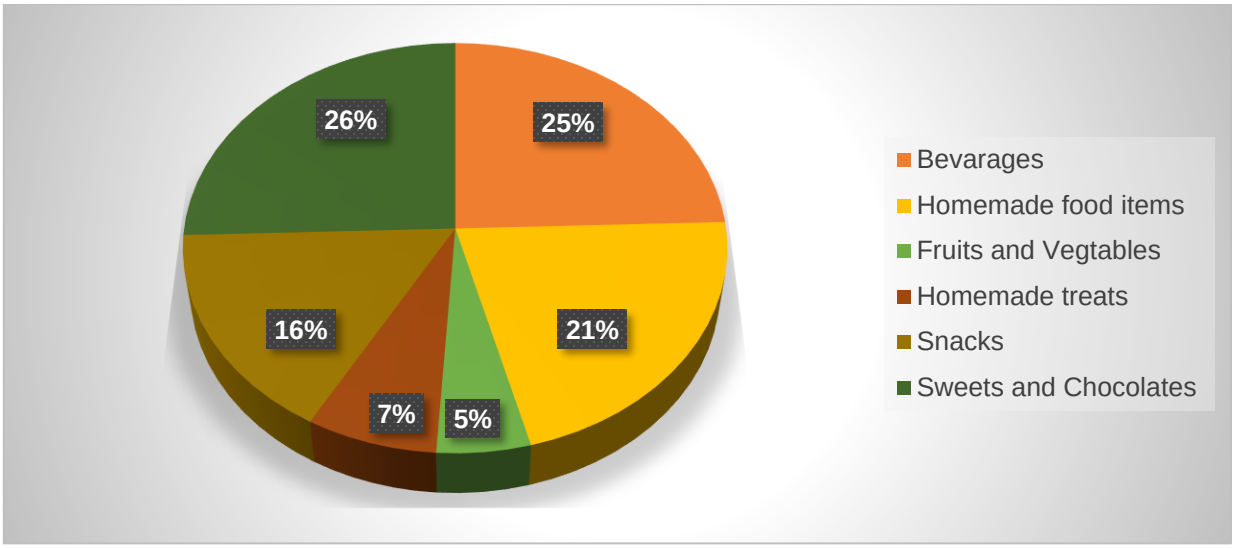

FIGURE 16: DISTRIBUTION OF THE PRODUCTS SOLD IN PARTICIPANTS' TUCK SHOPS (N=198)

Figure 17 below features a summary of the various products sold in participating private and public quintile five school tuck shops. Of the 134 different food and beverage products sold in participating private school tuck shops, 29,1% (n=39) was made up of beverages, 20,0% (n=27) homemade food products, 14,1% (n=19) snack items such as chips and biscuits and 26,8% (n=36) sweets and chocolates (Addendum F). Participating public quintile five school tuckshops sold a total of 116 different products and was made up of 25,0% (n=29) beverages, 20,6% (n=24) homemade food products, 18,1% (n=21) snack items such as chips and biscuits and 25,0% (n=29) sweets and chocolates.

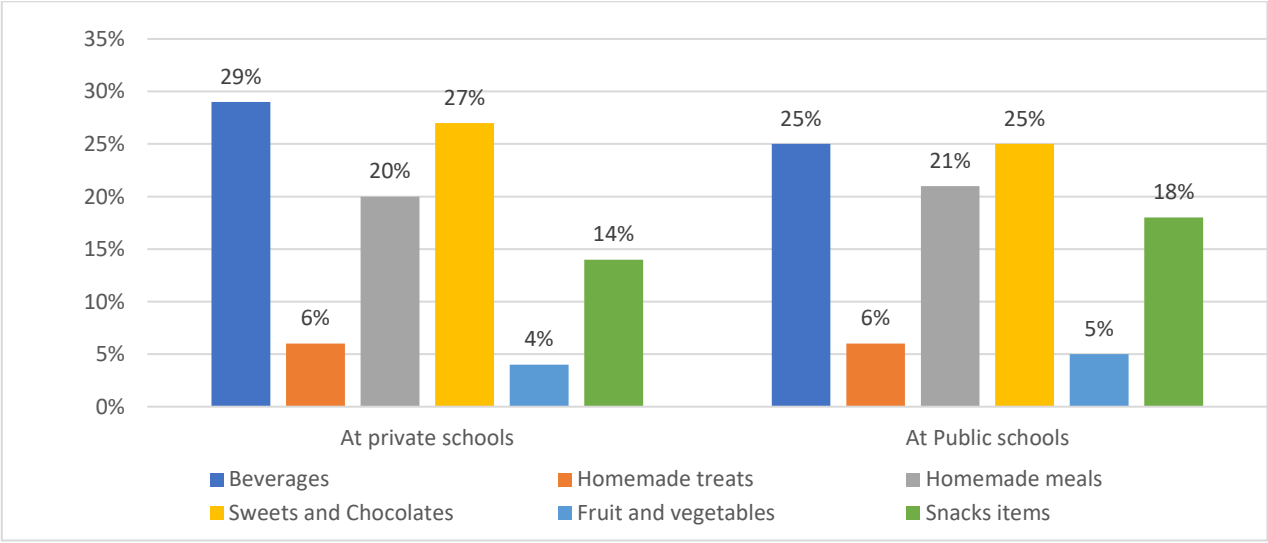

FIGURE 17: DISTRIBUTION OF THE PRODUCTS SOLD IN PARTICIPATING PRIVATE AND PUBLIC QUINTILE FIVE SCHOOL TUCK SHOPS (N=198)

The most available/stocked products sold in participating tuck shops can be seen in Figure 18 below. Still water was seen to be the most popular item, as it was sold in almost all (n=31, 93,9%) of the participating tuck shops, followed by a variety of toasted sandwiches, of which ham and cheese was found to be the most popular type (n=29, 87,8%). The soft drink Coca-Cola (n=27, 81,8%) was the next most popular, followed by Nestle Bar-one chocolates (n=27, 81,8%) and finally Maynard's jelly babies (n=25, 75,7%). Out of the five most popular food items stocked at participants' tuck shops, only two were considered by the DoH's online nutrient profiling calculator (SANPM) as healthy, i.e., meeting the health/nutrition claims.

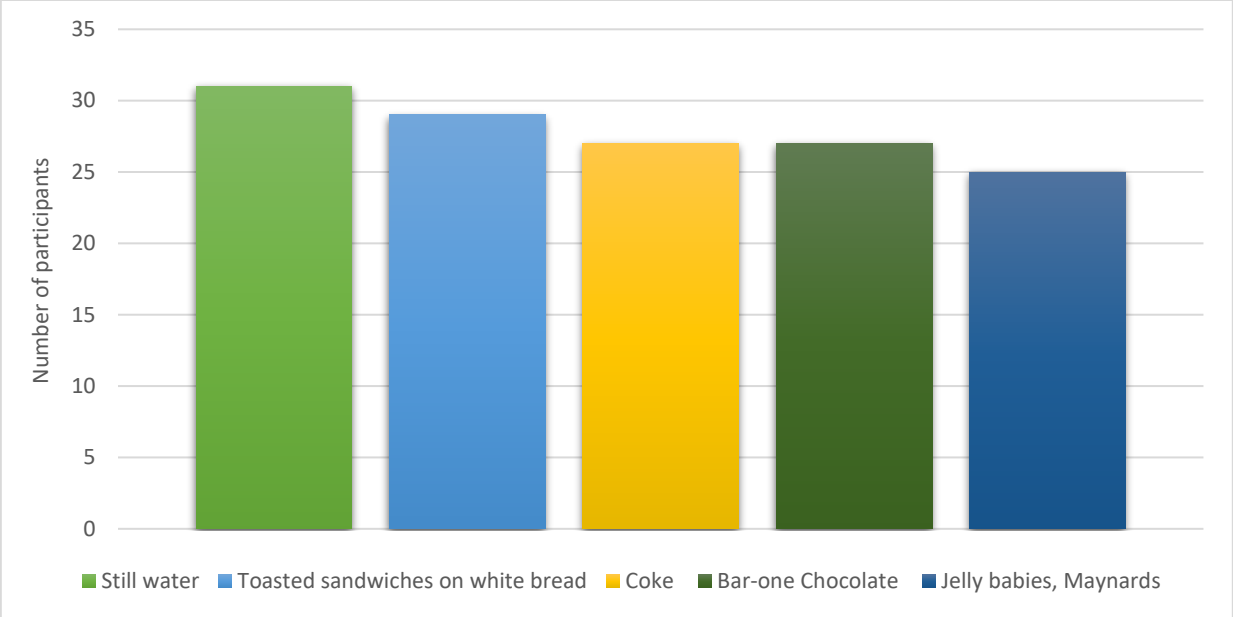

FIGURE 18: MOST POPULAR FOOD AND BEVERAGE PRODUCTS SOLD (N=33)

4.4.2 Nutritional quality percentage scores of participants

As seen in Figure 19 below, the mean nutritional quality percentage score of all participating tuck shops (n=33) was 42,2%. Whereby, the nutritional quality percentage score for participating tuck shops at private schools was 39,5%, while participating tuck shops at public schools scored 44,8%. No two participating tuck shops shared the same nutritional quality percentage score, as the variety of products sold in the participating tuck shops differed greatly. However, Pearson's correlation analysis found that the distribution of nutritional quality percentage scores between participating public quintile five and private school tuck shops was not significantly different (r=0,15, P=0,404).

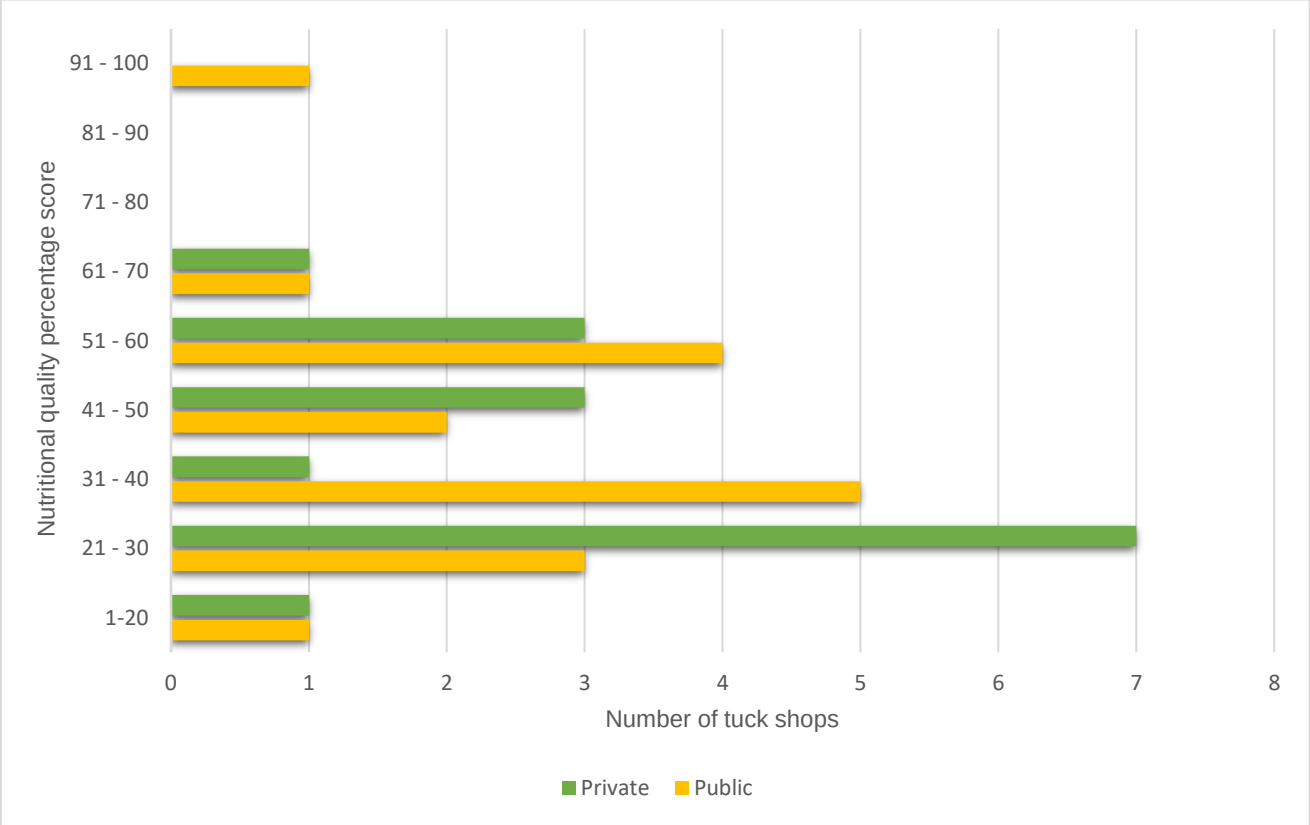

FIGURE 19: DISTRIBUTION OF NUTRITIONAL QUALITY PERCENTAGE SCORES OF PARTICIPATING PRIVATE AND QUINTILE FIVE SCHOOL TUCK SHOPS (N=33)

4.5 Relationship between nutrition competency scores of participants and nutritional quality percentage scores of products sold in participating tuck shops.

Based on the results of the study, and as indicated in Table 10 below, no statistically meaningful correlation could be found between the nutrition competency scores of participants and the nutritional quality percentage scores of products sold in the participating tuck shops, r=0,12, P=0,478.

Furthermore, no meaningful statistical correlation was found between nutrition competency scores of tuck shop owners and nutritional quality percentage scores of products sold at participating tuck shops at private schools (r=0,22, P=0,400) and public quintile five schools (r=0,09, P=0,727).

TABLE 10: RELATIONSHIP BETWEEN NUTRITION COMPETENCY SCORES OF PARTICIPANTS AND NUTRITIONAL QUALITY PERCENTAGE SCORES OF PRODUCTS SOLD IN PARTICIPATING TUCK SHOPS (N = 33)

	Mean nutrition competency score of participants	**Mean nutritional quality percentage scores and beverage products sold**	**r[a]**	**P-value[b]**
Public schools (N= 17)	19,05	44,88	0,09	0,727
Private schools (N= 16)	19,68	39,50	0,22	0,400
Total sample (N=33)	19,36	42,27	0,12	0,478

[a] Pearson correlation coefficient
[b] Level of statistically significance

4.6 Nutrition-related policies and guidelines in participants tuck shops

As seen in Figure 20 below, more than a third (n=6, 35,2%) of participants from participating public school tuck shops reported having no nutrition-related policies in place, while more than three quarters (n=13, 80,0%) of participants from participating private school tuck shops reported having nutrition-related policies in place. In addition, of all the participants (n=33), more than two thirds (n=24: 72,7%) reported having nutrition-related policies in place in their primary school tuck shops.

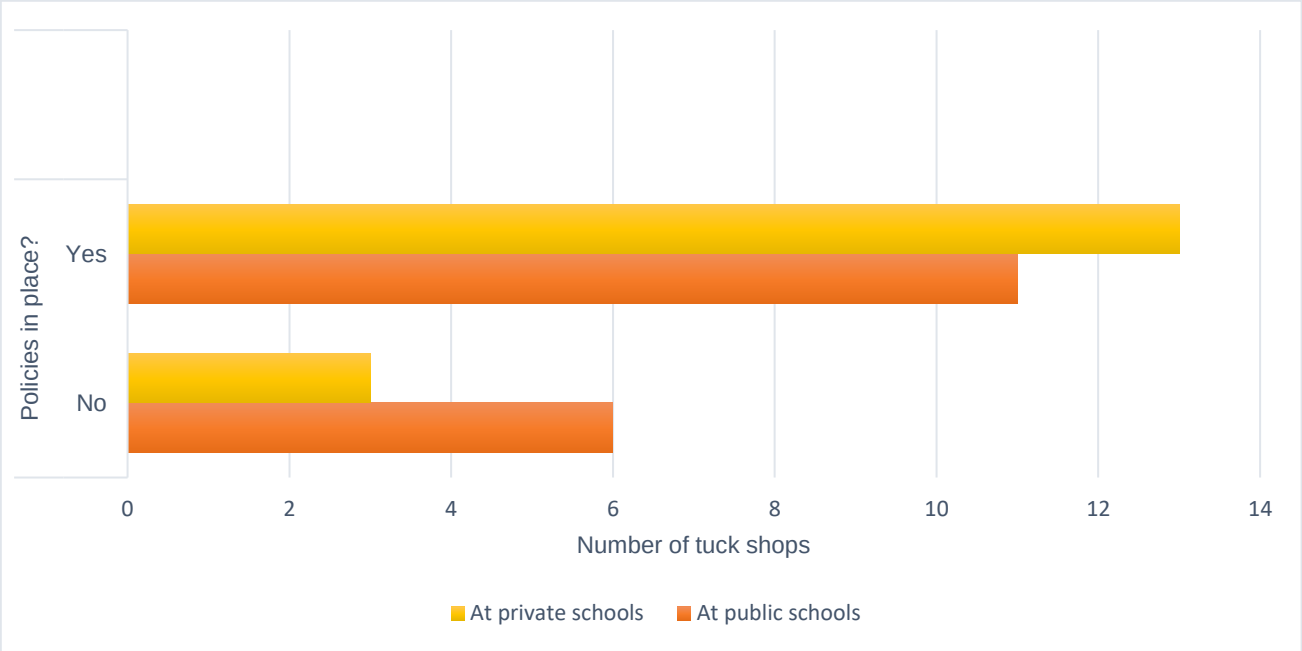

FIGURE 20: DISTRIBUTION OF NUTRITION-RELATED POLICIES IN PARTICIPATING TUCK SHOPS (N= 33)

The result of this study found that almost half (n=16, 48,5%) of participants followed policies in their participating school tuck shops that were set by the school, while almost a quarter (n=7, 24,2%) of the participants reported setting their own nutrition-related policies in their participating school tuck shop. The two most popular policies set in place (n=9, 37,3%), as indicated in Figure 21 below, were: no sugary food and beverage products sold in the morning or at first breaks, only from second breaks onwards, and only selling food and beverage items that the participants perceive as “nutritious/healthy”. The second most popular policy in place was; only selling food and beverages products with little to no added sugars (n= 3, 12,1%).

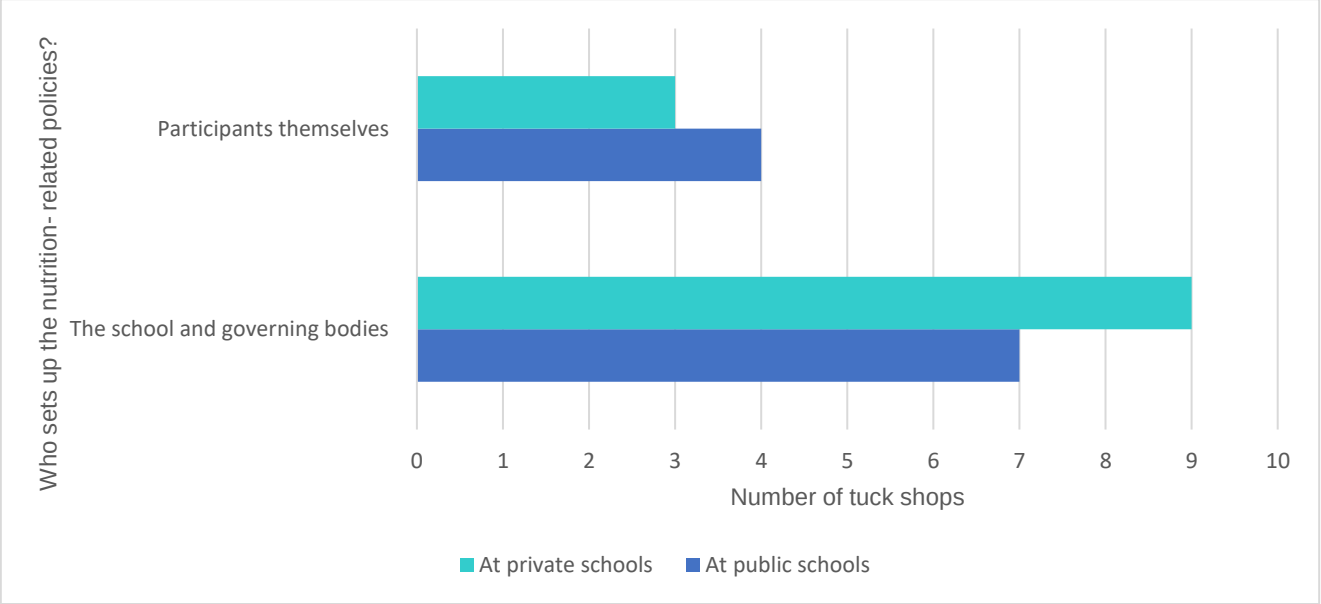

FIGURE 21: DISTRIBUTION OF NUTRITION-RELATED POLICY CREATION IN PARTICIPATING TUCK SHOPS (N=33)

A large majority (75,0%) of the participants from participating private school tuck shops' nutrition policies were set up by the schools, while 42,4% of the participants from participating public school tuck shops' policies are set by themselves. The two most popular policies adopted by participating private school tuck shops (n=5, 20,0%), as seen in Figure 22 below, were; sugary products are only to be sold at second breaks or after school and only selling "nutritional/healthy" food and beverage items.

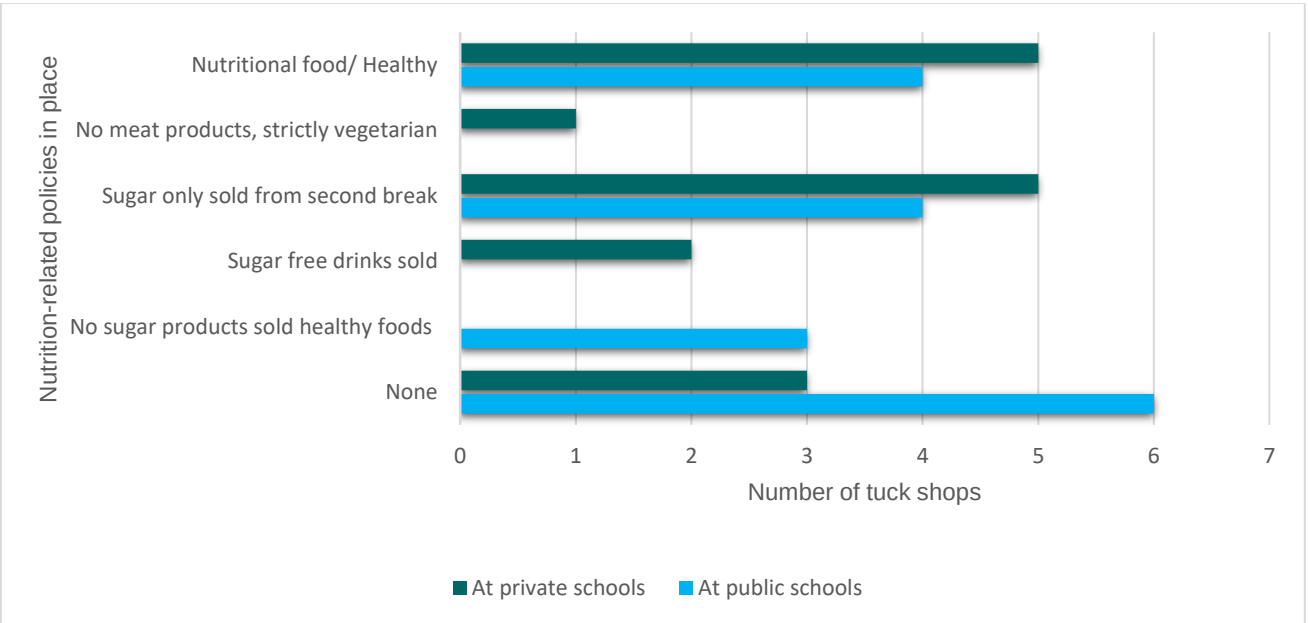

FIGURE 22: DISTRIBUTION OF NUTRITION-RELATED POLICIES FOLLOWED IN PARTICIPATING TUCK SHOPS (N=33)

As seen in Figure 23 below, of the 33 participants, only a little more than half (n=18, 54,5%) were aware of nutrition-related guidelines available to aid in setting up policies for their tuck shops. It was found that most participants from participating private school tuck shops (n=10, 62,5%) were informed about the various guidelines available, while most participants from participating public school tuck shops were not aware of them at all (n=9, 52,9%). The most followed guideline between the four presented in the questionnaire was the Good Tuck shop Practices guidelines from DoH. It was reported to be implemented in 66,6% of those participants' tuck shops, especially among those who reported observing one or more of the available guidelines. Of those participants who reported being aware of the guidelines available, only 8 of the 10 from participating private school tuck shops followed one or more of the guidelines, while all the participants (n=8) from participating public school tuck shops followed one or more of them.

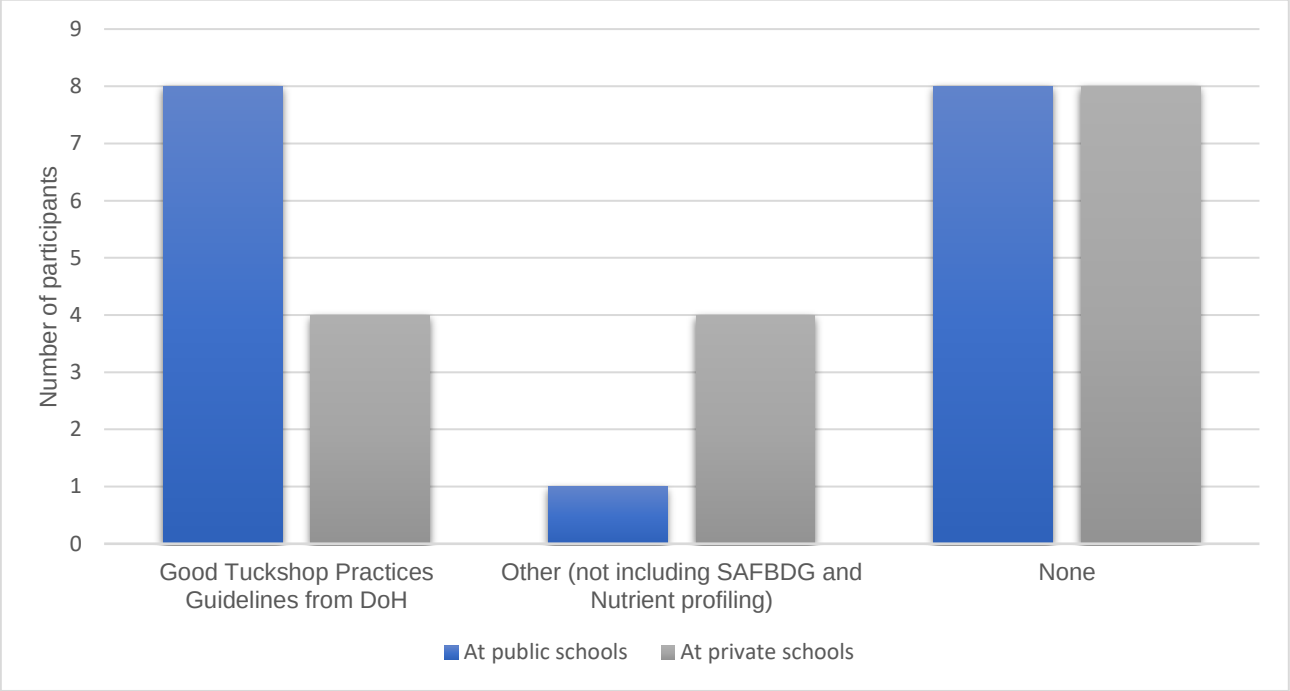

FIGURE 23: DISTRIBUTION OF NUTRITION-RELATED GUIDELINE AWARENESS AND IMPLEMENTATION IN PARTICIPATING TUCK SHOPS (N=33)

4.6.1 Relationship between nutrition policies and the nutritional quality percentage score of food and beverage products sold at tuck shops

Statical results from a Pearson's correlation coefficient found a positive correlation between the implementation of nutrition policies and nutritional quality percentage scores of participating tuck shops, r=0,41, P=0,017. Increases in nutritional quality percentage scores were correlated with tuck shops that implemented nutrition-related policies.

TABLE 11: RELATIONSHIP BETWEEN NUTRITIONAL QUALITY PERCENTAGE SCORES OF PRODUCTS SOLD AND NUTRITION-RELATED POLICIES IMPLEMENTED IN PARTICIPATING TUCK SHOPS (N = 33)

	Mean participants who tuck shops who implemented nutrition-related policies	**Mean nutritional quality percentage score of food and beverage products sold**	**r[a]**	**P-value[b]**
Public schools (N= 17)	11	51,17	0.43	0.074
Private schools (N= 16)	13	43,08	0.47	0.070
Total sample (N=33)	24	46,76	0,41	0,017

[a] Pearson correlation coefficient
[b] Level of statistically significance

A Pearson correlation coefficient was computed to assess the relationship between the type of nutrition policies in place and nutritional quality percentage scores of participating tuck shops. A strong positive correlation was identified between the type of nutrition policies in place and participants' nutritional quality percentage scores, r=0,88, P=0,027. As seen in Figure 24 below, increases in nutritional quality percentage scores were correlated with tuck shops that implemented nutrition-related policies. Specifically, our results suggest that implementing a 'no sugar' policy in participating primary school tuck shops had a better nutritional quality percentage score. No other statistically significant differences could be found between nutritional quality percentage scores of participating tuck shops from private and public quintile five schools and the different types of policies implemented.

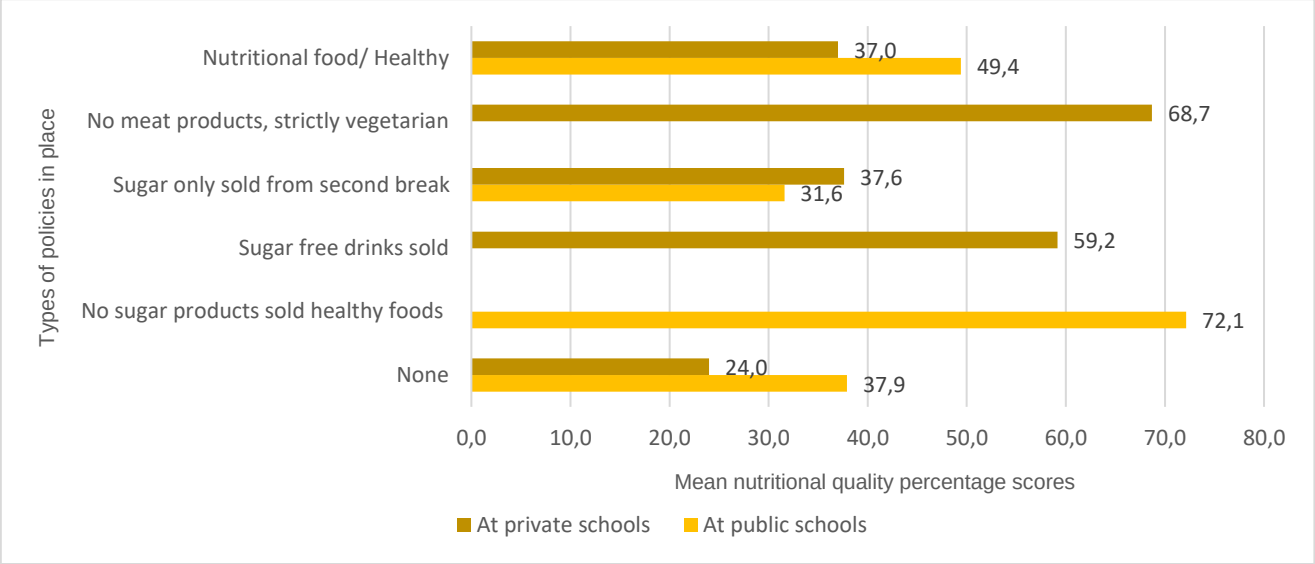

FIGURE 24: MEAN NUTRITIONAL QUALITY PERCENTAGE SCORES BETWEEN TYPES OF POLICIES IMPLEMENTED AT PARTICIPATING SCHOOL TUCK SHOPS

4.6.2 Nutrition-related training and nutrition-related policies

As seen in Figure 25 below, most of the participants from participating public school tuck shops (n=11, 64,7%) received nutrition-related training, while most participants from participating private school tuck shops (n=10, 62,5%) had not received any form of nutrition-related training. On average, only half (n= 17, 51,5%) of the participants reported having received any form of nutrition-related training. A significant correlation was found between participants who implemented nutrition-related policies in their tuck shops and those who have received some form of nutrition-related training (r=0,49, P=0,003).

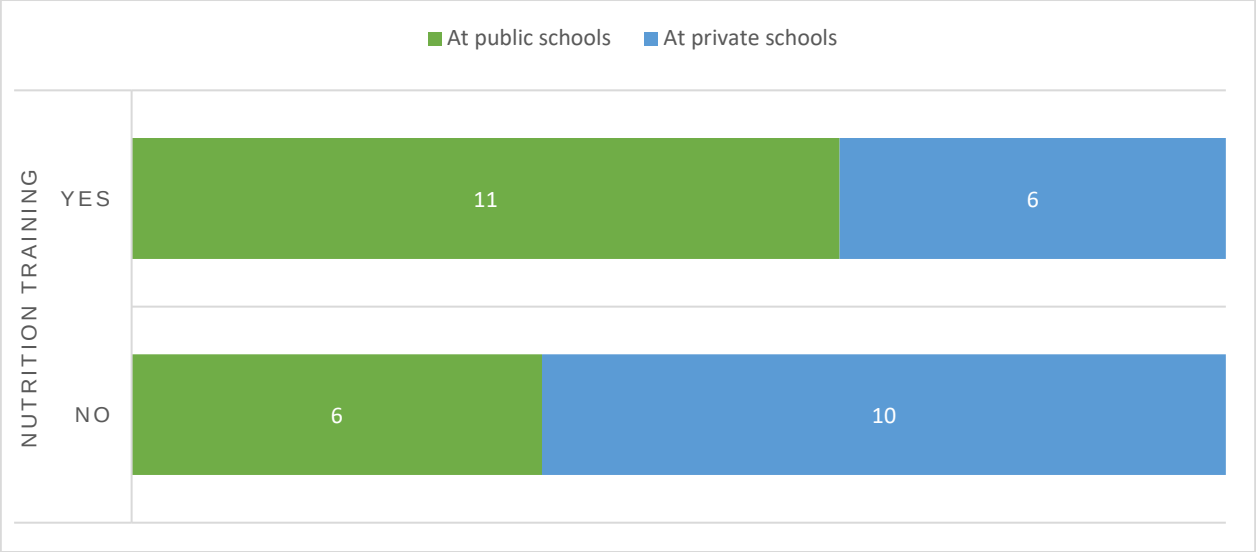

FIGURE 25: DISTRIBUTION OF NUTRITION-RELATED TRAINING IN PARTICIPATING TUCK SHOPS (N=33)

A Pearson's chi-square test was performed to examine the relationship between participants who have received nutrition-related training and types of policies in place in participating tuck shops. The relation between these variables was significant, X^2=8,088, P=0,004, where participants who had received nutrition-related training were more likely than those who had not to implement nutrition-related policies relating to the sales of healthy food and beverage products.

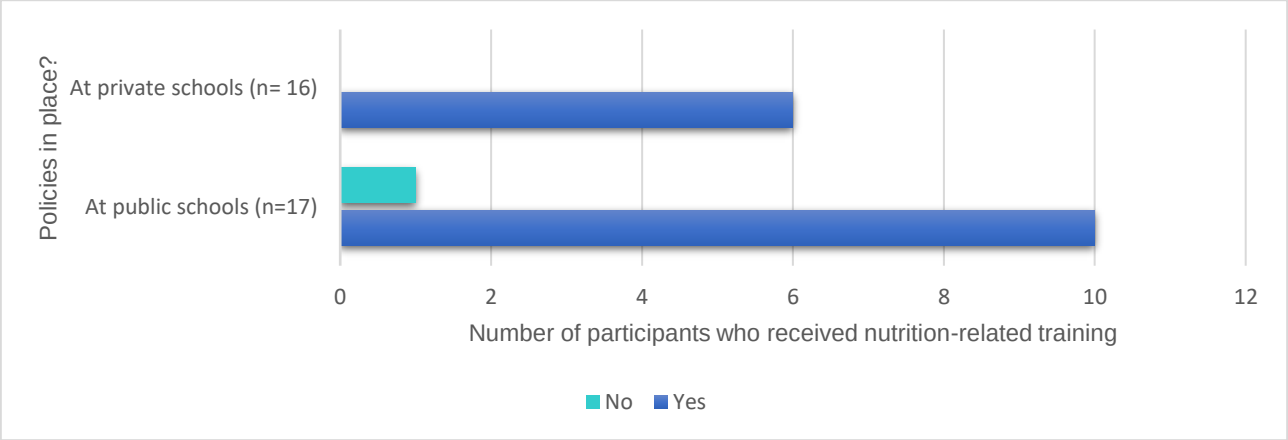

FIGURE 26: DISTRIBUTION OF PARTICIPANTS WHO HAVE RECEIVED NUTRITION-RELATED TRAINING AND DECISIONS ABOUT WHAT TO SELL (N= 33)

Furthermore, a relation was found between nutrition-related training and the driver for decision making about what products to sell in participating tuck shops X^2=11,377, P=0,044. These results suggest that participants who have received some form of nutrition-related training were more likely to hold meetings with school principals and governing bodies to decide what food and beverage products to sell in their primary school tuck shops.

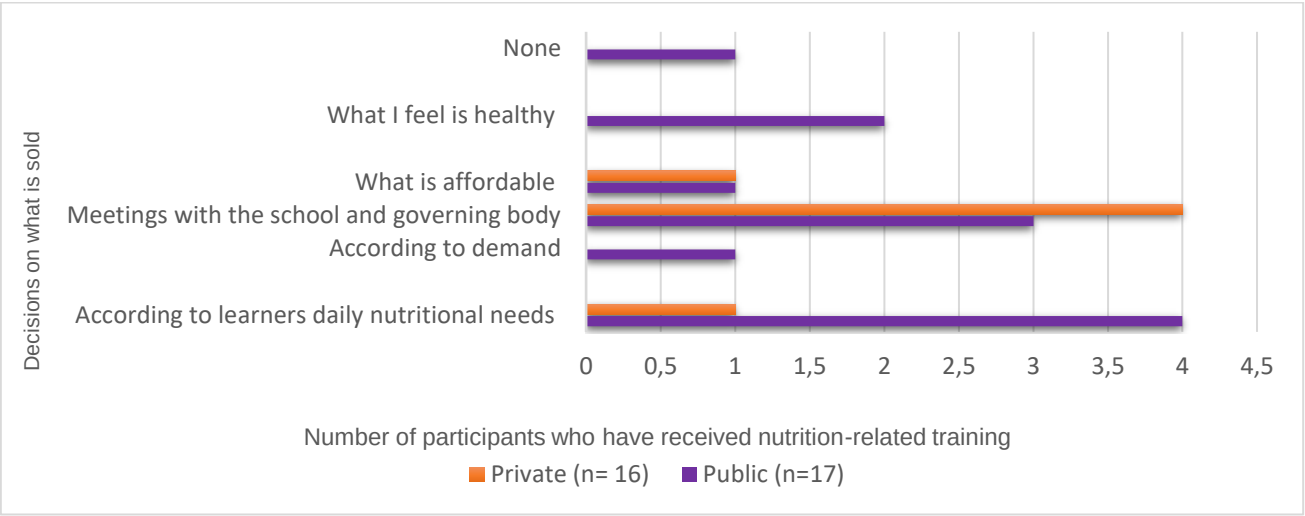

FIGURE 27: DISTRIBUTION OF PARTICIPANTS WHO HAVE RECEIVED NUTRITION-RELATED TRAINING AND DECISIONS ABOUT WHAT TO SELL (N= 33)

4.6.3 Relationship between nutrition-related training and the nutritional quality percentage score of food and beverage products sold at tuck shops

Based on the results of the study, a statistically significant relationship was found (r=0,40, P=0,021) between participants nutritional quality percentage scores and nutrition-related training received.

TABLE 12: RELATIONSHIP BETWEEN NUTRITION-RELATED TRAINING AND THE NUTRITIONAL QUALITY PERCENTAGE SCORE OF FOOD AND BEVERAGE SOLD IN PARTICIPATING TUCK SHOPS (N=33)

	Mean participants who received nutrition-related training	**Mean nutritional quality percentage score of food and beverage products sold**	**r[a]**	**P-value[b]**
Public schools (N= 17)	11	44,88	0,39	0,121
Private schools (N= 16)	6	39,50	0,29	0,268
Total sample (N=33)	17	42,27	0,40	0,021

[a] Pearson correlation coefficient
[b] Level of statistically significance

Furthermore, a Pearson's correlation analysis was computed to assess the relationship between nutritional quality percentage scores of participants and their highest level of education. A positive correlation was identified (r=0,42, P=0,015), whereby the results suggest that participants who have achieved a higher level of education ran tuck shops that sold more, high in nutritional quality food and beverage products.

TABLE 13: RELATIONSHIP BETWEEN NUTRITIONAL QUALITY PERCENTAGE SCORES OF PRODUCTS SOLD IN PARTICIPATING TUCK SHOPS AND HIGHEST LEVEL OF EDUCATION OF PARTICIPANTS (N=33)

	Mean participants who received a post matric qualification	Mean nutritional quality of food and beverage products sold	r[a]	P-value[b]
Total sample (N=33)	26	46,1	0,42	0,015

[a] Pearson correlation coefficient
[b] Level of statistically significance

As seen in Figure 28 below, the mean nutritional quality percentage scores were higher among participants who had reported having obtained a post-matric qualification (Mean= 46,1), compared to those who only attained matric as their highest form of education (Mean=27,7). No other statistical differences were found between nutritional quality percentage scores of demographic variables using independent t-tests and Pearson's correlation analysis.

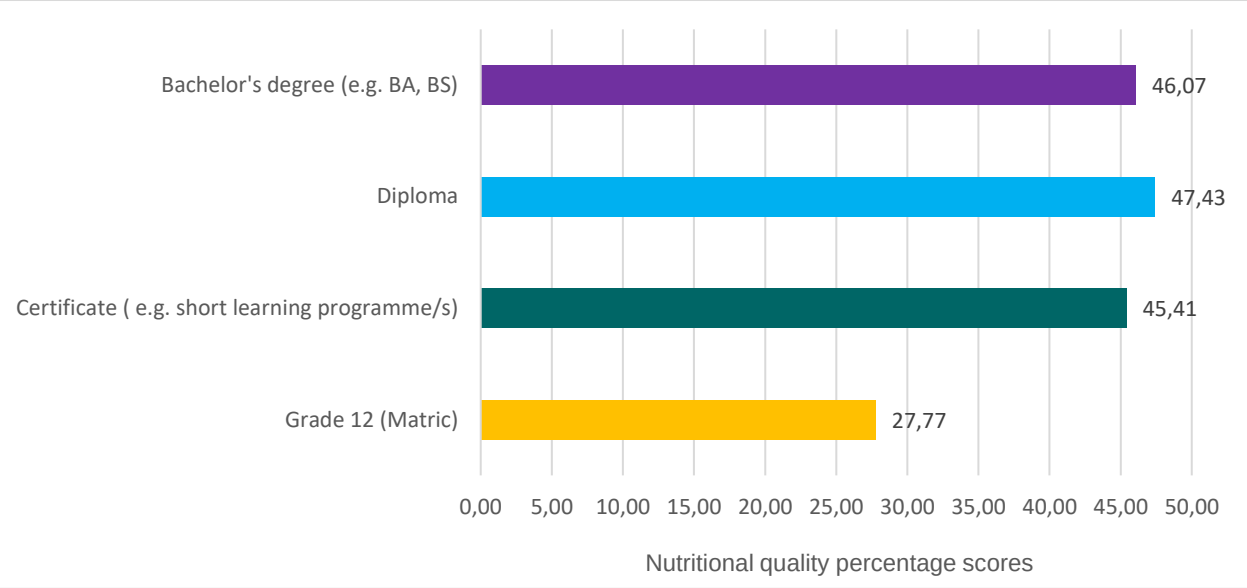

FIGURE 28: MEAN NUTRITIONAL QUALITY PERCENTAGE SCORES BETWEEN HIGHEST LEVEL OF EDUCATION OF PARTICIPANTS

4.7 Summary of results

This chapter interprets and presents the results collected from a self-administered nutrition competency questionnaire and observational checklists. Thirty-three participants were involved in the study, and data were collected from sixteen private and seventeen quintile five primary school tuck shops in the Third Region of Tshwane. The researcher analysed the data using appropriate statistical methods such as descriptive statistics, Pearson correlation, Pearson's chi-square analysis, and independent t-tests using the computer program SPSS. Correlations were done on some variables in hopes of identifying a potential relationship. The scores of the participants' nutritional quality percentage scores and nutrition competencies were compared; however, statistical analysis revealed no statistical significance between the two scores. Participants revealed valuable information, the findings of which will be presented and discussed in terms of the sub-sections and objectives of the study in Chapter five

CHAPTER 5

DISCUSSION OF FINDINGS

In this chapter, the study's results were discussed in relation to the aim and objectives. The results and findings were also compared and discussed in view of the current literature. The chapter is outlined as follows:

5.1 INTRODUCTION

Currently, in South Africa, most tuck shops provide a minimal variety of food and beverage products that are high in nutritional quality. Instead, tuck shops mainly consist of calorie-dense, low nutritional quality (unhealthy) products that support the obesogenic school food environment (Drewnowski, 2017; Kruger & De Villiers, 2011; Lehmann *et al.*, 2017; Morshed *et al.*, 2016; Nortje *et al.*, 2017; Pacific *et al.*, 2020; Rayner, 2017; Wiles *et al.*, 2013; Wrottesley *et al.*, 2019). This type of school food environment may have negative consequences on children's eating habits and ultimately their nutritional status, subsequently resulting in an increased risk of long term health consequences such as overweight or obesity, and NCD (Birch & Anzman, 2010; Hawkes *et al.*, 2017; Ma & Wong, 2018; Morshed *et al.*, 2016; Saravia *et al.*, 2018). An understanding of tuck shop owner's nutrition competencies and the nutritional quality of food and beverage products sold in tuck shops at primary schools may lead to an improved school food environment (Faber *et al.*, 2014; Mawela & van den Berg, 2018; Molotja *et al.*, 2020; Nguyen *et al.*, 2017; Walsh *et al.*, 2003; Wiles *et al.*, 2011; Wrottesley *et al.*, 2019).

Very little was known about the nutrition competencies of tuck shop owners prior to this study. In addition, most of the previous studies done involved public schools characterised as lower quintile and low in socioeconomic status. These studies mainly focused on products sold in the school food environment and learners' eating habits, knowledge, and behaviours (Faber *et al.*, 2019; Molotja *et al.*, 2020; Okeyo *et al.*, 2020; Wethington *et al.*, 2020).

This quantitative study conducted in a quintile five and private primary school setting generated new knowledge about these school food environments. Very little research has been conducted exploring the influences of nutrition-related policies and training on the nutrition quality of products sold and made available in primary school tuck shops (Faber *et al.*, 2019; Teo *et al.*, 2021; Wethington *et al.*, 2020).

Understanding the competencies of tuck shop owners and how these competencies potentially relate to the nutritional quality of food and beverage products sold in tuck shops may be critical for progress to be made towards collaborative efforts addressing adolescent overweight and obesity in the school food environment (O'Halloran *et al.*, 2020; Rathi, Riddell & Worsley, 2018; Reeve *et al.*, 2021; Teo *et al.*, 2021).

This study aimed at determining the relationship between the nutrition competency scores of tuck shop owners and the nutritional quality percentage scores of food and beverage products sold at quintile five public and private primary schools of Third Region of Tshwane, South Africa.

Therefore, this study posed the following research questions:

- What is the current nutrition competency level of primary school tuck shop owners from schools with higher socioeconomic status?
- What is the overall nutritional quality percentage scores (as measured by SANPM) of products sold in their tuck shops?
- Does a relationship exist between the tuck shop owners' nutrition competencies and the nutritional quality percentage scores of foods and beverages products sold in their tuck shops?
- What nutrition-related policies/guidelines are followed and implemented in these school tuck shops?
- Have tuck shop owners received nutrition-related training, and does it influence the nutrition quality of products sold in tuck shops?
- Does a relationship exist between tuck shop owners' nutrition-related training received and their tuckshops' nutritional quality percentage scores?
- Does a relationship exist between policy implementation in participating tuckshops and the nutritional quality percentage scores?

5.2 Discussion of sample characteristics

The study sample was selected to represent the Third Region of Tshwane. Demographical data were gathered to provide helpful information concerning respondents background, which allowed for better characterisation of the sample population. While sample demographics do not necessarily influence the outcomes of this study directly, they may provide useful information concerning participants behaviours prior to nutrition knowledge through exploring their highest level of education.

This study's sample population was relatively evenly distributed/homogeneous in terms of demographical characteristics between the 16 private and 17 public quintile five school tuckshop owners. A large majority of the sample consisted of females between the ages of 55-64 years of age, which correlates with StatsSA that showed that there are slightly more females (50%) than males (49%) residing in the city of Tshwane (Stats SA, 2011). Less than half (42%) of participants reported attaining some form of post-matric qualification (short courses, bachelor's degree, postgraduate degrees, diplomas). Furthermore, 78,01 % of the Third Region of Tshwane fell within the medium to low-income category, which is supported by this study's demographic results, which found that 63% of participants fell within the medium to low-income range (Stats SA, 2011).

5.3 Nutrition competency of participants

The nutrition competency scores of participants were measured using the nutrition dimension part of a food literacy scale and assessed participants' nutrition competencies in terms of their nutrition-related knowledge, skills and behaviour. Nutrition competency relating to food literacy addresses health and well-being by investigating an individual's knowledge, skills and behaviours about nutrient functions, food groups, how a diet should be constituted, and consequences of consumption of inappropriate quantities of various nutrients (Fisher *et al.*, 2019; Mafugu, 2021).

Each of these dimensions is discussed below.

5.3.1 Nutrition competencies relating to nutrition knowledge

Good nutrition knowledge is imperative for healthy living and lifestyle choices. It is needed to make healthier food and cooking choices that will not only nourish the body but also provide the necessary daily nutritional requirements and prevent nutrition-related diseases, including NCDs (Corkins *et al.*, 2016; Mamba *et al.*, 2019; Rivera Medina *et al.*, 2020; Worsley, 2002). Nutrition knowledge can also be a valuable tool in intervention programs to provide a baseline for addressing the population's nutritional needs (Chung, 2017; De Villiers *et al.*, 2016; Hirvonen *et al.*, 2017; Pillai *et al.*, 2019; Truman & Elliott, 2019; Walsh *et al.*, 2003). The acquisition of adequate nutrition knowledge among tuck shop owners in primary school food environments is imperative in addressing issues such as nutrient deficiencies and the increased risk of DBM. Having proper nutrition competencies, including nutrition knowledge, among school food handlers/tuck shop owners is said to play a critical role in improving the overall nutritional environment of primary school learners (Chung, 2017; Kadi & Mosa, 2017; Katsagoni *et al.*, 2019; Molotja *et al.*, 2020).

According to this study's results, the participants' nutrition competency score relating to nutrition knowledge was 81%. They had the best nutrition knowledge about topics relating to general health and wellbeing, macronutrients and food groups as tested by the questions; brown sugar is not healthy; carbohydrates in potatoes are healthy; peanuts are a source of protein; all carbohydrates are bad; brown rice is released slowly; brown bread is recommended; oats are more nutritious than corn flakes; olive oil contains no bad fats; fruit releases quick energy and finally; the body breaks down all vegetable fibres. While participants scored a relatively high nutrition competency score relating to knowledge, they seemed to have a lack of knowledge relating to micronutrients and food additives, as tested by the questions; sunshine (vitamin D) is needed for healthy bones; not all food colours are bad; salt is harmful.

Education plays a vital role in providing individuals with the knowledge, skills and behaviours needed to participate effectively in society and the economy. In addition, higher education levels are said to improve an individual's quality of life, especially in areas relating to health, civic participation, political interest, community involvement and overall happiness (Chung, 2017; De Villiers *et al.*, 2016; Hirvonen *et al.*, 2017; Pillai *et al.*, 2019; Truman & Elliott, 2019; Walsh *et al.*, 2003). This is supported by this study's results, whereby a relationship between participants nutrition competencies scores and their highest level of education (P=0,012) was found. This relationship indicated higher nutrition competency scores among participants who had reported having obtained a post-matric qualification compared to those who had not. It can therefore be said that education may play a role in not only increasing tuck shop owners' nutrition knowledge but also their nutrition competencies as a whole.

The measurement scale used in this study merely tested participants general nutritional knowledge and not necessarily their nutrition knowledge relating to children's health and wellbeing. Based on the results of this section of the questionnaire, it can be said that tuck shop owners have a relatively good nutrition competency relating to general nutrition knowledge; however, they may benefit from receiving additional nutrition-related training/education, more specifically regarding the nutritional needs of children (Dumont *et al.*, 2021; Molotja *et al.*, 2020).

5.3.2 Nutrition competencies relating to nutrition-related skills

Food and nutrition skills refer to an individual's ability to produce, procure, prepare, and consume based on food choice available and its effect on nutrition outcomes to meet nutrient needs (Fisher *et al.*, 2019). Skills are heavily dependent on an individual's knowledge, as knowledge forms the foundation and understanding of food products that will allow the individual to have the skills and behaviour to select, prepare food products that will best suit their nutritional needs (Burton, Riddell

& Worsley, 2018; Cullen, Hatch, Martin, Higgins & Sheppard, 2015; Ronto *et al.*, 2016a; Vidgen & Gallegos, 2014). Primary school tuck shop owners need to have the skills to produce, source, procure and sell healthy foods to schoolchildren, and set up policies (Wojcicki & Elwan, 2014).

Many school tuck shops are run and owned by unskilled individuals who do not possess the necessary skills to provide primary school children with healthy, nutritious foods/products (Reeve *et al.*, 2021; Trübswasser *et al.*, 2021; Wojcicki & Elwan, 2014). However, this was found not to be the case in this study as participants managed to score 80% in the skills section of the nutrition competency questionnaire. Most participants could correctly identify appropriate cooking procedures for optimal health and to minimise nutrient losses during cooking, as tested by the questions; use oil sparingly when cooking; vegetables should be cooked just before serving and; when deep-frying oil temperature has health consequences.

Purchasing, sourcing, and ingredient substitution skills are essential because primary school children do not have control over food choices regarding availability and consume what is available and affordable (Ronto *et al.*, 2016a). Literature shows a strong need to increase the availability, accessibility and affordability of healthy/nutritious food options while limiting the availability and accessibility of unhealthier/less nutritious foods in the primary school tuck shop. In various studies done analysing primary school children and parents' preferences on food available in tuck shops, many have expressed a desire for a wider variety of healthier foods such as fruits, vegetables, and cooked meals to be sold (Berry, 2019; Mafugu, 2021; Teo *et al.*, 2021).

Many tuck shops owners have expressed time constraints as a barrier to providing children with healthy meals. Additional nutrition-related training/education to increase tuck shop owners' nutrition-related skills may benefit many tuck shop owners in the areas relating to creating nutritious meals speedily and with the available equipment, i.e., microwave cooking. It was found that most participants in this study had poor skills relating to microwave cooking as measured by the question; cooking vegetables in the microwave destroys all nutrients. An increase in microwave cooking skills, among others, may aid tuck shop owners in creating speedy meals that are high in nutritional quality for children, as microwave cooking was found to be one of the better cooking methods for preserving nutrients in foods, especially water-soluble vitamins (Rana, Ahmad, Sayem, Jothi, Hoque & Rahman, 2021; Yong, Amin & Dongpo, 2019). Microwaves are an energy and space-efficient cooking method that could blanch and steam vegetables, cook starches and grains, and cook various meat products with little to no additional fats (Puligundla, Abdullah, Choi, Jun, Oh & Ko, 2013).

Additional competencies relating to cooking and nutrition skills may benefit tuck shop owners in creating a healthier school food environment by providing children with a wider variety of home-cooked meals. Research has shown a positive association between increasing food/meal quality due to preparing home-cooked meals and a lower body mass, suggesting that pertinent benefits to children's food intake and consequently their health may be brought by the regular consumption of home-cooked meals, i.e. increasing availability of homemade meal in tuck shops (Mills, Brown, Wrieden, White & Adams, 2017:9).

Similar recommendations call for tuck shop owners to be trained in certain skills, specifically those relating to the appropriate use of cooking methods, quality and quantity of ingredients, and menu planning of homemade tuck shop products, while using the SAFBDG as guidance in making healthy choices was made (Bekker *et al.*, 2017; Reeve *et al.*, 2021; Temple *et al.*, 2006a; Wiles *et al.*, 2011)

5.3.3 Nutrition competencies relating to nutrition-related behaviour

Participants scored the best in the nutrition-related behaviour (87%) section of the nutrition competency questionnaire compared to nutrition-related knowledge and skills. They were able to correctly identify the importance of incorporating a variety of foods from the various food groups within their daily diets and recommended dietary practices for optimal nutrition as indicated by the questions; it is recommended to eat five fruits and vegetables daily; it is important to eat a variety of foods; and it is recommended to drink more than six glasses of water daily. In addition, participants were also able to correctly identify general healthy dietary habits as indicated by the questions; no additional fat is needed when cooking regular mince; chicken is sometimes pumped up with saltwater; egg yolks are healthy and; coffee creamer is not a healthy milk substitute.

The study participants seemed to struggle using their knowledge, skills, and behaviours to balance and incorporate micro and macro nutrient-rich products, food labelling, health, wellness, and balanced diets into their tuck shops, as reflected by the nutritional quality of foods sold in their tuck shops. While participants of this study managed to achieve relatively high scores relating to behaviour (87%), as discussed in section 5.5.2, many did not carry this knowledge of behaviours into practice in their tuck shops, as reflected by this study's low nutritional quality percentage scores (42%). Studies support this, indicating that most tuck shop owners have a preference for selling food low in nutritional quality, such as fast foods, chips, chocolates and high sugary drinks, while being reluctant to selling or preparing healthier meals that are high in nutritional quality (Bekker *et al.*, 2017; Dickson-Spillmann & Siegrist, 2011; Faber *et al.*, 2019; O'Halloran *et al.*, 2021; Teo *et al.*, 2021; Wrottesley *et al.*, 2019).

5.4 Total nutrition competency scores of participants

Food literacy is more than just nutrition knowledge; instead, it encompasses the skills and behaviours displayed in knowing where food comes from, the ability to select and prepare these foods/meals, all the while behaving in ways that will meet nutritional guidelines (Block *et al.*, 2011:7; Vaitkeviciute, Ball & Harris, 2015a:650).

Research has clearly recognised an association between obesity, food choices, nutrition knowledge, food preparation skills, and how these impact health (Fisher *et al.*, 2019; Pendergast *et al.*, 2011:415).

The result of this study indicates that overall, participants had good nutritional competencies (76%), with participants from participating private school tuck shops having a slightly higher nutritional competency than those from participating public quintile five school tuck shops. While participants of this study can be said to have high nutritional knowledge, skills and behaviours, it should be noted that nutrition competencies, as measured by the scale used, related more to general nutrition competencies and were not specific to children's nutritional health and well-being needs. Tuck shop owners may thus benefit from some additional education/training to increase their nutritional competencies relating to children's health and well-being. Nutrition education programmes or interventions have been reported to improve not only nutrition knowledge but nutrition-related skill and behaviours as well (Dumont *et al.*, 2021; Molotja *et al.*, 2020). This is further stressed by the results indicating the relationship between participants' nutrition competency scores and their level of education, whereby a statistically meaningful correlation was found between tuck shop owners nutrition competency scores and their level of education (P= 0.012). These results indicate that the higher the level of qualification/education the participant managed to obtain, the higher their nutrition competencies appeared to have been. Additional education may assist in providing tuck shop owners with the cognisance of the types of food and beverage products to provide to children to support a healthier overall school food environment (Dumont *et al.*, 2021; Teo *et al.*, 2021).

5.5 Nutritional quality of products sold in participating tuck shops

This study determined the nutrient quality of food and beverage products sold in participating tuck shops using the SANPM (Faber *et al.*, 2019; National Department of Health, 2020; Rayner, 2017; Wicks *et al.*, 2020).

5.5.1 Types of foods and beverage products sold in participants' tuck shops

Studies done have indicated that most primary school learners have the pre-learned behaviour of consuming healthier/nutritious foods from home but may not be able to do so in the school food environment due to the limited accessibility and availability of healthy food options available; this poses a challenge for them to follow the healthy choices learned (Bruening *et al.*, 2012). The results of this study added to this notion, whereby the most considerable portion of products sold in participating tuck shops was made up of sweets and chocolates, and the smallest portion was fruits and vegetables.

While many participating tuck shops sold low-nutrition quality foods predominantly, a handful of them did, however, provide learners with a limited variety of healthy options, including homemade meals and fresh fruits and vegetables. This was seen after still water and homemade ham and cheese toasted sandwiches were found to be part of the five most popular food and beverages sold in participating tuckshops. These two products were classified as high in nutritional quality, i.e., meeting the health/nutrition claims during this study; however, the remaining three of the five popular products, namely Coca-Cola soft drink, Nestle Bar-one chocolate, and Maynard's jelly babies, were classified as low in nutritional quality. These results are similar to those found in various other studies examining popular tuck shop purchases among primary school children. These studies found that sweets, potato crisps, cold drinks, fried chips and white bread were among the most popular products sold (Claasen *et al.*, 2016a; Naidoo *et al.*, 2009; Payán *et al.*, 2017; Stupar *et al.*, 2012; Tydeman-Edwards *et al.*, 2018; Wrottesley *et al.*, 2019). In this study, it appeared that participating public quintile five school tuckshops' proportion of healthy snack items such as home popped popcorn, health muffins and peanuts etc., stocked was larger than those of participating private school tuckshops, who sold a larger variety of sweets and chocolate products compared to participating public quintile five school tuck shops.

The low availability and variety of food and beverage products high in nutritional quality sold in participating tuck shops are concerning as research indicates that learners who lack adequate macro and micronutrient intake have been shown to have a decreased academic performance, impaired concentration and are at greater risk of DBM (Florence, Asbridge & Veugelers, 2008; Hochfeld *et al.*, 2016; Pacific *et al.*, 2020; Wicks *et al.*, 2016).

This study was no exception. When it came to fresh fruits and vegetables sold in school tuck shops, the most accessible and available form of vegetables in participants' tuck shops were offered as a minimal variety of salads ranging from Greek to chicken. Participating public quintile

five school tuck shops seemed to offer a slightly greater variety of fresh fruits and vegetables than participating private school tuck shops.

However, it should be noted that many of these participating tuck shops at both private and public quintile five schools that offered salads did not offer them daily but rather only twice a week, due to low demand and perishability. Regarding fruits sold in the participants' tuck shops, the only fresh fruit recorded as being available was bananas, apples, pears, oranges and watermelon, which, as seen in addendum K, was also only limitedly stocked. The limited availability of these products due to low demand is similar to the results of studies done that have found that only 30% of primary school boys and 37% of girls reported purchasing and eating fruits and vegetables daily (Faber *et al.*, 2014; Kadi & Mosa, 2017; Maunder *et al.*, 2015).

While the WHO and South African paediatric FBDGs recommend a minimum amount of 400g or five portions of 80g each (2,5- 3 cups) of fruit and vegetables daily, the results of this study indicate that neither participating public quintile five nor private school tuck shops provided adequately for these daily needs (Naudé, 2013; Sinyolo *et al.*, 2020; World Health Organization, 2008).

As seen in the results of this study, the most popular food items made available are low in nutritional quality and are made up of high in kilojoules, sugar, fat and sodium contents, which contributes to the obesogenic school food environment. Therefore, these research findings add to the notion that the school food environments are not offering a wide enough variety of healthy food choices to primary school learners (Claasen *et al.*, 2016a; Naidoo *et al.*, 2009; Payán *et al.*, 2017; Stupar *et al.*, 2012; Tydeman-Edwards *et al.*, 2018; Wrottesley *et al.*, 2019)

5.5.2 Total average nutritional quality percentage scores of participating tuck shops

According to various studies, nutrient profiling of foods can be used for not only educational but also regulatory purposes in South African primary schools. They further stress that through nutrient profiling, foods and beverages can be ranked/classified based on their nutrient composition and may be used in combination with food prices to identify foods and beverages that are healthy and affordable to sell in their tuck shops (Faber *et al.*, 2019; McColl *et al.*, 2017). The WHO recommends, in conjunction with the SAFBDG, the use of nutrient profiling as a tool to be used by tuck shop owners to increase the nutritional quality of food and beverage products provided to children for sale in their tuck shops (Wicks *et al.*, 2016; Wicks *et al.*, 2020; World Health Organization, 2006).

Nutritional quality scores were expressed as a percentage and were used to determine the nutritional quality of food and beverage products in participating tuck shops. A similar approach was used in a study that used nutrient profiling to determine the healthiness of processed foods frequently consumed by children, as well as in a study that used nutrient profiling to analyse snacks sold in vending machines (Rozman, Mis, Kupirovič, Pravst, Kocbek, Strauss & Turk, 2021; Theron, 2019). The results of this study indicated that overall, while all tuck shops sold a few items that were considered as healthy/high in nutritional quality, only four participating tuck shops achieved a nutritional quality percentage score of above 60%, whereby only one managed a near-perfect score of 95%.

The results of this study seemed to indicate that participating tuck shops at public quintile five schools had a surprisingly higher nutrient quality percentage score compared to participating private school tuck shops.

Three of these four participating tuck shops that had managed to score a relatively good nutritional quality percentage score was from participating quintile five public school tuck shops. It could be owing to the fact that participating private school tuck shops consisted of a larger proportion of high in sugar and low in nutrient quality products that they scored a lower nutritional quality percentage score compared to public quintile school tuck shops. Participating public quintile five school tuck shops overall sold a greater variety of healthy snack type items such as peanuts, homemade popcorn, health muffins etc., and fruits and vegetables, compared to participating private school tuck shops. Although most of the participating tuck shops (69%) sold little to no food and beverage products that were considered as high in nutritional quality, as indicated by the total low percentage score of 42% for the entire sample.

These results are similar to those seen in the literature, indicating that poor nutritional quality of food and beverage products in most primary school tuck shops is one of the leading causes of creating an obesogenic school food environment. Furthermore, many studies have indicated that these obesogenic school food environments lead to an increased risk of NCD (Adiele *et al.*, 2018; Hochfeld *et al.*, 2016; Lockyer *et al.*, 2020; Maunder *et al.*, 2015). While many tuck shops have been shown to be reluctant in selling a wider variety of healthier food options due to healthier foods and beverage products being perceived as more costly, nutrient profiling combined with food costs may be used as a tool to aid tuck shop owners in making healthier more affordable food choices for their tuck shops (Belancová, 2015; Faber *et al.*, 2019; McColl *et al.*, 2017; Rayner, 2017).

5.6 Relationship between nutrition competency scores of tuck shop owners and the nutritional quality percentage score of food and beverage products sold in participating tuck shops

Primary school learners are still young and very impressionable. They do not yet have the level of nutrition knowledge needed to make informed decisions about their health and wellbeing. Learners spend more than one-third of their day at school. Purchase decisions about food choice, variety, quality, and portion size are made without a guardian/parental supervision. It is thus up to the school food providers to provide these learners with a variety of healthy choices that will aid in ensuring overall better health and lifestyles as opposed to hindering it (Chen & Yang, 2014; Hawkes *et al.*, 2017; Ma & Wong, 2018; Nortje *et al.*, 2017; Wiles *et al.*, 2013). It is expected of tuck shop owners/school food providers to use their nutrition competencies to create a school food environment that provides learners with high nutritional quality food and beverage products (Department of Basic Education, 2008; Kadi & Mosa, 2017; Qila & Tyilo, 2014). Currently, there is no known research available on tuck shop owners' nutrition competencies, nor the influences of these competencies on the nutritional quality of products sold.

No statistically meaningful relationship (P= 0,478) was found between participants' nutrition competency scores and nutritional quality percentage scores, meaning that a high nutrition competency score did not necessarily translate into a tuck shop with a high nutritional quality percentage score and vice versa. These results indicate that despite having a high nutrition competency, many tuck shop owners still choose to stock their tuck shops with food and beverage products that are categorised as unhealthy/low in nutritional quality. While tuck shop owners are well aware of nutritional practices that could aid in improving overall health, some are not utilising their competencies by putting those practices into action. This can be seen when comparing average nutrient competency scores of participants' knowledge (72%), skills (93%) and behaviours (80%) to the average nutrient profiling percentage score (42%).

Participants in this study may have scored highly in the nutrition competency questionnaire, which may indicate that they have good nutrition knowledge and skills. However, this does not mean they apply said competencies when making decisions about what to sell in their tuck shops. Nutritional support staff from the school food environment, i.e., tuck shop owners, could be valuable in increasing dietary diversity, increasing nutritional status, and encouraging healthier eating habits among primary school learners (Department of Basic Education, 2008; Kadi & Mosa, 2017; Qila & Tyilo, 2014).

Tuck shop owners are encouraged to increase not only their knowledge but also implement the nutrition competencies, guidelines, and tools at their disposal to guide in making healthier food choices about what to sell and what not to sell (Alrige *et al.*, 2017; Drewnowski, 2017; Hess & Slavin, 2017; Letlape *et al.*, 2010). For example, 94% of participants agreed that peanuts are a good source of protein, but when compared to the number of participants who sold this affordable protein source, only 39% sold peanuts in their tuck shops.

Similarly, while 84% of participants agreed that the carbohydrates in potatoes are considered healthy, most chose to sell a high fat, unhealthy form of potatoes in their tuck shops instead of the whole food product. Fifty four percent of participants sold hot chips, 60% sold Simba potato chips, 45% sold Lays potato chips, and 6% sold Pringles. None of the thirty-three participants sold baked potatoes or meals in which potatoes were utilised in a healthier, more nutritious manner.

These practises contributes to the obesogenic school food environment and is similar to observations seen in literature, whereby most tuck shop owners provide a wide variety of unhealthy food options such as chips, pies, muffins, and chocolates as opposed to preparing/providing healthier homemade meals (Delaney, Sutherland, Wyse, Wolfenden, Lecathelinais, Janssen, Reilly, Wiggers & Yoong, 2019; Naidoo *et al.*, 2009; Payán *et al.*, 2017). Therefore, it can be said that participants knew the basics of nutrition and health but did not put these into practice to improve the nutritional quality of products sold in their tuck shops and providing learners with a diverse variety of food and beverage products.

5.7 Nutrition-related policies and guidelines in participants tuck shops

Currently, in South Africa, there are no formal policies required by the government for private tuck shop owners to follow with regards to what can and cannot be sold to learners, merely a set of guidelines that they are encouraged to follow (Department of Basic Education, 2008; Govender *et al.*, 2018; Marraccini *et al*., 2012). The four most common guidelines available to South African tuck shop owners in order to aid them in making decisions about what foods to be made available and sold in their tuck shops are; Good tuck shop practices guidelines from DoH; NSNP guidelines; the SAFBDG, and; nutrient profiling (Department of Basic Education, 2008; Naidoo *et al.*, 2009).

Only a little more than half (54%) of the participants of this study were aware of one or more of these four policies, whereby tuck shop owners' from participating private schools (62%) reported being the most aware of the various guidelines available to aid them in setting up nutrition-related policies as compared to participating quintile five public school tuck shops (47%).

The DoH strongly encourages tuck shops to follow the NSNP's guidelines and the Good tuck shop practices (Department of Basic Education, 2008). In this study, the most followed guideline was the Good tuck shop practices guidelines from DOH, whereby 36% of participants reported implementing certain practices taken from these set of guidelines in their tuck shops. None of the participant's reported following the SAFBDG or nutrient profiling. The NSNP's Good tuck shop practices are a set of guidelines created by the DoH to aid tuck shop owners in their decisions about the types of food and beverage products to sell in their tuck shops. These guidelines are merely recommendations made by the DoH, and tuck owners are under no obligation to adopt these guidelines (Department of Basic Education, 2008).

The Good tuck shop practises recommend that tuck shop owners sell healthy beverages such as whole milk, 100% fruit juice (and not fruit concentrate) and water. When it comes to food, the Good tuck shop practises suggest tuck shop owners provide children with fish, chicken, lean meat or eggs daily as a healthy protein, while they recommend to avoid any type of fried and processed forms of food products (Department of Basic Education, 2008; Devereux *et al.*, 2018; Nguyen *et al.*, 2017; Pandor, 2004; Vorster *et al.*, 2013). As seen in Figure 29 below, the SAFBDG have similar recommendations to the Good tuck shop practises with the inclusion of mass or yoghurt every day in addition to whole milk. The main goal of the SAFBDG is to aid in the prevention of nutrition-related diseases and improve nutritional intake and food choice (Nguyen *et al.*, 2017; Tydeman-Edwards *et al.*, 2018; Vorster *et al.*, 2013). Compared to what dairy products are available in participants' tuck shops, 30% (n=10) of the participants were found to sell whole milk in their tuck shops, and 10% sold yoghurt, which was considered as healthy by the nutrient profiling model used. The SAFBG recommend that individuals have milk, mass and yoghurt products daily. Only 3% (n=1) of participants sold a homemade food item featuring dairy in a somewhat healthy way, such as melkkos and milk tart. These food products were made using full cream milk instead of cream while being conscientious about the amounts of sugar added to the dish.

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FIGURE 29: NSNP'S GOOD TUCKSHOP PRACTISES (DEPARTMENT OF BASIC EDUCATION, 2008)

In addition to the good tuck shop practices illustrated in Figure 29, the DoH recommend that each tuck shop owner have a copy of the SAFBDG on-site to refer to as guidance about the best type of products to provide in their tuck shops (Department of Basic Education, 2008).

FIGURE 30: ILLUSTRATION OF SAFBDG (DEPARTMENT OF BASIC EDUCATION, 2008)

Compared to the results of this study, more than half (n= 19, 58%) of the participants only provided a minimal variety of lean protein sources as recommended by the SAFBDG, and good tuck shop practises, namely chicken salads, homemade chicken burgers, chicken pasta dishes, boiled eggs, omelettes, and chicken wraps. The rest of the protein sources provided by participating tuck shops were classified as low in nutritional quality by the nutrient profiling calculator. These products included chicken nuggets, burgers (made with commercial patties), an assortment of pies, hot dogs, mince dishes, samosas and boerewors rolls. These products were categorised as low in nutritional quality due to the highly processed nature of these products, high sodium contents, high in kilojoules and high-fat preparation methods.

The SAFDBG recommend that individuals eat plenty of beans and legumes regularly, such as dry beans, split peas, lentils and soya. The NSNP has put peanuts on their list of recommended nutritious snacks for tuck shops to sell (Department of Basic Education, 2008). Peanuts are classified as a legume that contains with a good source of plant-based protein, iron and vitamins B and E (Bonku & Yu, 2020). Research has shown that primary school children need around 46g per day; furthermore, it has also stressed the importance of the inclusion of good quality protein sources, essential fatty acids, iron, zinc, vitamin A and calcium in their daily diets (Anwar *et al.*, 2018; Banfield *et al.*, 2016; Corkins *et al.*, 2016; Department of Basic Education, 2008).

Compared to other protein sources, peanuts are a relatively inexpensive and high quality protein, making them an excellent option for tuck shop owners to stock in their tuck shops (Department of Basic Education, 2008). When examining the nutrient profile of the participating tuck shops, only 39% of participants reported selling them, despite the additional general consensus (93%) by the

participants of them being a good source of protein. It is encouraged that tuck shop owners sell a wider variety of good quality protein sources in their tuck shops as the nutrients in these products are essential for growth and development and support a lean body and muscle mass (Dasi *et al.*, 2019).

The SAFBDG recommend that starchy foods make part of most meals, while the good tuck shop practices strongly recommend that tuck shop owners pay special attention to food's GI (glycaemic index). Carbohydrates are macronutrients that contain starches, sugars, and dietary fibres. Starchy foods are a good source of energy for growing children and the primary source of a range of nutrients in their diets, such as fibre, calcium, iron and B vitamins. Starches are mainly found in foods such as fruits, vegetables and cereals. The average primary school-aged child requires around 150g of grains daily; however, in South Africa, most diets are characterised by the excess consumption of starchy foods. This could be due to starchy food items being highly accessible and affordable to the South African population (Du Plooy *et al.*, 2018a; Faber *et al.*, 2014; Kadi & Mosa, 2017; Maunder *et al.*, 2015; Wrottesley *et al.*, 2019). Therefore, the Good tuck shops guidelines recommend that tuck shops make available nutritious snacks that are good for the provision of energy, metabolic processes and growth while avoiding the sales of chips, fries, pies, pizzas, or highly processed foods (Nguyen *et al.*, 2017; Vorster *et al.*, 2013).

Another SAFBDG that participants in tuck shops did not observe in their tuck shops was the guideline of using sugar and consuming products high in sugar sparingly (Nguyen *et al.*, 2017; Vorster *et al.*, 2013). According to the good tuck shop practices, owners are encouraged to sell snack items that do not contain high amounts of sugars, sodium, and colourants. These kinds of foods are discouraged due to being characterised as foods that lead to a lack of classroom concentration and increased NCD risk (Department of Basic Education, 2008). When comparing this guideline to the participants tuck shops, most (n=31, 93%) of the participants tuck shops sold sugary products such as sugary sweets. Of the fifty various types of sweets and chocolates observed to be sold among all the participants tuck shops, Bar-one chocolates were found the most popular (n=27, 81%), followed by jelly babies (n=25, 75%), lollipops (n=23, 69%), jellybeans (n=21, 63%) and KitKat chocolates (n=21, 63%).

Water is one of the most essential fluids required by the human body, and adequate intake should be ensured, especially in children (Nguyen *et al.*, 2017; Vorster *et al.*, 2013).

However, when it comes to the guidelines of drinking plenty of clean, safe water, all participants recognised the importance of drinking at least six glasses of water a day as recommended by the nutrition dimension of the food literacy scale and the Good tuck shop practises. Furthermore, of

the thirty-three participants, only two failed to sell/stock water in their tuck shops, emphasising the importance of ensuring children are provided with safe, clean water daily.

Great emphasis has been placed on enjoying a variety of foods, not only in the SAFBDG and good tuck shop practices but also in various research articles (Bekker *et al.*, 2017; Chung, 2017; Corkins *et al.*, 2016; Poelman *et al.*, 2018; Vorster, 2013). This dietary guideline is strongly recommended because the wide variety of nutrient-dense foods consumed ensures that children are provided with sufficient macro and micronutrients daily (Dasi *et al.*, 2019; Nguyen *et al.*, 2017; Vorster *et al.*, 2013). Furthermore, it has been shown that diets lacking in a variety of nutritious foods could be the main underlying reason for affecting growth and development and developing the DBM among children (Dasi *et al.*, 2019). Which is supported by the results of this study showing that a vast array of chips (16%), sweets and chocolates (33%) made up the most considerable portion of tuck shops selves while a limited variety of whole meals (7%), fruits, salads and vegetables (5%) were stocked and sold.

Finally, it is recommended that individuals consume at least five fruits and vegetables daily, with primary school children's daily vegetable needs being approximately two to three cups of vegetables and one to two cups of fruits (Nguyen *et al.*, 2017; Vorster *et al.*, 2013). However, despite these daily nutritional needs, research shows that South African primary school-aged children are only consuming on average a combined portion of 2,5 cups of fruits and vegetables daily (Tydeman-Edwards *et al.*, 2018). Furthermore, when comparing what is being sold in tuck shops to the guidelines set out by the government, it can be seen that despite the recommendation to sell plenty of fresh fruits and vegetables, only ten (30%) participants' tuck shops sold fresh fruits daily, despite the majority (n=28, 84%) reporting agreement in the importance of consuming at least five daily.

5.7.1 Relationship between nutrition policies and the nutritional quality percentage score of food and beverage products sold at tuck shops

The results of this study indicated that more than two-thirds of all participants in this study had implemented some form of nutrition policy in their tuck shops. Between participating private and public quintile five school tuck shops, it was found that more participating private school tuck shops had implemented nutrition-related policies.

A statistically significant relationship was found between participants who implemented nutrition-related policies in their tuck shops and their nutritional quality percentage scores (P= 0,017).

It was also indicated that in tuck shops at participating private schools, a 'no sugary foods and beverages sold in the morning or at first break,' policy was the most popular policy. As shown by

statistical analysis, this policy seemed not to influence the nutritional quality of food and beverage products sold in the tuck shops. It could also be said that most policies reported in participating tuck shops were poorly implemented or monitored, as sweets and chocolates still occupied the second largest portion of tuck shops shelves. Considering the second most popular policy reported among participating schools, namely, 'only selling healthy/nutritious food,' and the nutritional quality percentage scores, an inconsistency may be seen between the two. This may indicate that participants might have believed that the variety of products provided in their tuck shops were much healthier and more nutritious than they actually were. This further adds to the notion that while tuck shop owners may have good nutritional competencies, they may require more specific training and guidance in policy creation and implementation, centred more specifically around children's nutritional needs. This is supported by the statistically meaningful relationship found between nutritional quality percentage scores and type of policy implementation. Participating tuck shops who implemented a 'no sugar' policy's nutritional quality percentage scores were significantly higher than those who implemented other types of policies or no policies at all. Thus, it is not only imperative to have and implement nutrition-related policies in the school food environment but also to implement the right type of policies that will be conducive to healthy eating habits and increased nutritional quality food choices.

5.7.2 Nutrition-related training and nutrition-related policies

Research has shown that intervention strategies in schools that has focused on training/education tuck shop owners centred around primary school children's nutritional needs and wellbeing has shown to have a positive influence on the school food environment, i.e., led to a healthier school food environment. Tuck shop owners who were trained in nutrition-related topics associated with children's diets and health needs in mind were able to make healthier, more informed decisions on the types of products to sell in their tuck shops (Shi-Chang, Xin-Wei, Shui-Yang, Shu-Ming, Sen-Hai, Aldinger & Glasauer, 2004). In addition, tuck shop owners who received nutrition-related training and were familiar with healthy eating guidelines (in South Africa, SAFBDG) reported increased knowledge about implementing healthier food choices, menu planning, and the provision of healthy food. It also enables tuck shop owners with the knowledge, skills and behaviours needed to cook and integrate the essential foods (high in nutritional quality) for a healthy diet and could widen their food choices in their tuck shops (Bekker *et al.*, 2017; Rana & Alvaro, 2010; Wiles *et al.*, 2011). Furthermore, studies showed that tuck shop owners who used the knowledge learned from this nutrition-related training and intervention strategies had led to an increase in sales of high nutritional quality food among primary school learners despite potential perceived barriers (Kadi & Mosa, 2017; Rana & Alvaro, 2010; Wang & Stewart, 2013).

The results of this study indicated that a little more than half the participants had received some form of nutrition training, whereby the largest number of participants who reported having received nutrition-related training was from participating public quintile five school tuck shops. This study also found a significant relationship between participants who had received some form of nutrition-related training and those who implemented nutrition-related policies in their tuck shops (P=0,003).

5.7.3 Relationship between nutrition-related training and the nutritional quality percentage score of food and beverage products sold at tuck shops

In addition to the relationship between nutrition-related policies and training, the results of this study indicated a statistically significant correlation between participants' nutrition-related training and the nutritional quality percentage scores of their tuckshops (P=0,021). It is thus postulated that education may play a vital role in potentially increasing the nutritional quality of products sold in school tuck shops. This observation is further supported by the statistically significant relationship found between participants highest level of education and the nutritional quality percentage scores of participating tuck shops (P=0,015).

These relationships seem to indicate that tuck shop owners who are knowledgeable/have received some form of nutrition-related training, run tuck shops that sell higher in nutritional quality food and beverage products. This could indicate that nutrition-related training may benefit tuck shop owners to equip them with the tools needed to source, prepare and provide learners with foods higher in nutritional value. In addition, nutrition-related training may also aid tuck shop owners in skills needed in designing and implementing nutrition-related policies in place by providing them with a set of clear guidelines to follow in order to create a healthier school food environment. A similar conclusion was found in various studies that stated that when tuck shop owners who were informed about nutrition-related policies and guidelines had implemented them by stocking healthy, nutrient-dense foods, it could aid in decreasing the risks of NDCs among primary school children (Drewnowski & Fulgoni, 2008; McColl *et al.*, 2017; Nguyen *et al.*, 2017; Nortje *et al.*, 2017; Tydeman-Edwards *et al.*, 2018).

This was even further emphasised by the results of this study that found a statistically significant relationship (P=0,044) between tuck shops owners nutrition competency scores and their implementation of the available nutrition-related guidelines in their tuck shops. Participants who had higher nutrition competency scores were more aware of the nutrition-related policies and guidelines at their disposal and had the skills and knowledge to use these guidelines to create and implement nutrition-related policies in their tuck shops.

The DoH strongly encourages that these guidelines given to be adopted and implemented in school tuck shops to create a food environment with a better quality nutrient profile and to protect against the risk of NCDs (Drewnowski & Fulgoni, 2008; McColl *et al.*, 2017; Nguyen *et al.*, 2017; Nortje *et al.*, 2017; Tydeman-Edwards *et al.*, 2018).

It is to be noted that despite the correlations drawn above, there was no statistical significance between nutrition competency scores and the nutritional quality percentage scores. This may indicate that other external factors/barriers may be preventing tuck shop owners from using their nutrition-related competencies to selling more products higher in nutritional quality. This observation is supported by research that found that a person's interaction with food and nutrition is not only affected by nutrition knowledge but also by several other factors such as the sensory appeal of food; financial implications; traditions; socio-demographic characteristics; cultural food preferences; concerns for the environment; cooking facilities; cooking skills (Dickson-Spillmann, Siegrist & Keller, 2011:617; Fisher *et al.*, 2019).

5.8 Potential barriers faced by tuck shop owners

The results of this study have indicated that while educating and training may not only improve tuck shop owners nutrition competency but also the nutritional quality of products sold in tuck shops, barriers may be in place preventing many tuck shop owners from using and applying their nutrition-related competencies and fully embracing the switch to a more health-focused tuck shop. The primary and most common barrier identified within literature is the perception that whole food products/healthy food products are more costly to stock and store than processed sugary foods (Dunn *et al.*, 2020; Lockyer *et al.*, 2020; O'Halloran *et al.*, 2021).

Tuck shops are seen as small businesses, and thus many tuck shop owners treat it as such and may be more profit than nutrition driven. Due to this, many tuck shop owners may fear that they would not make as big a profit selling healthier food items due to the low demand and high perishability of these types of 'healthy' products (Bekker *et al.*, 2017; De Villiers & Faber, 2015; Hochfeld *et al.*, 2016; Kim *et al.*, 2012b; Lockyer *et al.*, 2020; Maunder *et al.*, 2015; Naidoo *et al.*, 2009; Nortje *et al.*, 2017; O'Halloran *et al.*, 2021). Similar findings were found in this study whereby few tuck shop owners' reported using demand as a driver to decide what types of products to sell in their tuckshops. This could indicate that tuck shop owners sell a greater variety of products that are lower in nutritional quality with the expectation of gaining a higher profit and thus elevating their total income (Bekker *et al.*, 2017; Hochfeld *et al.*, 2016; Khambule, 2020; Kruger *et al.*, 2020; Lockyer *et al.*, 2020; Maunder *et al.*, 2015; Naidoo *et al.*, 2009; Nortje *et al.*, 2017; Pérez-Escamilla *et al.*, 2020).

It could be that now, more than ever, due to the COVID-19 pandemic, these tuck shop owners are met with a trade-off between selling healthier food and beverage products with the risk of making less profit or selling more unhealthy food and beverage products with the certainty that they would sell, thus making them a higher profit, but contributing to an overall unhealthy school food environment (Bekker *et al.*, 2017; Hochfeld *et al.*, 2016; Khambule, 2020; Kruger *et al.*, 2020; Lockyer *et al.*, 2020; Maunder *et al.*, 2015; Naidoo *et al.*, 2009; Nortje *et al.*, 2017; Pérez-Escamilla *et al.*, 2020).

Loss in profit is not the only potential barrier identified, as many tuck shop owners may also be reluctant to stocking more healthy food products due to the high costs associated with healthier food products (Brooks & Begley, 2014; Dickson-Spillmann & Siegrist, 2011; Faber *et al.*, 2019; O'Halloran *et al.*, 2021). One study found an association between nutrient profiling scores and the energy cost of products that indicated that the healthier the food item, the more expensive they were. Thus tuck shop owners may benefit from receiving additional nutrition-related training focused on how to use nutrient profiling as a tool to guide tuck shop owners in selecting healthier food options at no additional costs (Brooks & Begley, 2014; Dickson-Spillmann & Siegrist, 2011; Faber *et al.*, 2019; O'Halloran *et al.*, 2021). Along with high nutritional quality foods being seen as high in cost per energy, it is also costly regarding facilities, storage and perishability, especially products such as fresh fruits and vegetables, homemade meals and dairy products. Tuck shop owners fear that these products will spoil before they are sold and thus resulting in a loss (Anekwe & Rahkovsky, 2013; Kadi & Mosa, 2017; Kim *et al.*, 2012b; O'Halloran *et al.*, 2021; Walton, Waiti, Signal & Thomson, 2010).

Another potential barrier may be time constraints, limited cooking skills and lack of knowledge. Many tuck shop owners have highlighted time constraints as a barrier to healthy cooking and eating as it is too time-consuming to do grocery shopping, prepare foods from scratch and clean up afterwards. Studies have found that overall knowledge, behaviours, and food practises among tuck shop owners were inadequate and that these school food providers did not have the competencies needed to create healthy menus, source nutritious ingredients, or prepare homemade meals (Anekwe & Rahkovsky, 2013; Brooks & Begley, 2014; Buru *et al.*, 2021; Marraccini, 2011; Teo *et al.*, 2021).

Similar results were reported within this study, showing that while participants had an overall good nutrition competency, there may be a gap in their competencies regarding certain aspects, for example, alternative healthier cooking methods and general knowledge of micronutrients and food additives as seen in Figures 10, 11 and 12 (in the results chapter). Furthermore, many studies have identified the positive effect of education on knowledge and practices. These studies have

highlighted that knowledge alone is not enough to change an individual's behaviour; however, adequate knowledge may easier change their practises if policies are put into place and are closely monitored/ supervised by school governing bodies (Faber *et al.*, 2019; O'Halloran *et al.*, 2021; Vo, Le, Le, Tran Minh & Nuorti, 2015). It is suggested that these policies be implemented slowly and with the input of tuck shop owners and school governing bodies and allow learners to voice the types of healthy products they would like to see being sold. It is postulated that by giving the learners an opportunity to voice their opinions, healthier products may be more readily accepted and therefore aid in overcoming the potential barrier of loss of sales due to rejection of healthy options by the learner (Belancová, 2015; O'Halloran *et al.*, 2020; Shrestha, Pyakurel, Gautam, Manandhar, Rhodes, Tamrakar, Karmacharya, Malik, Mattei & Spiegelman, 2017).

Furthermore, research has shown that it is better to limit unhealthy options while increasing the number and variety of high nutritional quality/healthy items instead of completely removing all unhealthy products (Belancová, 2015; Kruger *et al.*, 2020; Wiles *et al.*, 2011). The consequences of which can be seen during celebrity chef Jamie Oliver's nutrition campaign through the UK and US to improve school food environments through strategies to encourage the increase of healthy products provided in schools. While the campaign was a success in the UK, when taken to schools in the US, children completely rejected the idea of healthy eating and stopped visiting the canteens and tuck shops altogether (Belancová, 2015; Kadi & Mosa, 2017; Oliver, 2018).

The importance of implementing nutrition-related policies in a primary schools setting was highlighted during Jamie's campaign, as it was found that primary school learners were more accepting of the new health policies as they were still learning healthy eating habits as compared to high schoolers who had already established unhealthy eating habits. One canteen owner who implemented nutrition-related policies slowly, and gradually changed her products from unhealthy to healthy, with the taste preferences of children in mind, was met with great success and reported having no loss in profits (Belancová, 2015; Kadi & Mosa, 2017; Oliver, 2018).

Similarly, other tuck shop owners overcame the barrier of loss in profits by taking a slow approach to changing over to a more health-focused tuck shop. To improve the school food environment, the South African Department of Basic Education recommends using SAFBDG and the use of nutrient profiling to identify healthy and affordable foods (Department of Basic Education, 2008; Faber *et al.*, 2019; O'Halloran *et al.*, 2021).

While tuck shop owners may thus have some degree of nutrition competencies in place to aid in the decision making of products to sell within their tuck shops, it might be that some of these

barriers, as mentioned above, are preventing tuck shop owners from providing products higher in nutritional quality (Kadi & Mosa, 2017; O'Halloran *et al.*, 2020; Walton *et al.*, 2010).

5.9 Summary of discussion

South Africa is currently faced with a mirid of health issues relating to the DBM among primary school learners. In various research papers, it has been found that the school food environment is currently not conducive to preventing risks associated with the DBM, such as NCD. Therefore, improving the school food environment may play a vital role in providing some solution towards lessening the risk associated with NCDs among schooling going children (Nugent *et al.*, 2020; Popkin *et al.*, 2019; Teo *et al.*, 2021; Tydeman-Edwards *et al.*, 2018; Zambuko, 2018).

This study shows that the nutritional quality of foods available in tuck shops is relatively poor, with more than 50% of them being classified as unhealthy products with poor nutritional quality by the nutrient profiling model. Despite having a high nutrition competency of 77%, it can be said based on this study's findings that many tuck shop owners may not be putting their knowledge, behaviours, and skills into practice to provide primary school learners with healthier school food environment. While the results show that these owners have an above-average nutrition competency, it could also be concluded that they may have overall good nutrition knowledge, skills and behaviour when it comes to their own lifestyles and dietary habits. However, they could potentially still be lacking in the competencies needed to provide primary school learners with the correct nutrition to supply their daily needs.

In other words, tuck shop owners may know how to apply healthy lifestyle choices within their own lives but do not have the necessary knowledge about children's nutritional needs to implement and create nutrition-related policies to improve their current school food environment and food choices.

Furthermore, while most (n=24) reported having nutritional policies in place, very few were aware of the guidelines at their disposal to aid them in policy setting and implementation. For example, none of the participants reported using nutrient profiling or the SAFBDG when deciding on what nutritional quality of foods to make available and sell in their tuck shops.

Therefore, it could be concluded that while it is vital to implement nutrition-related policies, it is more beneficial to make use of the relevant guidelines at hand to ensure the correct policies designed with primary school children's nutrition needs in mind are being implemented and maintained. Lastly, potential barriers could be the leading cause preventing tuck shop owners from implementing nutrition-related policies and fully embracing the switch to a more health and

nutrition-focused tuck shop (Kadi & Mosa, 2017; Marraccini *et al.*, 2012; O'Halloran *et al.*, 2020; Walton *et al.*, 2010).

Therefore, the findings of the performed study confirmed the requirement of additional supportive educational nutrition-related material and training of tuck shop owners and workers to enable them to effectively create a healthier school food environment, as discussed further in Chapter 6.

5.10 Conclusion

This chapter presented and discussed the results of this study as pertaining to the study participants' nutrition competency scores, quality of food items sold within their tuck shops, and policy awareness and implementation thereof. Special attention was paid to the relationships between these variables, specifically between nutrition competency scores and nutrient profiling scores. The next chapter presents the study's conclusions, limitations, recommendations and discusses the achievement of the study's aims.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the study's conclusions on the nutrition competencies of tuck shop owners in relation to food items sold in tuck shops in Tshwane South African primary schools. The conclusions are based on the main findings, limitations, and the value of the study to Consumer Science as an academic discipline. Recommendations for future research are also made within this Chapter.

6.1 Introduction

The literature review in Chapter 2 highlighted the need to develop nutrition-related competencies, policies, and guidelines within tuck shops in primary schools to address nutrition-related health issues in South Africa. The high incidence of the DBM and the increased prevalence of NCDs amongst primary school learners needed to be addressed. The aim of this study was to assess the tuck shop owner's nutrition competency in relation to the quality of food and beverage products sold in primary school in Tshwane, South Africa. Data were collected in April/May and analysed during June. Study findings were considered and are discussed in relation to the set-out aims and objectives of this study

This chapter is divided into the following sections:

- Significance of the study,
- Measurements,
- Summary of Findings (according to the aims and objectives),
- Conclusions,
- Limitations and
- Recommendations

6.2 Significance of the study

The literature reviewed in the first two chapters of this study revealed that the DBM is a significant problem worldwide. In South Africa, it is most prevalent in vulnerable groups such as primary school-aged children. While DBM is the outcome of an array of interrelated factors such as eating habits, food insecurity, nutrition knowledge, education, culture and behavioural factors, most literature has in the past focused more in-depth on older children's (high school-aged) nutrition knowledge and behaviours. The importance of other aspects such as the food environment, specifically the school food environment, in children's overall health and nutrition has only recently been recognised as a critical factor in improving DBM among children (Claasen, Van Der Hoeven & Covic, 2016b; Maccarrone-Eaglen & Schofield, 2018; Marraccini *et al.*, 2012). It is thus essential to address malnutrition in schools, especially primary schools, to improve the nutritional statuses of vulnerable and affected groups to ensure their optimal health.

Therefore, this study aimed to assess and describe the nutrition competency and nutritional quality of food items sold in tuck shops across the Third Region of Tshwane to help identify and address DBM as a nutrition-related problem. This study is of great significance as it could aid in identifying and correcting poor nutrition-related choices and practices (such as lack of proper nutrition competencies by the tuck shop owners). It could also encourage and aid in policy creation to promote good practices in their tuck shops, contributing to primary school children's optimal growth and development.

Limited studies have been conducted on school food providers' food knowledge and practices, specifically school tuck shop owners from higher socioeconomic schools. Minimal research has been published on the topic, as most research focuses primarily on primary school learners' food knowledge and practices in lower quintile/lower socioeconomic school environments (De Villiers & Faber, 2015; Faber *et al.*, 2014). This study, therefore, fills a significant knowledge gap regarding the nutrition competencies of primary school tuck shop owners in Tshwane, South Africa.

Furthermore, many previous studies have focused on learners' consumption behaviours and patterns instead of the functioning's of a tuck shop and the potential barriers preventing tuck shop owners from providing an environment conducive to healthy eating (Claasen *et al.*, 2016b; Maccarrone-Eaglen & Schofield, 2018; Marraccini *et al.*, 2012). This study also contributes to the body of knowledge regarding the current nutrient quality of food and beverage items available in school tuck shops and some potential barriers identified that might hinder the sales of healthier food items.

Literature has also highlighted the rising burden of chronic NCDs on the South African health care services and system (Indongo & Kazembe, 2018; Sheik *et al.*, 2016). More so now, due to health care services being spread thinly treating individuals during the pandemic. Additionally, it has been shown that individuals who have NDCs are also more at risk for experiencing complications when diagnosed with COVID-19 (World Health Organization, 2021). The importance of school-based interventions to promote lifelong healthy behaviours and influence children to make healthier food choices has also been noted in various studies (Nortje *et al.*, 2017; Stupar *et al.*, 2012; Wiles *et al.*, 2011).

Hence the results of this study could be used to aid in creating school tuck shop educational materials, policies, and guidelines to be implemented to improve the current school food environment. It could also be a helpful resource for role players to use to adjust/form intervention strategies for their tuck shop owners. These strategies may help overcome the various barriers preventing healthy eating practices by addressing the societal concern of DMN and ultimately lessening the heavy burden on the South African health care systems by preventing the risks of increased NCD of children in adulthood (Greenberg, 2017; Prentice, 2018; World Health Organization, 2021).

6.3 Measurement

A cross-sectional, non-experimental research design incorporating quantitative research methods was implemented to answer the research question. First, a pilot study was conducted to test and refine the questionnaire and checklists used for data collection. Then, the questionnaire covering the following aspects was distributed: demographic information of the tuck shop owners to characterise the participants. Nutrition competencies were assessed with the nutrition part of a South African food literacy scale; this portion of the questionnaire consisted of questions relating to nutrients, overall nutrition, cooking and preparation methods, and food choices to test tuck shop owner's nutrition knowledge, skills and behaviours. Finally, the tuck shop owner's policy awareness and implementation were assessed in the questionnaire's last section. The questionnaire was administered to a sample of thirty-three primary school tuck shop owners from quintile five and private primary schools.

Observations were also used to gather information about the nutritional quality of food and beverage items made available and sold in the primary school tuck shops. Stratified sampling was used to select the sample for this study from the Third Region of Tshwane. A sample of thirty-three tuck shop owners was chosen to participate in this study. All respondents gave formal consent to participate in the research.

The researcher analysed the data using appropriate statistical methods such as descriptive statistics using the SPSS computer program. Combined frequencies were done on all variables. The Pearson's correlation test was used to test the relationship between the continuous variables of tuck shop owners' nutrition competency scores and the nutrition quality percentage score of food and beverage items sold in their tuck shops. Pearsons correlation was also used to explore the relationships between nutrition-related training and the nutritional quality percentage scores and between nutrition-related policies and nutritional quality percentage scores of participating tuck shops. In addition, the Pearson chi-square and independent t-tests were used to test for statistical differences between categorical variables.

6.4 Summary of Findings

6.4.1 Summary of Demographics

As much as the demographic characteristics of the participants were not part of the study's objective, they do indirectly affect the outcomes and results. The majority (42%) of participants were between 55 and 64 years of age, whereby most (72%) were married. Most (78%) of the participants had acquired a post-matric qualification, and all the participants (n=33) had acquired a basic high school education. It is assumed that with this level of education, participants would be more likely to observe healthier eating habits and take into account some of the basic nutrition education that had been learned within the school curriculum. Their higher level of education may very well strengthen the level of nutrition knowledge; however, it was indicated in section 5.3 that, despite being well educated and knowledgeable, participants could benefit from additional nutrition-related training primarily focused on children's nutrition as opposed to general nutrition.

The largest proportion (n=20, 60%) of this study's participants earned less than R1000- R59,999 per annum. This raises a concern whether the current income of the majority plays a role in influencing the decisions made about what food and beverage products to sell in their tuck shops. Literature has indicated that many tuck shop owners were more inclined to provide food and beverages high in demand, which would guarantee to make them a higher profit at the end of the day. This is also identified as one of the biggest barriers that tuck shop owners have regarding stocking and selling healthier food and beverage items, as indicated by literature. In view of the above, participants might not be willing to apply their knowledge due to a lack of financial resources, as greater demand and availability of unhealthy foods translates into higher profits.

6.4.2 Summary of the main findings

Each objective will be discussed in terms of the main findings that shed light on tuck shop owners' nutrition competency level, the quality of food sold in their tuck shops and the relationship between the two scores.

6.4.2.1 Objective 1.1: At quintile five public and private primary schools in the Third Region of Tshwane, assess and describe the nutrition competency (as a dimension of food literacy) score of tuck shop owners in terms of nutritional knowledge, skills, and behaviour

In order to determine tuck shop owners' basic nutrition competency scores in this study, a nutrition part of a food literacy scale that encompassed 25 closed-ended dichotomous questions were deemed fit and used. The scale was used due to its ability to highlight the interconnectivity between food, health and the environment while simultaneously creating a better understanding of food, nutritional requirements and cooking skills (Amin *et al.*, 2018a; Ronto *et al.*, 2017; Vidgen & Gallegos, 2014). Good nutrition-related knowledge has been said to be an excellent tool in intervention programs to provide a baseline in addressing nutrition needs. Poor nutrition knowledge is said to affect an individual's food choices, dietary interventions negatively and compromise health (Chung, 2017; De Villiers *et al.*, 2016; Hirvonen *et al.*, 2017; Pillai *et al.*, 2019; Truman & Elliott, 2019; Walsh *et al.*, 2003). Good nutrition knowledge of tuck shop owners/school food providers is thus required to improve children's dietary habits and behaviour, to ensure adequate nutrition for primary school learners is reached and in this way to prevent increased risk of DBM and NCDs (Chung, 2017; Kadi & Mosa, 2017; Katsagoni *et al.*, 2019).

The results of the nutrition competency questionnaires indicate that the overall competency score achieved by participants was relatively high (19/25, 76%). More than three quarters (n=27) of the participants managed to achieve a score above 72%. Participants from private school tuck shops scored a higher competency score (78%) than those from public quintile five school tuck shops (76%).

Noteworthy significant findings found was between the average nutrition competency score and the highest level of education (P= 0,012). As well as between competency scores and types of nutrition-related guidelines followed and implemented in school tuck shops (P=0,024).

It can be said that participants of this study knew something about nutrition due to the higher end average scores achieved. Most also knew the importance of certain nutrients and food groups in a healthy diet and lifestyle.

For example, most of the participants agreed upon the importance of consuming five fruits and vegetables daily, as well as the importance of variety in a healthy diet.

Although the tuck shop owners knew the broad basic nutrition concepts, it could be assumed that they lack detailed knowledge regarding the functions of certain foods and the inclusion of certain types of foods in their tuck shops to improve school learner's overall nutrition status and diet diversity. Thus, it can be said that they lack competency regarding appropriate food choices for school learners. This potential lack of nutrition competency is further indicated by their choices of foods and beverage items to make available and sell, as they tended to sell non-nutritious food and snack items such as chips, chocolates, biscuits, ice creams, carbonated drinks, fries and jelly babies

A study done in Australia suggested that creating a healthy food environment that supports healthy dietary behaviours can be achieved by providing nutritional education to those responsible for food distribution in the food environment (Ronto *et al.*, 2017; Tysoe & Wilson, 2010). Furthermore, poor nutrition knowledge coupled with poor dietary practices is the driving factors in the development of DBM. The tuck shop owners had some knowledge about the relationship between diet and diseases, but as stated earlier, they failed to apply said knowledge when deciding on the types of product to make available in their tuck shops (Molotja *et al.*, 2020). It can therefore be concluded that many tuck shop owners may benefit from interventions such as additional educational material that focuses mainly on children's nutrition to increase their nutrition competency levels.

6.4.2.2 Objective 1.2: At quintile five public and private primary schools in the Third Region of Tshwane, assess and describe the nutritional quality (as measured by SANPM) of food and beverage products sold at tuck shops.

The second objective aimed to assess and describe the nutritional quality percentage scores of food and beverage items sold at private and quintile five public school tuck shops. The assessment of the products was done using a tool called nutrient profiling. This tool categorised foods and beverages based on their nutrient composition (Drewnowski & Fulgoni, 2008; Rayner, 2017).

When comparing nutritional quality percentage scores, it was found that participating private schools tuck shops achieved a worse score (40%) than participating public quintile five school tuck shops (45%), meaning they sold overall more unhealthy food and beverage products.

Few tuck shops had good quality fresh fruits and vegetable products sold daily. Salads were the most popular form of fresh vegetables made available and was sold in at least eighteen (54%) tuck shops, while only ten (30%) of the participants' school tuck shops sold fresh fruits daily. A mean of fifty products was sold in each tuck shop, of which a mean of nineteen products was considered healthy by the nutrient profiling calculator. This means that tuck shops were only considered 38% healthy.

Not surprisingly, the most significant proportion of tuck shops' inventory consisted of sweets and chocolates (32%), with the second-largest portion making up beverages (25%). The five most popular products featured in almost every tuck shop sampled was water (93%), toasted sandwiches (87%), Coca-Cola soft drink (81%), Bar-one chocolates (81%) and jelly babies (75%).

Based on the results of this study, it can be said that due to the lack in variety of nutrient-dense food products being sold, tuck shop owners are providing learners with poor dietary choices in the school food environment.

At quintile five public and private primary schools in the Third Region of Tshwane, assess and describe the relationship between the nutrition competency score of tuck shop owners and the nutrient profiling score of food and beverage products sold. Although the literature reviewed indicated a close association between good nutrition knowledge and good nutrition practices. The results of the Pearson correlations analysis for this study showed no statistical significance between the nutrition competency scores and the nutritional quality percentage scores. For example, according to the results of this study, the tuck shop owner's competency level did not make a significant difference to the nutritional quality of foods and beverages sold within their tuck shops. This lack in correlation may be due to specific barriers preventing tuck shop owners from using their competencies to implement healthy changes in their primary school tuck shops. An example of these barriers could include limited access to low-cost healthy snack foods and beverages such as fresh fruits, vegetables and water, and the convenience of high-density, low-cost food alternatives. Additionally, tuck shop owners may not know what products are considered as healthy or unhealthy, and thus may sell products they deem as healthy while, in fact, it might not be as healthy as they perceived it to be (Marraccini, 2011). A statistical difference was found between nutritional quality percentage scores and education. It could be postulated that through potentially increasing tuck shop owners' nutrition competencies/nutrition knowledge through training and education, tuck shop owners may be better equipped to increase their tuck shops' nutritional quality.

6.4.2.3 Secondary objectives: At quintile five public and private primary schools in the Third Region of Tshwane, explore the relationship of nutrition-related training and the nutrition-related policies on the nutritional quality of food and beverage products sold at tuck shops

This study also found a significant relationship between participants who had received some form of nutrition-related training and those who implemented nutrition-related policies in their tuck shops. Furthermore, the meaningful difference between participants nutritional quality percentage scores and nutrition-related training received highlighted the importance of training tuck shop owners to improve the types of policies created (that is centred around primary school children's

nutritional needs) and, in turn, the nutritional quality of food and beverages sold in their tuck shops (Shi-Chang *et al.*, 2004; Teo *et al.*, 2021).

6.5 Limitations of the study

When conducting a study of this nature, limitations are often inevitable, and this study is no exception. Although the research study reached its aims and objectives, there were still some shortcomings and limitations present.

The age and gender distribution of the group were not evenly distributed as there were more females than males who participated in this study. Most of the respondents in the sample were from the baby boomer generations, with a household size of two; however, in spite of this limitation, valuable information on this generation and gender groups food practices were gained.

This study only concentrated on tuck shop owners within a particular geographical area (Third Region of Tshwane Region) and did thus not represent the larger South African tuck shop owners' population. Additionally, the study initially planned to sample schools from all quintiles 1-5 (excluding private schools, however, due to the pandemic and closure of school tuck shops in the lower quintile school environment, this study only sampled participants from schools that fell within the higher socioeconomic groups, i.e., quintile five and private schools.

It should be kept in mind that the food literacy and nutrient profiling models are mainly concerned with the prudency of diets and healthy eating and not the adequacy thereof; it can therefore not be regarded as a universal solution for all nutrition-related problems.

Even though the nutrient profiling model used was validated, and the credibility of the classification of foods confirmed, it does not mean any food regarded as healthy by this model can be eaten without restriction. However, it is recommended that these foods be included to form part of an overall balanced diet.

Portion sizes of foods should still be taken into consideration by the tuck shop owners when selling products in their tuck shops. For example, a diet high in kilojoules, protein, fibre, sugar, and fat will still lead to obesity even if the consumer exclusively uses food classified as healthy by the nutrient profiling model.

The validation of this nutrient profiling model is very new and has, to the researcher's knowledge, only been attempted in a few studies. Therefore, the findings of this study could not be compared to a large number of other studies.

Similarly, the food literacy scale that was used to assess the nutrition competencies of the tuck shop owners, while validated, is also reasonably new. Only a small number of studies have made use of it in a South African context, even fewer using it to assess the knowledge, skills and behaviour of individuals responsible for creating healthier food environments. Thus, the findings of this study could not be compared to a large number of other studies.

6.6 Recommendations

The following recommendations can be made based on the results of the study:

- School management should provide training to food handlers/tuck shop owners about food preparation, general hygiene and healthy snack and meal alternatives to sell within tuck shops. Additionally, tuck shop owners should get relevant training regarding proper child nutritional needs (e.g., informal nutrition education training that would enable them to choose, handle, prepare, store and give nutritious types of foods to learners) to improve the nutrition quality of tuck shops.
- Using nutrient profiling in combination with the SAFBDG to source and sell more products that are high in nutritional quality at more affordable prices to learners to place healthy foods within their reach.
- An interdisciplinary approach should be adopted whereby stakeholders, parents, and governing bodies are involved in policy setting to curb overweight and obesity in schools. For school tuck shops to achieve a healthier school food environment, there needs to be collaboration between the DoH, learners' parents and other stakeholders through knowledge sharing. Meaningful involvement by learners' parents in the decision-making process about the food availability in the food environment will further empower learners to make healthier food choices.
- Tuck shop owners and workers should be educated on the SAFBDG as well as the importance of adhering to these guidelines to assist them in making healthier decisions regarding the availability of foods in the tuck shop.
- Based on the results of this study, it is also recommended that tuck shop owners are informed about the types of healthy or unhealthy food choices they provide in their tuck shops. The majority of the participants in this study's tuck shops consisted of unhealthy food items characterised by high sugar, sodium and fat contents. It is of utmost importance that tuck shop owners focus on making healthy and nutritious food, snack, and beverage items available, accessible, and affordable to primary school learners.

- In order to educate tuck shop owners, different workshops could be conducted with the tuck shop owners and workers. For example, a poster (with pictures of foods) of the SAFBDG and Good tuck shop practices from the NSNP would be used as a nutrition education tool to educate tuck shop owners about the different issues such as healthy food choices, including snacks and drinks, the nutritional value and functions of specific foods in the diets and the value of dietary diversity.
- The following information regarding the importance of including a variety of foods in the primary school learner's diets. As wells as how that can be achieved would first be given at the beginning of the workshop:
    - Snacking plays an important role in children's diets; thus, it is important that tuck shop owners provide children with healthy snacks that will contribute to their optimal growth and development. Therefore, it is advisable and recommended to choose snacks using the SAFBDG or use the suggestions given in the good tuck shop practices guidelines to guide in formulating healthy snack ideas.
    - Unhealthy snacks should be avoided as far as it has been found that some may interfere with the learner's appetite and academic performance at schools. Therefore, it would not benefit the child's optimal growth and development but contribute to creating an obesogenic school food environment.
    - The following are examples of the type of foods that could be consumed as healthy snacks (Department of Basic Education, 2008):
        - Peanut butter/ cheese sandwich on brown bread,
        - High fibre low sugar Cereal with fruit and milk,
        - Cheese,
        - Meals featuring eggs such as boiled eggs, omelettes, or scrambled eggs,
        - Fresh fruits (depending on availability as some are seasonal, e.g., apples, banana, pear, peaches, oranges, naartjies, apricots, pawpaw's, litchis),
        - Fruit juices (100%, e.g., Tropika, Liqui fruit, Ceres),
        - Raw vegetables (e.g., carrot sticks, celery sticks, cucumber sticks).
    - It is encouraged that schools enforce policies in which tuck shop owners should avoid or limit the use of the following foods as snacks:
        - Chips (e.g., Simba, Lays, Doritos),
        - Biscuits (shortbread, bakers, Oreos),
        - Sweets (e.g., candy, chocolate, lollipop, jelly babies etc.),
        - Soft drinks (e.g., coke etc.)

6.6 Suggestions for future research

- It could be helpful in the future to have an equal representation of the different socioeconomic groups, i.e., all private schools and quintiles 1-5 schools.
- This study could be replicated in other urban areas of South Africa in order to compare the results and to obtain more information on the food practices of tuck shop owners.
- Based on the small sample size (n=33), which is not representative of the larger Tshwane population, the external validity of the results is questioned, as these results cannot be generalised to the whole population. A study like this should include a bigger sample which would give the profile of tuck shop owners in the whole Tshwane or even Gauteng so that nutrition practices applicable to all primary school tuck shop owners in the community are reported and observed. This would enable the researcher to develop solutions that would be applicable to all primary school tuck shops in the community. In other words, all types of tuck shop owners in Gauteng should be explored to find out about their nutrition-related competencies, capacities, practices, resources at their disposal, and differences in policy setting and implementation.
- In this study, data were collected at a single point in time and thus did not allow the researcher to measure change over time. For future research, a longitudinal study that involves examining the same respondents at different time intervals is recommended. This would give a clearer picture of actual events, e.g., what is being sold in tuck shops during different times, and seasons of the year. This type of research design would also allow the researcher to determine whether the intervention (e.g., nutrition education and nutrition policies) brought about positive changes or not as far as children's overall health and nutrition are concerned.
- Further research to identify potential barriers preventing tuck shop owners from switching to a more health-focused tuck shop, and strategies to alleviate these barriers.
- Additionally, due to the pandemic, many parents/guardians have been negatively impacted financially during this time. This has led to many families struggling to afford healthier food options; thus, it is recommended that schools play an even more critical role in providing affordable, healthy food and beverage options to their learners.

6.7 Concluding Remarks

The results of this study confirm that nutrition-related competencies and policies set in place in primary school tuck shops contribute to the nutrient quality of foods made available and sold in primary school tuck shops. Although a few studies have been conducted internationally on the contribution of school food handlers' knowledge on the school food environment, limited studies have been conducted in a South African context. This research contributed to a better understanding of tuck shop owners' nutrition competency, the role of nutrition-related policies and the current nutrient quality of foods made available and sold in private and quintile five tuck shops. By assessing and describing the competency level of the tuck shop owners in the Third Region of Tshwane, this study filled the knowledge gap on the topic in South Africa. This study confirmed the importance of policy implementation in primary school tuck shops as well as the increased need to educate tuck shop owners about children's nutritional needs. This is largely due to the findings that despite their good general nutrition competency level, they may be lacking in the nutrition competency needed to provide school learners with a healthier school food environment. Although these tuck shop owners had adequate access to healthy foods and had the knowledge and skills to prepare healthier meals to be sold in tuck shops, they did not necessarily apply these skills and knowledge in their establishments, nor did they follow the guidelines made available to them by the DOH.

In conclusion, the findings of this study show that while tuck shop owners have a good general nutrition competency level, they may not have the specific nutrition competency needed to provide primary school children with a healthier school food environment. Overall, the participants of this study had not observed the available guidelines and policies or implemented their nutrition competencies in their tuck shop, which could be the cause for the availability of poor nutritional quality food in their school tuck shops. This study achieved all its formulated objectives and, therefore, could be considered to make a valuable contribution to the research knowledge in this field.

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ADDENDUM A: INFORMED CONSENT LETTERS

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Dear Sir/Madam

PERMISSION TO CONDUCT RESEARCH IN TSHWANE PRIMARY SCHOOL'S TUCK-SHOP

The purpose of this letter is to obtain permission to conduct a research project in selected primary school's tuck shops in Tshwane, Gauteng Region 3. This project, titled "Nutrition Competencies Of Tuck shop Owners In Relation To Food Items Sold In Tuck shops In Tshwane South African Primary Schools", will be conducted by Nadine du Piesanie, in partial fulfilment of the requirements for the degree of Master of Consumer science at the University of Pretoria.

The prevalence of overweight and obesity in children is increasing worldwide at an alarming rate. To prevent children from becoming overweight and obese adults with increased risk for diabetes, cardiovascular disease and other lifestyle diseases, research suggests that the school environment might be the ideal place for the promotion of healthy eating habits and thereby influence health behaviour early in life. This research project aims to assess and describe the nutrition competencies of tuck shop owners in public primary schools of Tshwane and to explore the relationship between these competencies on the nutritional quality of food items available and frequently sold in their tuck shops.

The findings of the study should provide us with valuable information which will enable policymakers to advocate the introduction of healthier food choices in tuck shops, as well as increase tuck shop owners nutrition competencies in an attempt to reduce the prevalence of overweight and obesity in children, allowing our youth to become healthy adults. The research requires that a sample of primary school tuck shop owners complete a questionnaire and a researcher visit school tuck shops to access food items for sale in school tuck shops.

The questionnaires assess the nutrition competencies of tuck shop owners by asking questions relating to their nutrition-related knowledge, skills, and behaviours and questions pertaining to nutrition-related policies and guidelines that are implemented/followed in tuck shops. The school tuck shop visits by the researcher will be to assess the types of food items sold at the tuck shop

and popular food items sold. This visit to the tuck shop should take about 20 minutes, and the completion of the questionnaire will take about 10 minutes.

For this purpose, we would like to invite you to participate in the project. Your participation in the project is voluntary, and you will have the right to withdraw from the project at any time if you wish to do so. The ethical principles of confidentiality and anonymity will be adhered to throughout the project, and you will not be asked to reveal any information that could allow your identity to be established. We will use pseudonyms to protect your identity, as well as that of the school.

Throughout the process, it will thus be our aim and responsibility to respect the dignity and promote the well-being of all participants. If you are willing to participate, please sign this letter as a declaration of your consent, i.e. that you agree to participate in this project willingly and that you understand that you may withdraw from the project at any time.

This study has been approved by the Health Research Ethics Committee at Pretoria University

Thank you for considering my request.

Kind Regards

Nadine du Piesanie

Department of consumer and food science

University of Pretoria

Nadinedp96@gmail.com

Informed consent

I …… …… hereby voluntarily grant my permission for participation in the project as explained to me by Nadine du Piesanie.

1.1 The nature, objective, possible safety and health implications have been explained to me, and I understand them.

1.2 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

1.3 Upon signature of this form, the participant will be provided with a copy.

Signed: _____ Date: _____

Witness: _____ Date: _____

Researcher: _____ Date: _____

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ADDENDUM B: TUCK SHOP CHECKLISTS FOR PILOT STUDY

This list was used during the pilot study to assess the primary school tuck shops

TABLE 14: PILOT TUCK SHOP VISIT CHECKLIST

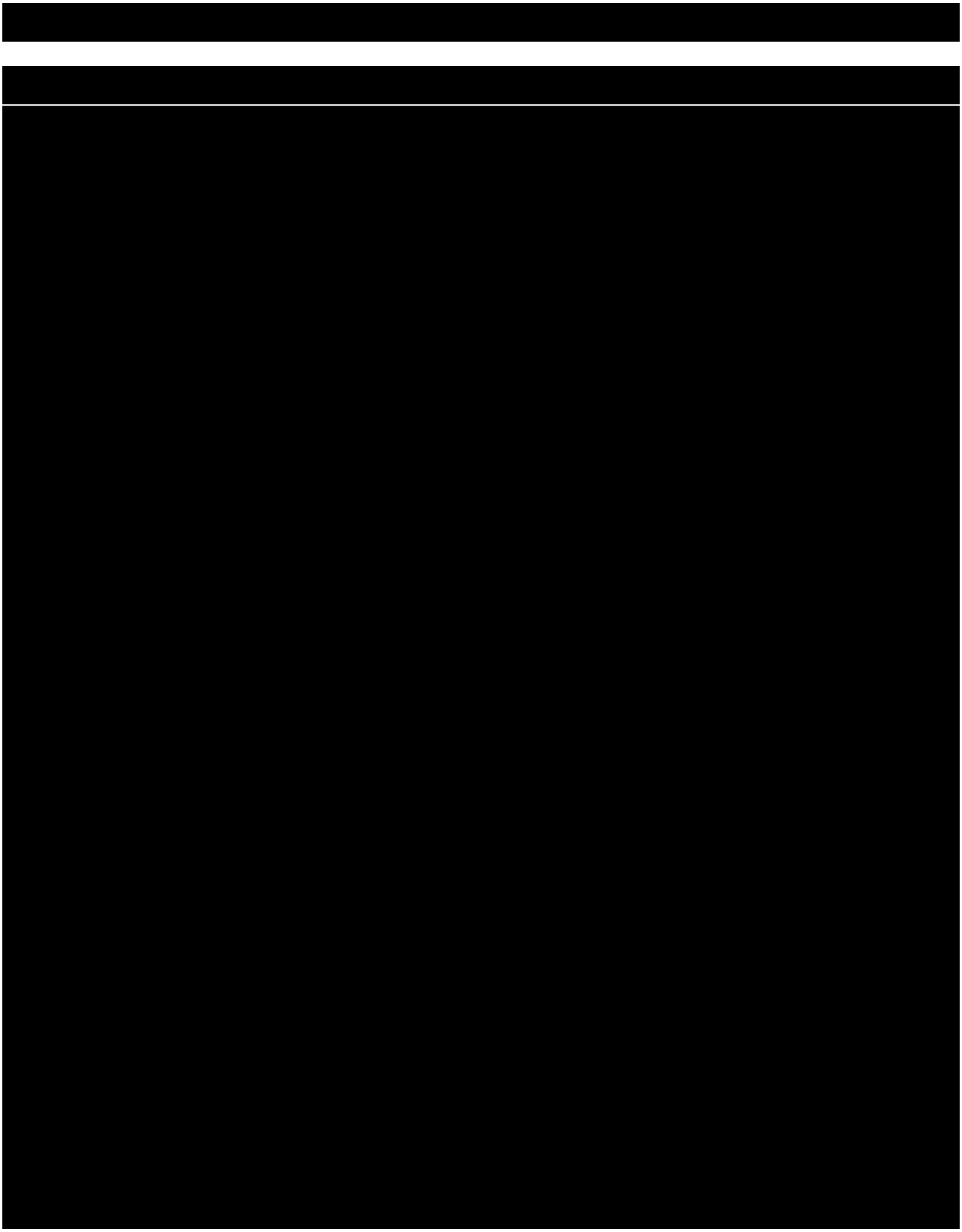
Tuck shop categories		Serving size	Item stocked in tuck shop	Average no units sold per day	No of tuck shops that stocked these items
Beverages	Frozen popsicles	70 g			
	Assorted cans	330 ml			
	Powerade	500 ml			
	Still water	500 ml			
	Flavoured water	500 ml			
	Sugar-free cans	330 ml			
	Starletta	330ml			
	Sprite	330ml			
	Coke light	330ml			
	Fanta	330ml			
	Cream soda	330ml			
	Tab	330ml			
	Coke	330ml			
	Sprite Zero	330ml			
	Lemon Twist	330ml			
	Water	500ml			
	Iced lollies (frozen cordial)	100ml			
	Energade	500ml			
	Canned fruit juice	330 ml			
	Mixed fruit blends	250 ml			
	Flavoured milk	275 ml			
Snack items	Potato crisps	30 g			
	Popcorn	500 ml			
	Doritos chips	45g			

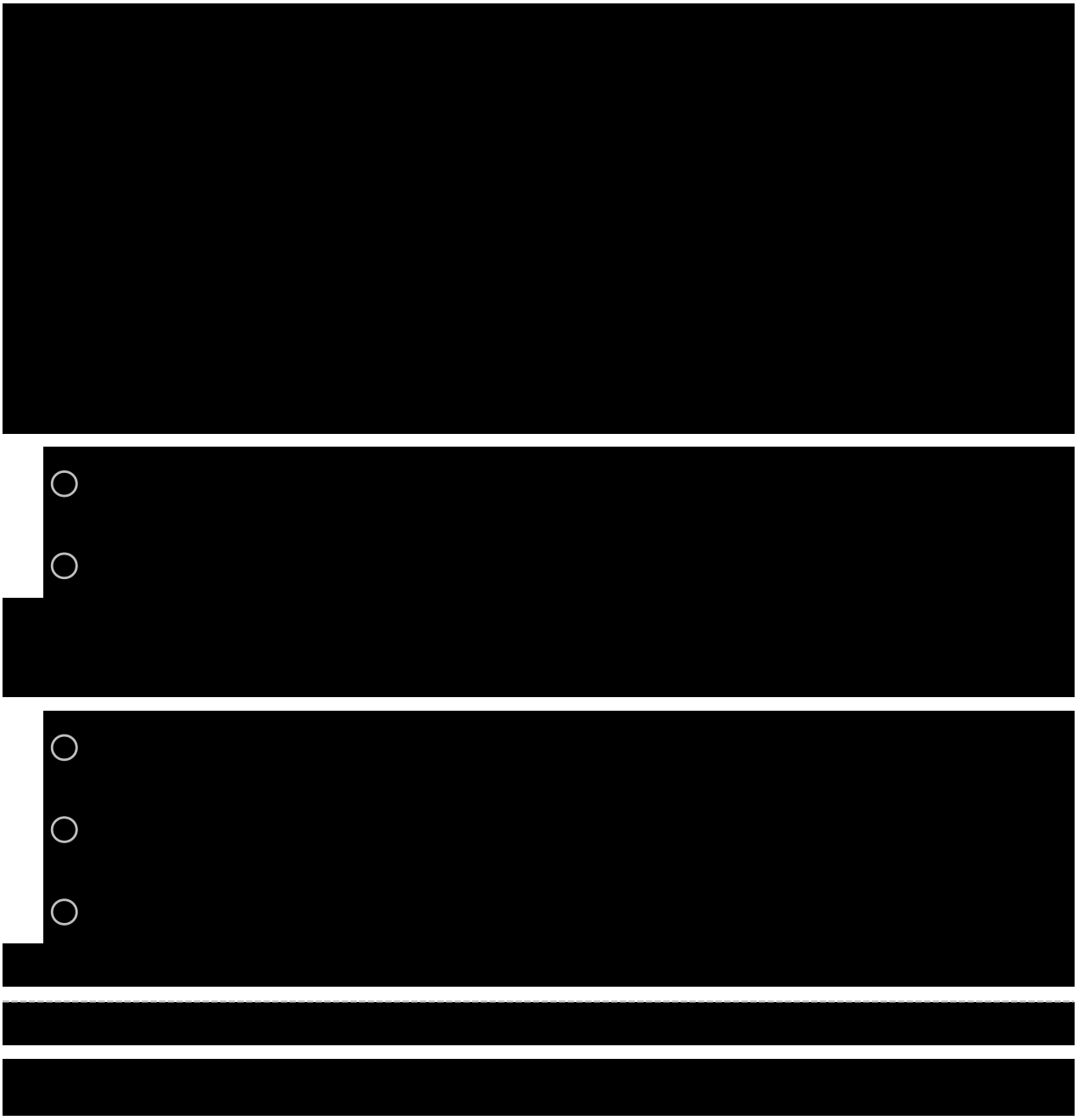
	Simba chips	36g			
	Fritos chips	50g			
	Lays chips	36g			
	Small corn crisps	20 g			
	Samosas	75 g			
	Peanuts and raisins	32 g			
	Doughnuts	45 g			
	Corn crisps	30 g			
	Coconut ice	16g			
	Fudge	20g			
	Peanuts	32 g			
	Tinkie	45g			
	Chocolate muffins	48 g			
	Packets of biscuits	33 g			
	Dried fruit stick	25 g			
	Homemade crunchies	25 g			
	Health muffins	48 g			
	Pretzels	25 g			
	Bananas	75 g			
	Fruit salad	375 ml			
	Jelly and custard	250 ml			
	Yoghurt	100 g			
Sweets and chocolates	Packets of sweets	75 g			
	Chocolates (mini size)	23 g			
	Jelly babies	75g			
	Jelly beans	75g			
	Tempo Chocolate	53g			
	Flake chocolate	32g			
	PS Chocolate	46g			
	Bar-one Chocolate	55g			

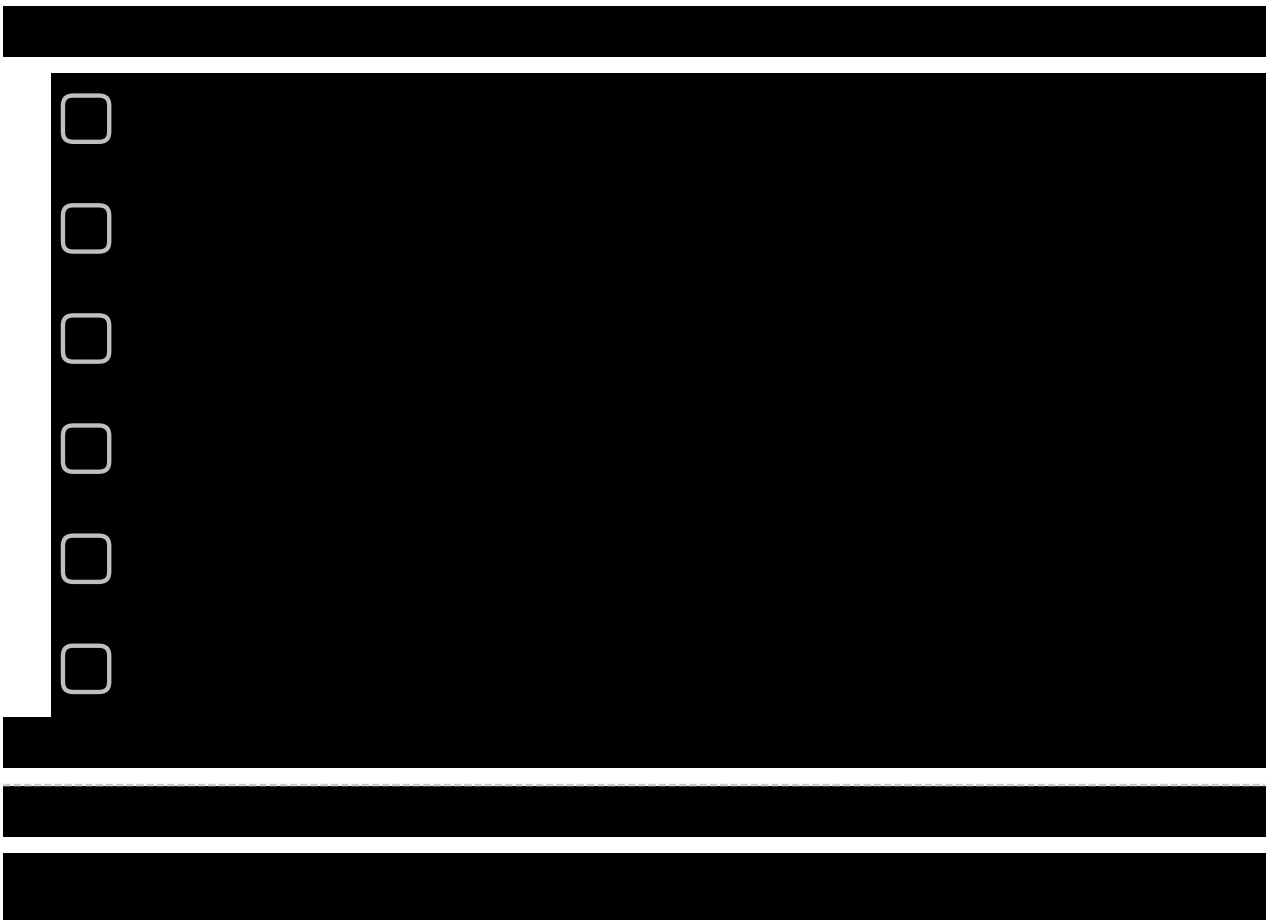
	Chocolates (normal)	48 g			
	Lollipops	13 g			
	Muesli energy bars	45 g			
Lunch items	Pies	170 g			
	Hot dogs	1 each			
	Assorted salad rolls	1 each			
	Toasted sandwiches	1 each			
	Pizzas	80 g			
	Beef burgers	1 each			
	Hot chips	250 g			
	Sausage rolls	165 g			
	Salads	1 each			
Other					

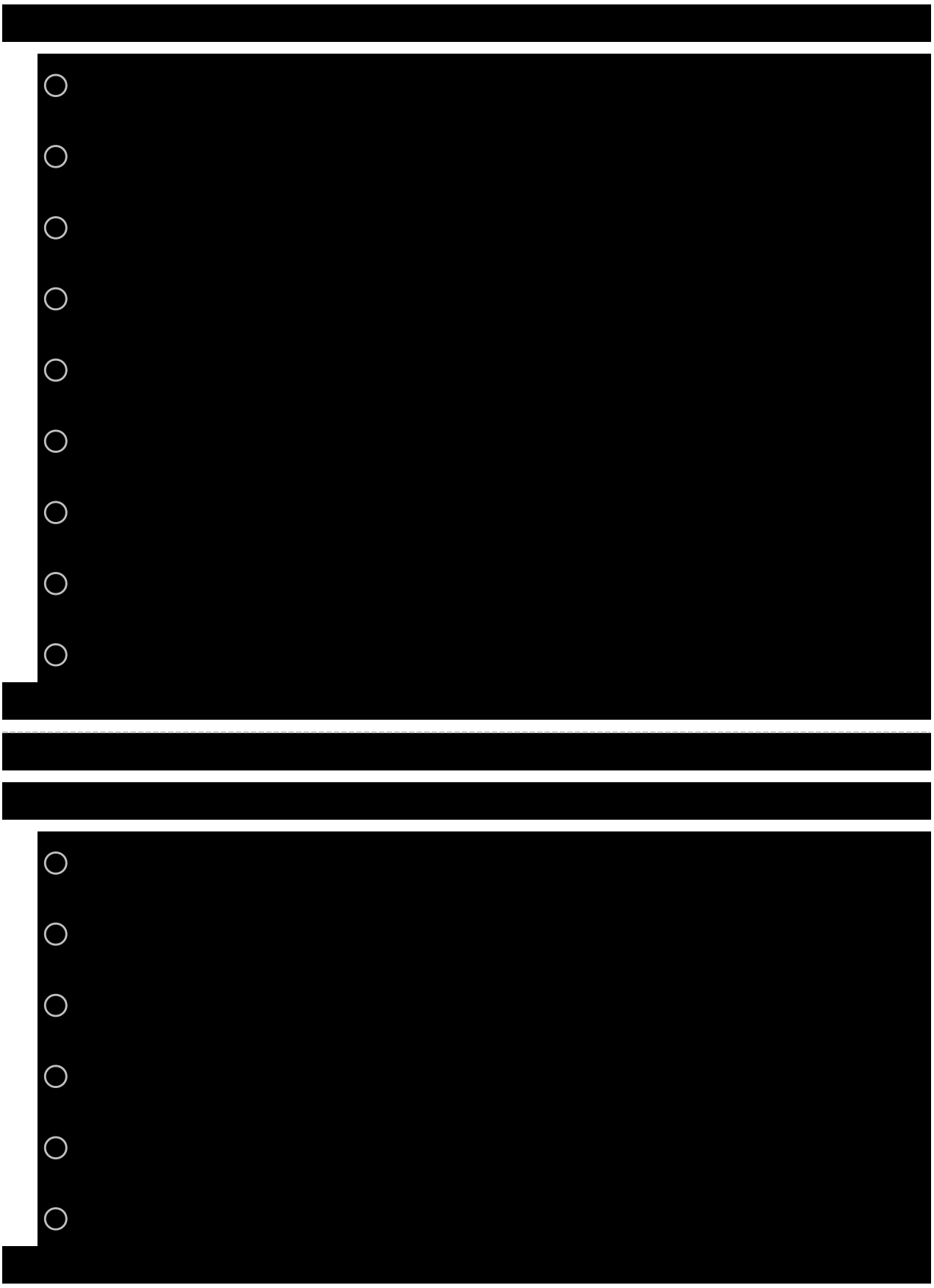
ADDENDUM C: NUTRITION COMPETENCIES QUESTIONNAIRE

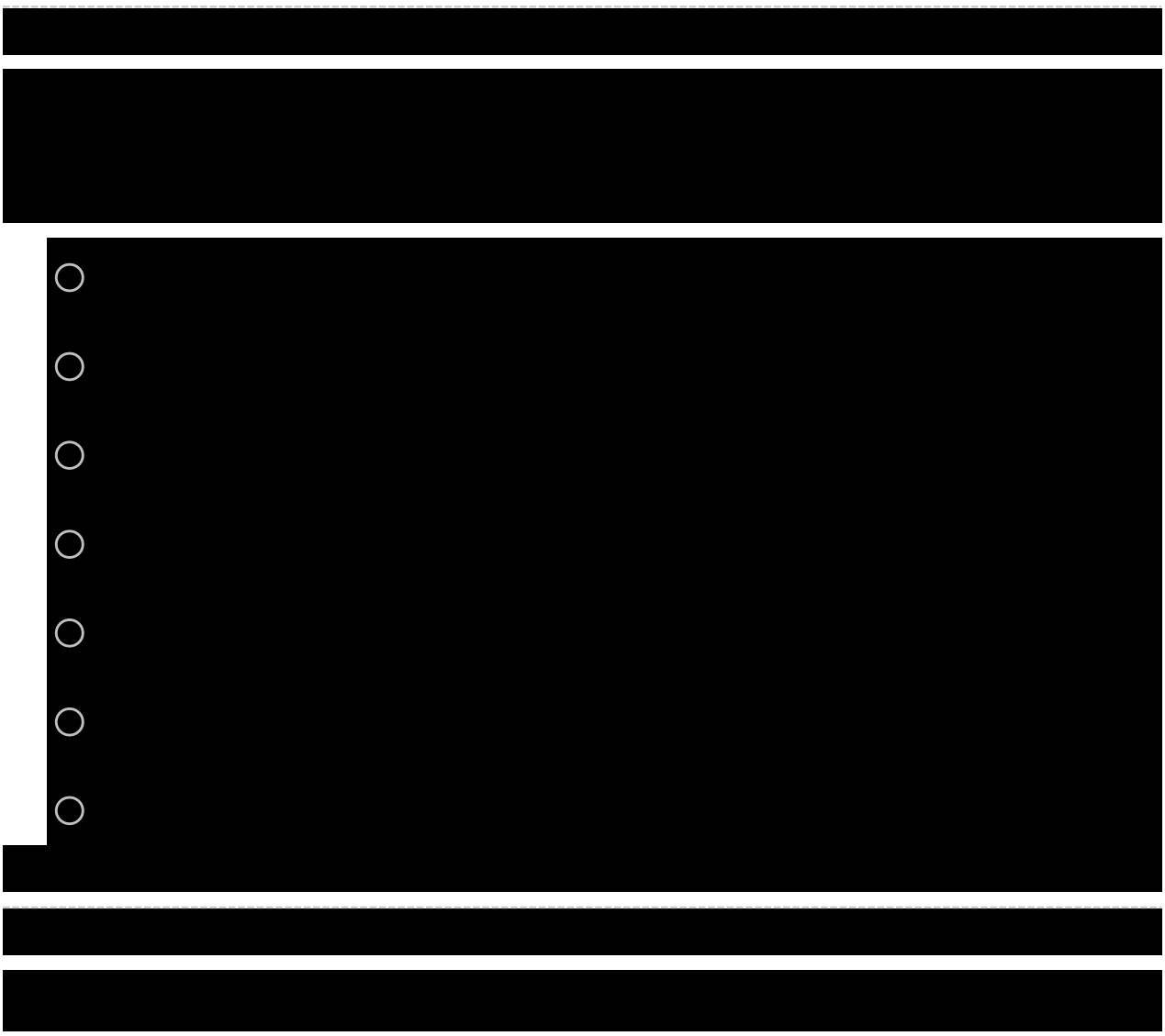
(available on request)

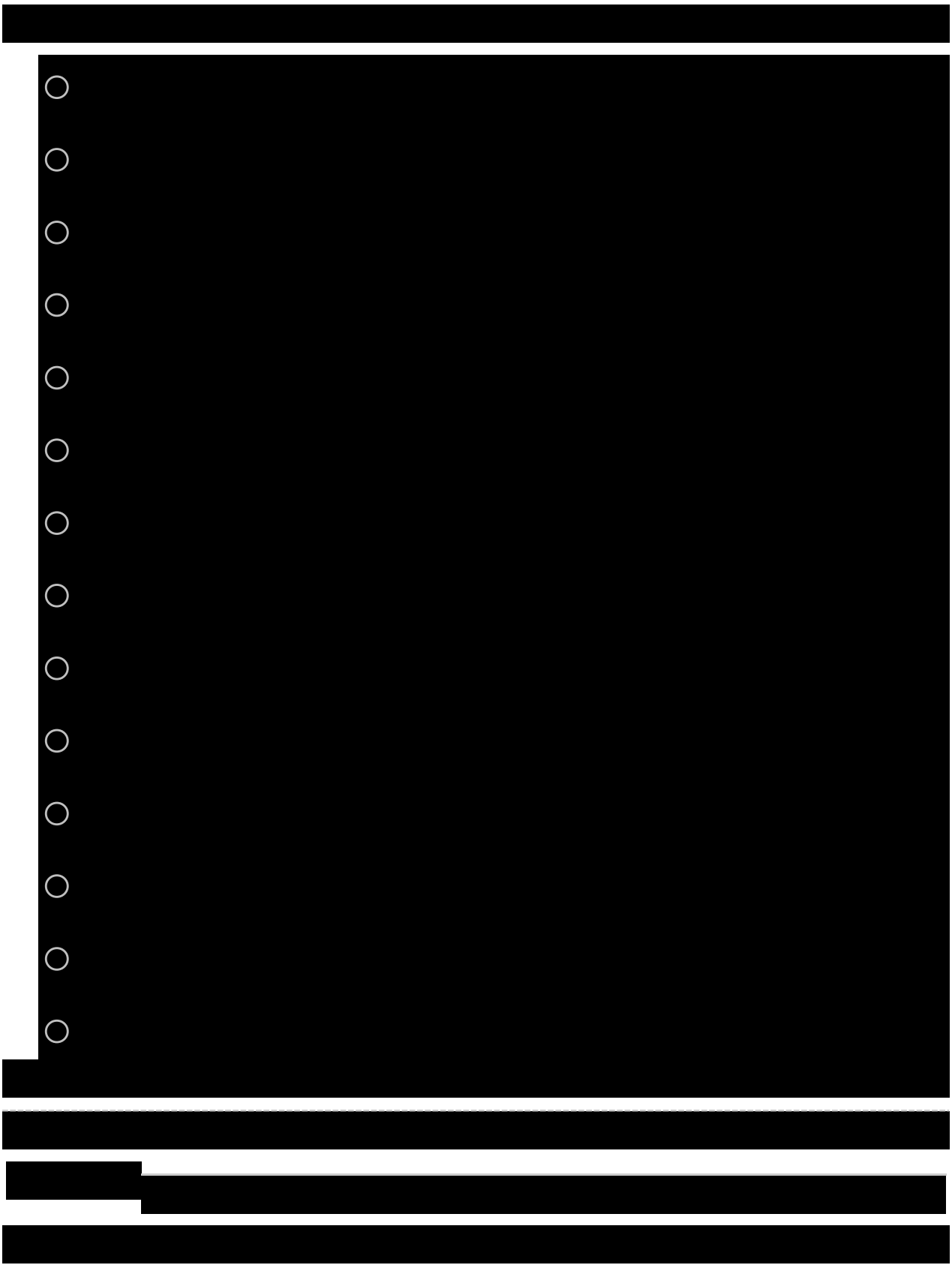


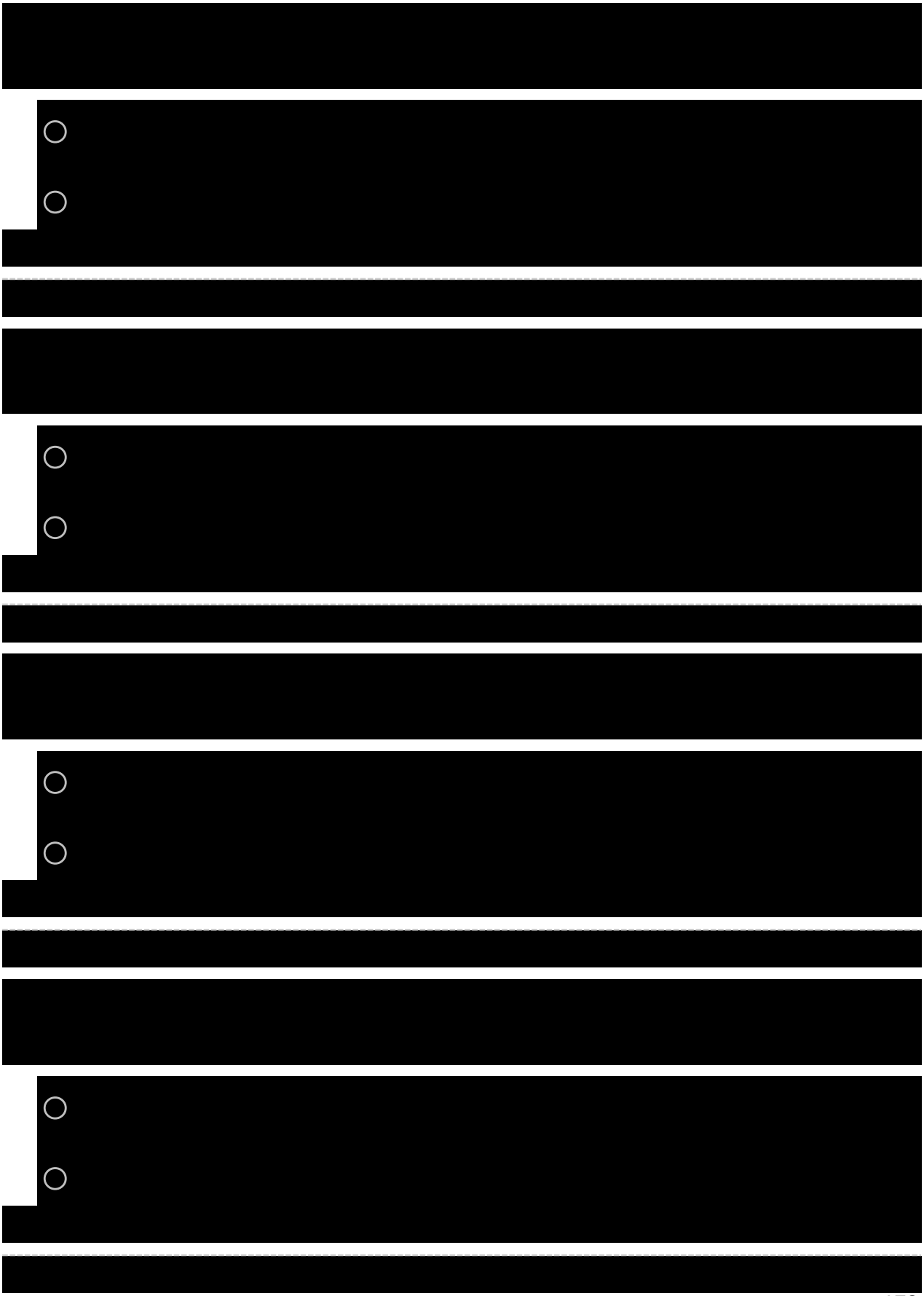


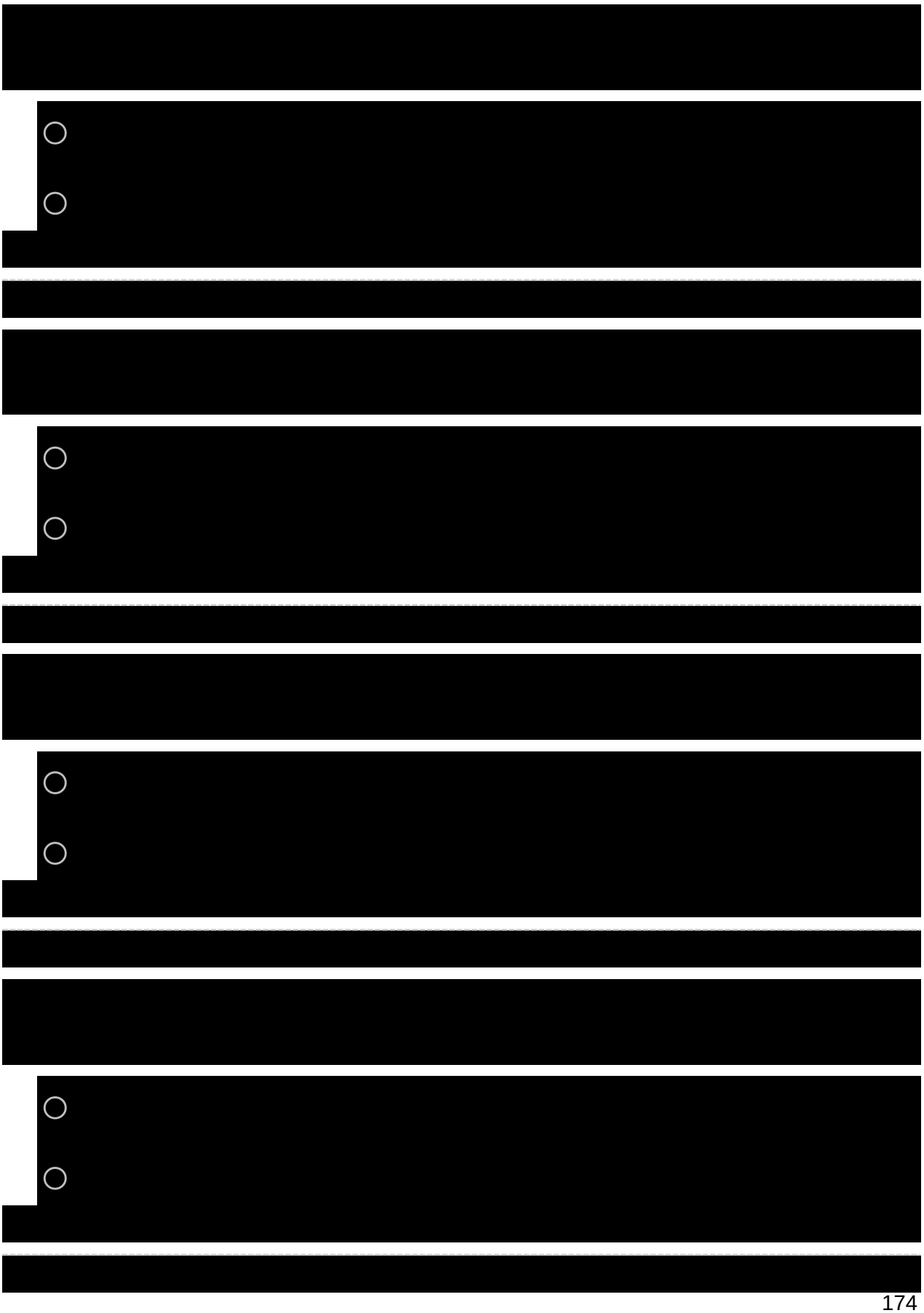


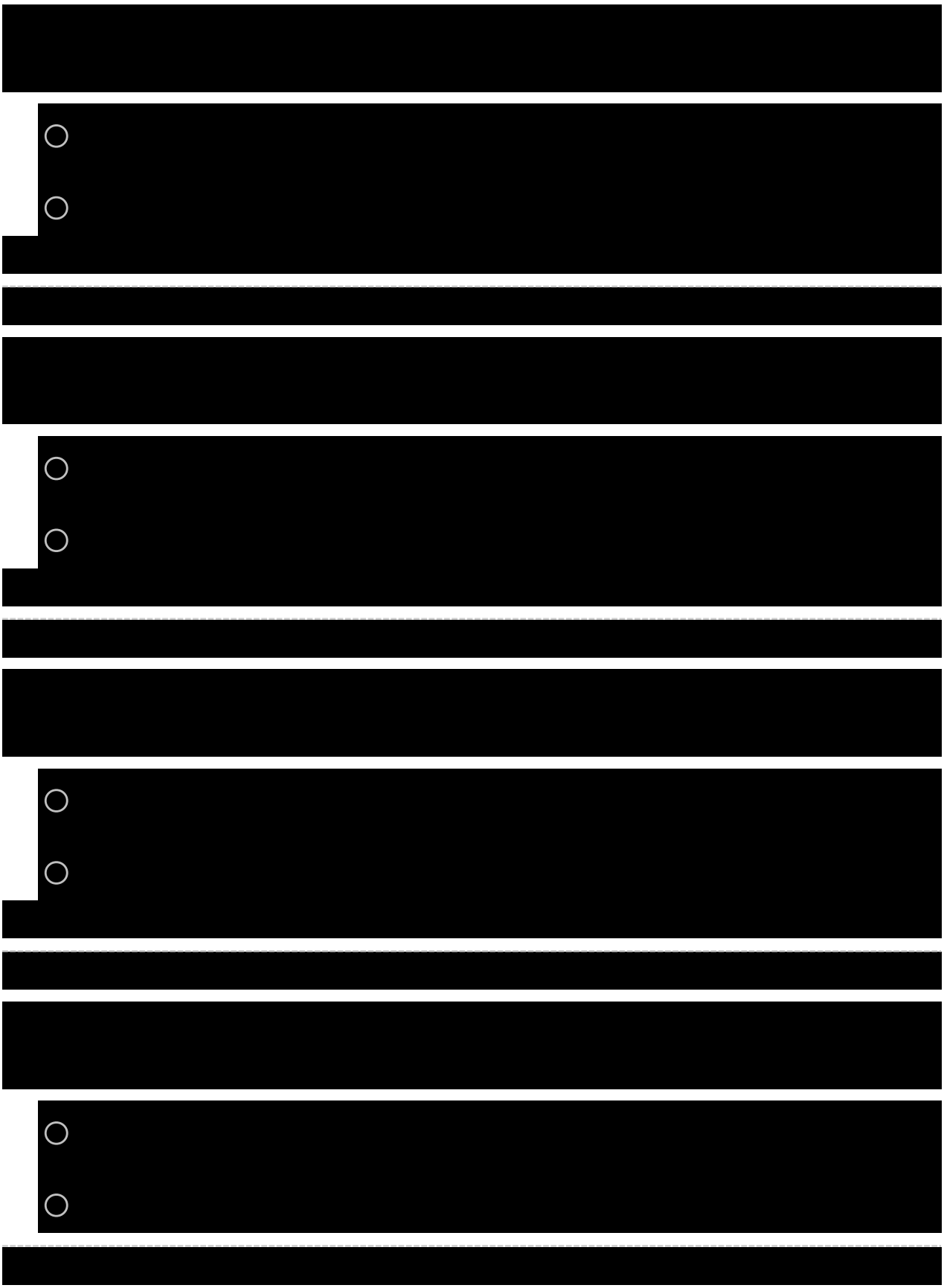


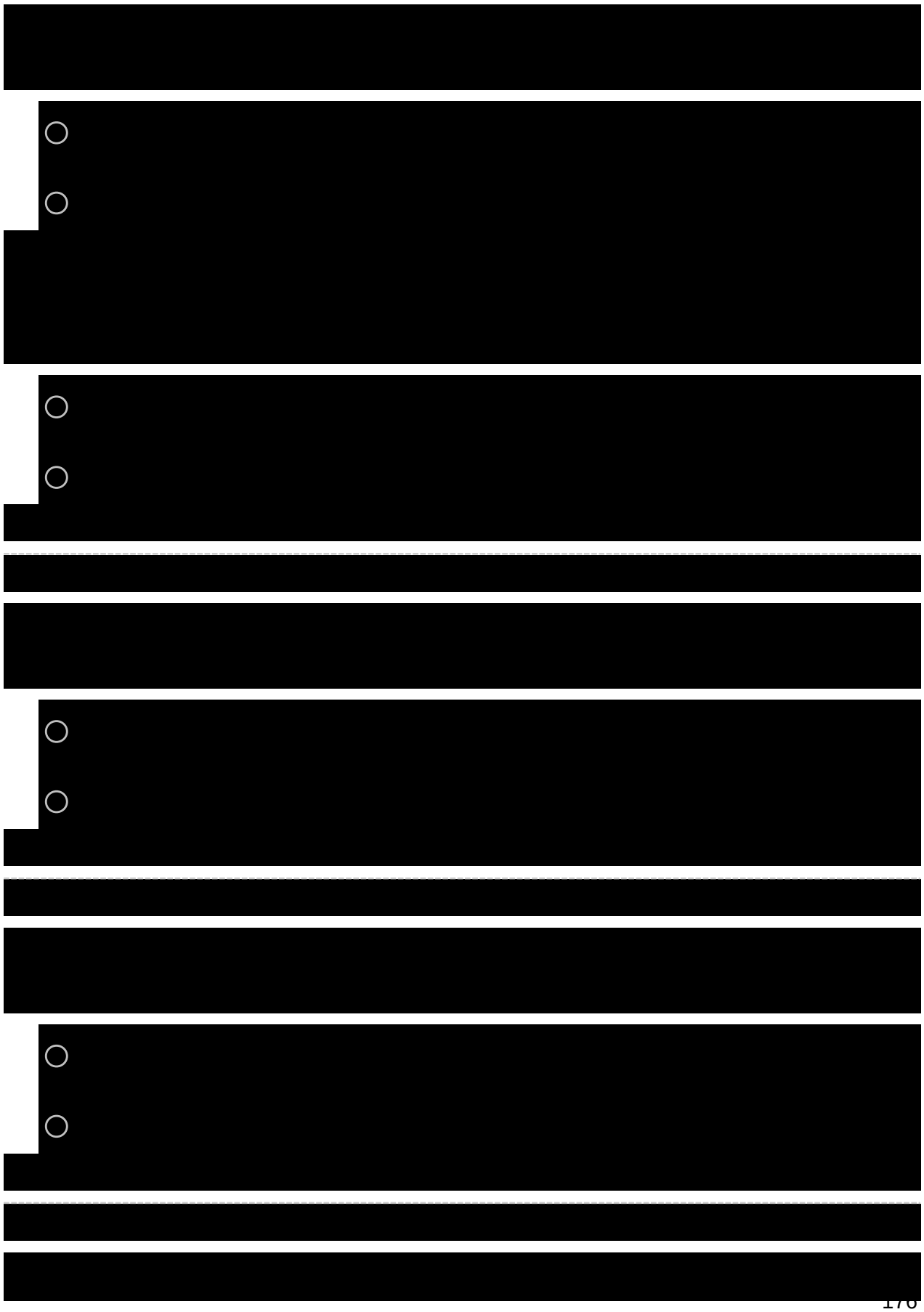


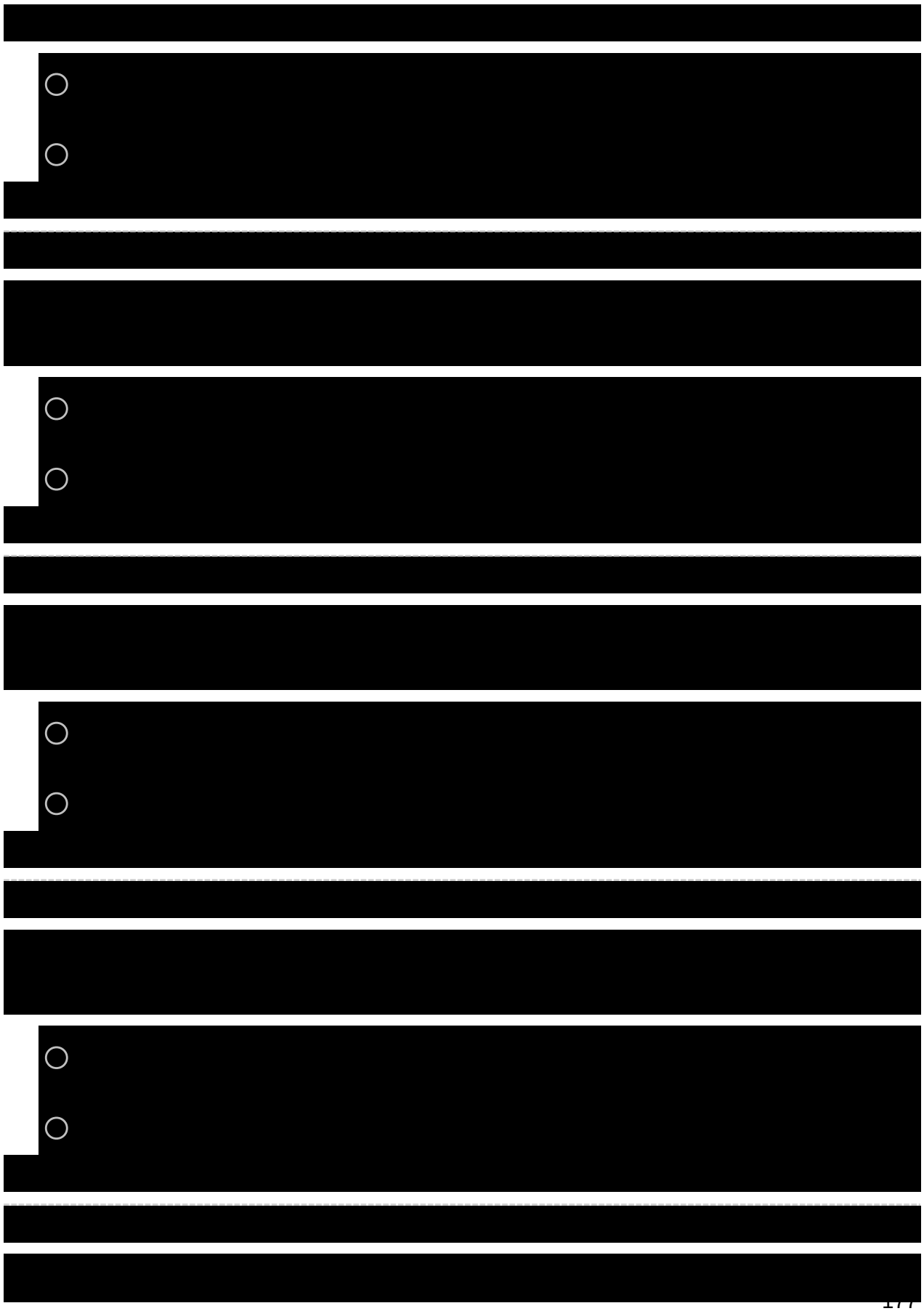


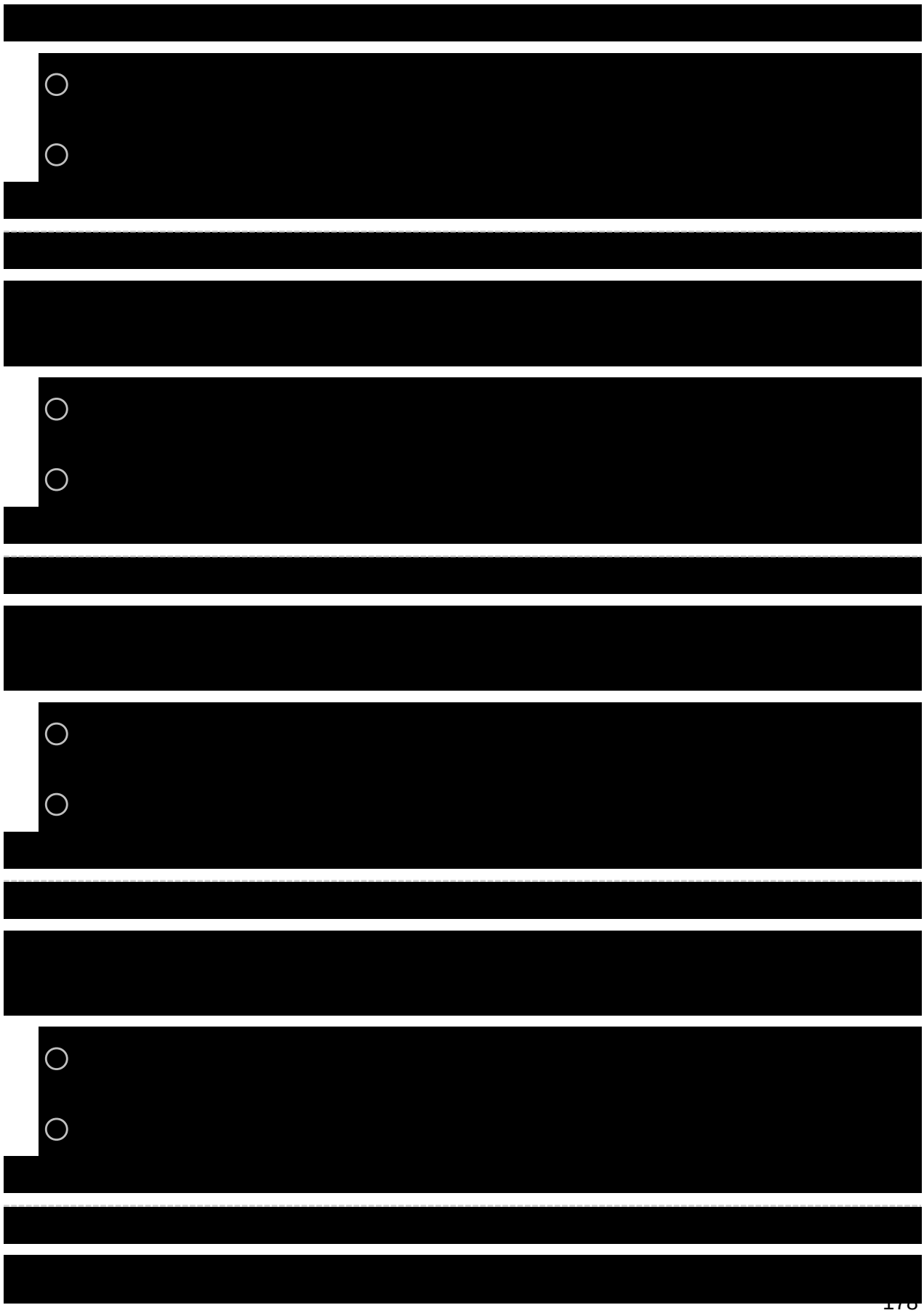


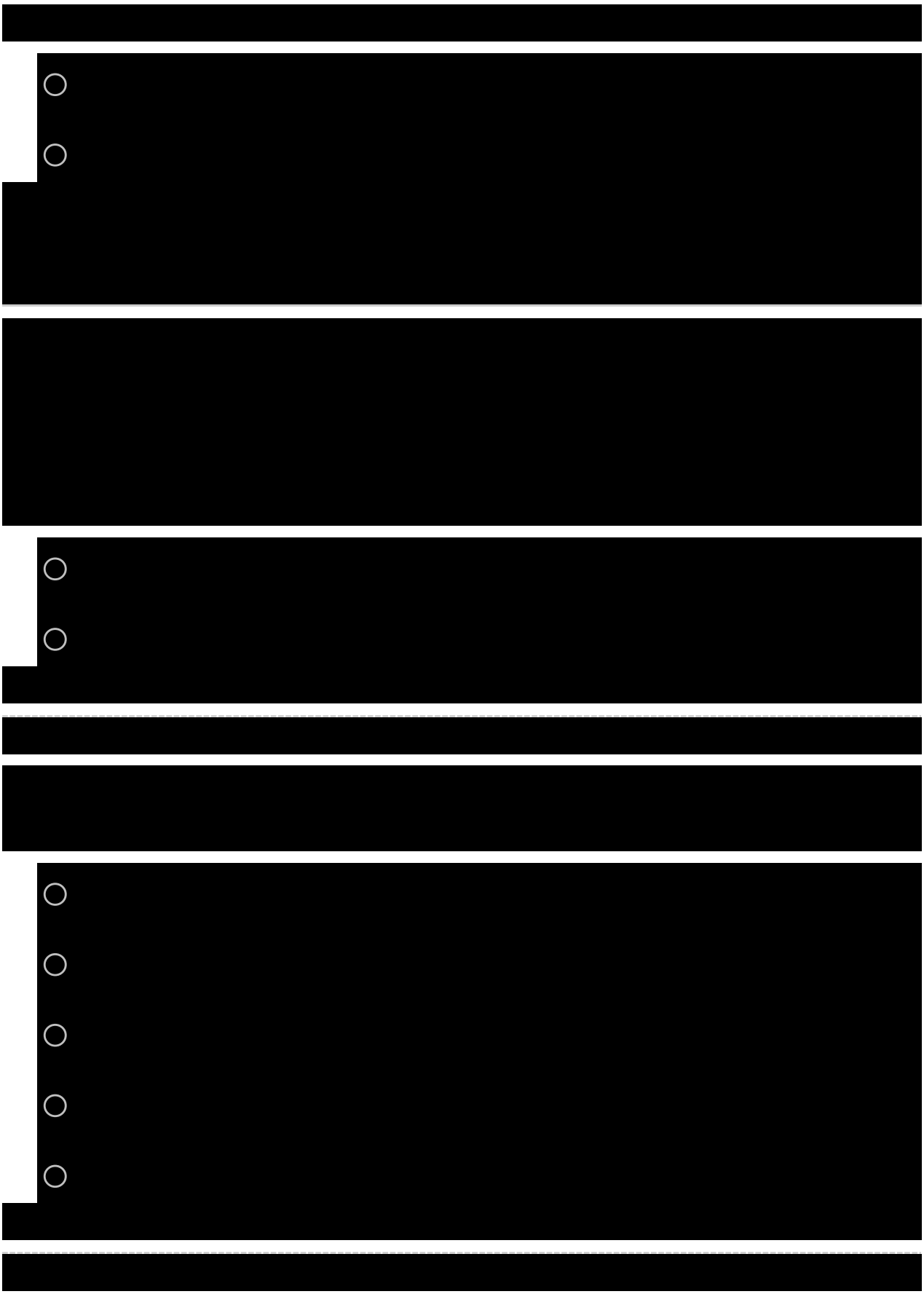


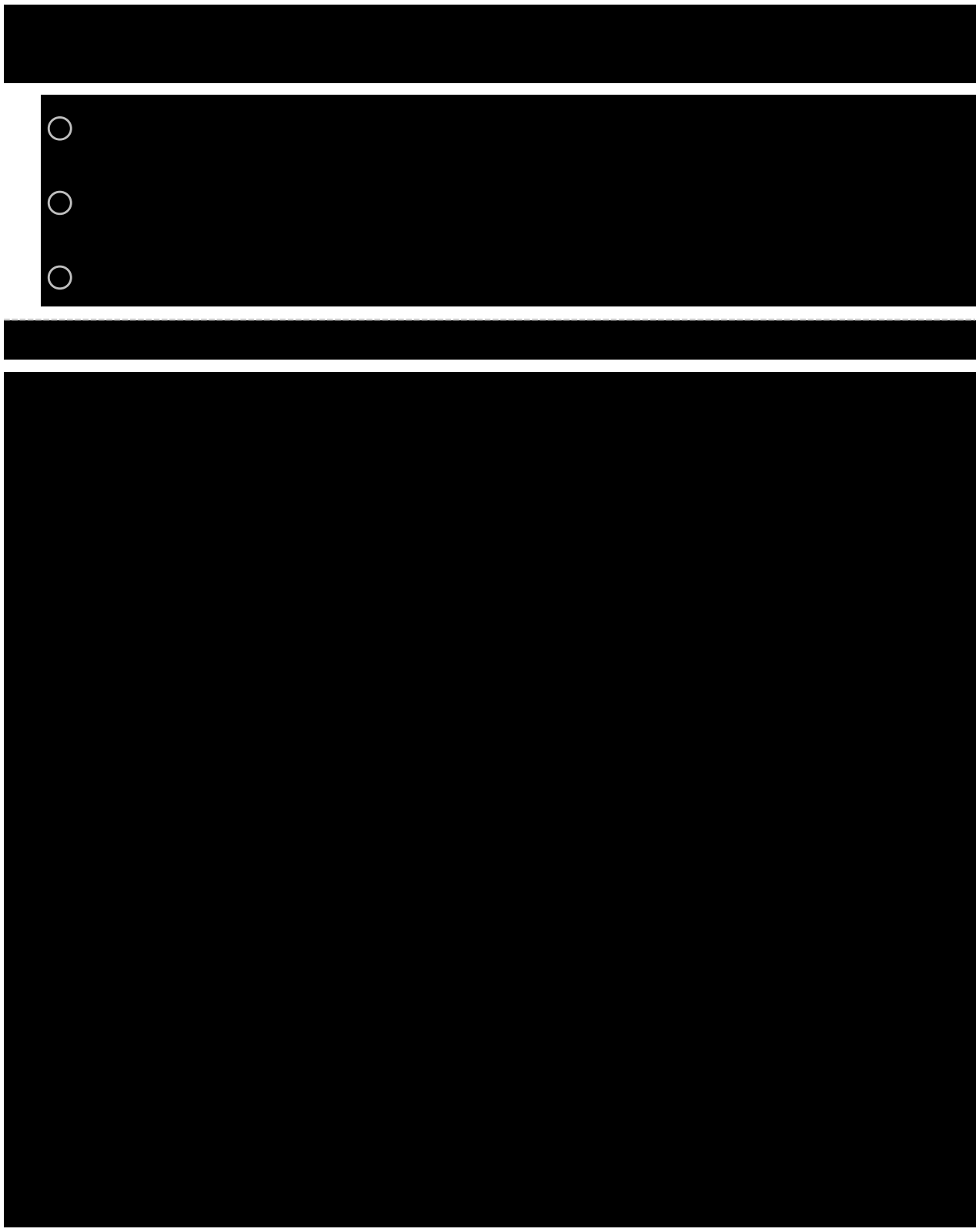












ADDENDUM D: NUTRITIONAL QUALITY FOR POPULAR TUCK SHOP ITEMS

TABLE 15: NUTRITIONAL INFORMATION OF PRODUCTS GENERALLY SOLD IN SCHOOL TUCK SHOP

This table is adapted from (Wiles *et al.*, 2011)

Tuck shop items	Serving size	Energy (kJ)	Protein (g)	Fat (g)	sugar (g)	Fruit, legume, nuts and vegetable content (%)
Beverages						
Assorted cans	330 ml	577	0	0	34.0	0
Sugar-free cans	330 ml	3.5	0	*	0	0
Frozen popsicles	70 g	83	0	0	4.5	0
Flavoured milk	275 ml	827	8.8	2.91	13.2	0
Mixed fruit blends	250 ml	550	2.0	0.10	24.0	0
Powerade	500 ml	645	0	*	*	0
Snack items						
Small corn crisps	20 g	411	0.8	0	0	0
Corn crisps	30 g	698	1.9	3.85	0	0
Potato crisps	30 g	695	2.0	2.77	0	0
Doughnuts	45 g	780.5	2.5	1.38	7.9	0
Chocolate muffins	48 g	710	2.5	1.36	15.3	0
Packets of biscuits	33 g	672	1.6	3.47	13.7	0
Samosas	75 g	1 694	3.1	4.76	0.6	0
Popcorn	500 ml	633	3.1	1.05	0	0
Peanuts	32 g	830	8.5	2.19	0	0
Peanuts and raisins	32 g	635	4.7	1.13	0	100
Homemade crunchies	25 g	519	1.1	4.00	8.1	60

Pretzels	25 g	416	2.7	1.1	*	0
Jelly and custard	500 ml	1 786	14.45	3.625	62.65	0
Sweets and chocolates						
Packets of sweets	75 g	1 202	0	0.53	69.1	0
Lollipops	13 g	512	0	0.22	29.4	0
Chocolates (normal size)	48 g	1 006	3,0	7.70	26.8	0
Chocolates (mini size)	23 g	513	1.7	3.97	12.8	0
Lunch items						
Muesli energy bars	45 g	912	3	*	*	40
Pies	170 g	2 138	15.1	13,09	0	0
Sausage rolls	165 g	2 739	16.2	17.99	0	0
Toasted cheese	1 each	1 808	19.1	11.7	0	0
Toasted cheese and tomato	1 each	1 476	14	7.9	0	0
Toasted ham and cheese	1 each	1 083	12.1	3.7	0	0
Toasted chicken mayo	1 each	1 516	24.4	2.4	1.2	0
Hot dogs	1 each	805	7.9	0.35	0	0
Hot chips	250 g	3 193	10.8	4.7	0	0
Beef burgers	1 each	1 917	26.9	7.9	0.5	0
Pizzas	80 g	1 226	13.8	*	66.8	0
Salad rolls, chicken	1 each	2 339	18.5	2.8	2.1	40
Salad rolls, cheese	1 each	986	9.4	5.7	0	0
Salad rolls, ham	1 each	1 264	12.1	4.4	0.6	0
Salads	245 g	679	5.5	3.4	0.1	100

This table is adapted from (Wiles *et al.*, 2011)

TABLE 16: NUTRITIONAL INFORMATION OF BEVERAGES IN SCHOOL TUCK SHOP

Item	Portion	Energy (kJ)	Carbohydrates (g)	Protein (g)	Fat (g)	Fruit, legume, nut and vegetable content (%)
Coke	330ml	594	36.3	0	0	0
Sprite Zero	330ml	10.8	0	0.03	0	0
Lemon Twist	330ml	681.5	39.3	0	0	0
Water	500ml	0	0	0	0	0
Powerade	500ml	645	39	0	0	0
Energade	500ml	600	35	0	0	0
Oros	300ml	477	29.37	0.002	<0.03	0
Drink-o-pop	150ml	94	5.55	0	0	0
Iced lollies (frozen cordial)	100ml	160	9.7	0	0	0
Milo	250ml	873	30.5	6	5.3	0
Flavoured Milk	350ml	250	9	3	1.5	0
Drinking yoghurt	300ml	396	16.3	3.4	1.8	0
Fruit juice	300ml	648	36	0.6	0.3	80
Starletta	330ml	624.8	36.3	0	0	0
Sprite	330ml	582	33.7	0	0	0
Coke light	330ml	1	0	0	0	0
Fanta	330ml	770	44.8	0	0	0
Cream soda	330ml	625.9	36.4	0	0	0
Tab	330ml	2.7	0	0.02	0	0

This table was adapted from (Bekker et al., 2017)

TABLE 17: CONTINUATION OF NUTRITIONAL INFORMATION OF FOOD PRODUCTS

Item	Portion	Energy (kJ)	Carbohydrates (g)	Protein (g)	Fat (g)	Fruit, legume, nut and vegetable content (%)
Chicken mayo pita	170g	2036.6	45.1	20.3	25	0
Pie (meat filling)	170g	2854.3	28.9	30.6	49.8	0
Toasted Polony & Cheese sandwich ("ham & cheese")	1 (2 Slices of bread)	1291.7	33	9.7	15.3	0
Hotdog with Vienna	1	1264	34.9	7.1	14.9	0
Beef burger	152g	1522.3	40.2	15.5	15.6	0
Roasted corn	60g	1096.2	43.5	5.32	8.6	0
Crunchie	33g	638	24.7	1.4	5.9	0
Biltong wheel	17g	221.7	0.4	7.4	2.4	0
Cupcake with icing	52g	505.9	17.7	1.2	5.1	0
Choc-chip muffin	**60g**	**698.6**	**24**	**5.5**	**5.3**	**0**
Milk tart	100g	928	25.2	4.8	11.3	0
Savoury tart	165g	2204.4	26.7	19.6	38.3	0
Biscuit	1	387	14.1	0.9	3.6	0
Rusk	1	338.3	10.7	1.5	3.5	0
Banana	1	286.5	15.4	1	0.2	100
Peach	148g	290.1	15.7	1	0.1	100
Coconut ice	16g	304.8	13.2	0.2	2.1	0
Fudge	20g	359	14.9	0.6	2.6	0
Doughnut	147g	2509.3	84.5	7.1	25.7	0
Tinkie	45g	317.3	22	1.6	5.4	0
Jungle bar, yoghurt	40g	739.2	22.3	2.4	7.2	40
Safari fruit bites	32g	482	25.9	0.74	0.13	80
Peanuts	45g	1070	7.7	11.7	20.3	100
Nutriday yoghurt	100g	413	16	3.3	2.3	0

Jelly babies	75g	332	19.5	1.4	0	0
Jellybeans	75g	353	22.8	0	0	0
Tempo Chocolate	53g	1103	31.3	1.9	15	0
Flake chocolate	32g	696	19.9	2.4	9.1	0
PS Chocolate	46g	1003	28.8	2.3	13.7	0
Bar-one Chocolate	55g	1007	36.7	2.4	10.9	0
Doritos chips	45g	959	280	4	11	0
Simba chips	36g	784	16	2.7	12.6	0
Fritos chips	50g	1134	26.2	3.5	18	0
Lays chips	36g	802	18	2.4	12.8	0

ADDENDUM E: NUTRIENT PROFILING TOOL (CALCULATOR)

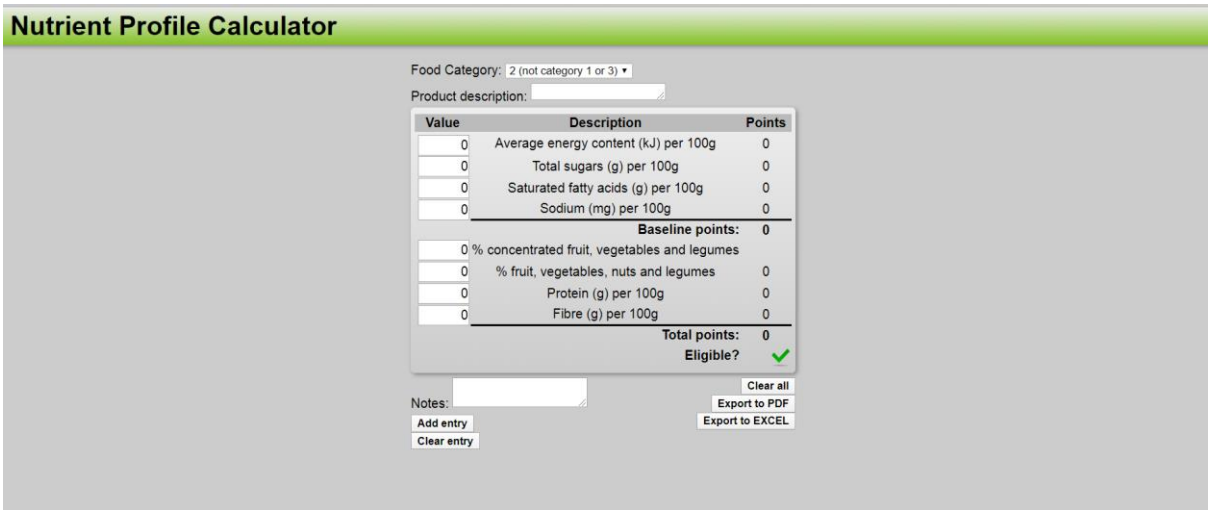


FIGURE 31: NUTRIENT PROFILING CALCULATOR (DEPARTMENT OF BASIC EDUCATION, 2008)

ADDENDUM F: NUTRIENT PROFILING TOOL CATEGORIES

Category	Scoring criteria	Food product included	Examples
Category 1	Final score **< 1** total points: Meets scoring criteria to be eligible carry a nutrient and or health claim.	Beverages (including milk)	Full cream milk Low fat milk Evaporated milk Malt beverage prepared with milk Fruit juice
Category 2	Final score **< 4** total points: Meets scoring criteria to be eligible carry a nutrient and or health claim.	Foods other than those included in category 1 or 3; and	All fruits All vegetables Meat and meat products Fish and fish products Chicken and chicken products Grains and cereals Cottage type cheese
Category 3	Final score **< 28** total points: Meets scoring criteria to be eligible carry a nutrient and or health claim.	Cheese and processed cheese with calcium content > 320mg/100g* Edible oil Edible oil spreads Margarine Butter	Cheddar cheese Brick margarine Tub margarine Butter Peanut butter

FIGURE 32: NUTRIENT PROFILING CATEGORIES (NATIONAL DEPARTMENT OF HEALTH, 2020)

ADDENDUM G: EXAMPLE OF FINAL TUCK SHOP CHECKLIST TEMPLATE USED

TABLE 18: ADDENDUM G: EXAMPLE OF FINAL TUCK SHOP CHECKLIST TEMPLATE USED

Category 1	Check (x)	Brand name	Nutrients	Comments
Beverages				
Powerade				
Still water				
Flavoured water				
Sugar-free cans				
Coke light				
Tab				
Sprite Zero				
Coke zero				
Fanta zero				
Iced tea				
Sprite				
Fanta				
Cream soda				
Coke				
Lemon Twist				
Energade				
Cappy Canned fruit juice				
Mixed fruit blends (Oros ready to drink)				
Flavoured milk (milo, super M)				
fruit juice (Liqui)				
Hot Chocolate				
Coffee				
Milk (whole, 2%)				
Tea				
Other				
Category 2				
Food Items				
Pies, chicken mushroom				
Pies, steak				
Pies, burger				

Sausage rolls				
Pies, spinach and feta				
Hot dogs				
Assorted salad rolls (meat)				
Assorted salad rolls (vegetarian)				
Toasted sandwiches white bread (cheese)				
Toasted sandwiches white bread (cheese and tomato)				
Toasted sandwiches white bread (Ham and cheese)				
Toasted sandwiches white bread (chicken mayo)				
Pizzas (Margherita)				
Beef burgers				
Hot chips				
Salads				
Falafel				
Other				
Snacks				
Popcorn (packaged not home popped)				
Doritos chips				
Simba chips (all flavours, including Fritos)				
Lays chips				
Puff Chips				
Pringles				
Niknaks				
Samosas				
Salted Peanuts and raisins				
Doughnuts				
Coconut ice				
Fudge				
Salted Peanuts				
Tinkie				

Chocolate muffins				
Packets of biscuits				
Dried fruit stick				
Homemade crunchies				
Health muffins				
Pretzels				
Bananas				
Apples				
Fruit salad				
Drinking Yoghurt				
Sweets and Chocolates				
Packets of sweets				
Cadbury Whispers (Chocolate balls)				
Apricot sweets				
Jelly babies				
Jellybeans				
KitKat				
Flake chocolate				
PS Chocolate				
Bar-one Chocolate				
Chocolates (normal)				
Lollipops				
Muesli energy bars				
Frozen popsicles (dairy based)				
Frozen popsicles (juice based)				
Marshmallows				
Fizzers (toffees)				
Sherbet				
Other				
Category 3				
Cheese				

ADDENDUM H: GANTT CHART

ACTIONS	May '20	Jun '20	Jul '20	Aug '20	Sep '20	Oct '20	Nov '20	Dec '20	Jan '21	Feb '21	Mar '21	Apr '21	May '21	Jun '21	Jul '21
Present Proposal	x														
Finalize methodology and make corrections		x	x	x			x		x						
Literature study		x	x		x	x									
Pilot Study								x	x						
*Data Collection										x	x	x			
Ethical aspects		x	X								x				
Data processing											x	x			
Statistical analysis							x	X	x			x	x		
Write Chapter 4 and 5													x	x	
Write Chapter 6														x	x
Dissertation preparation														x	x
Language editing															x
Dissertation completion															x

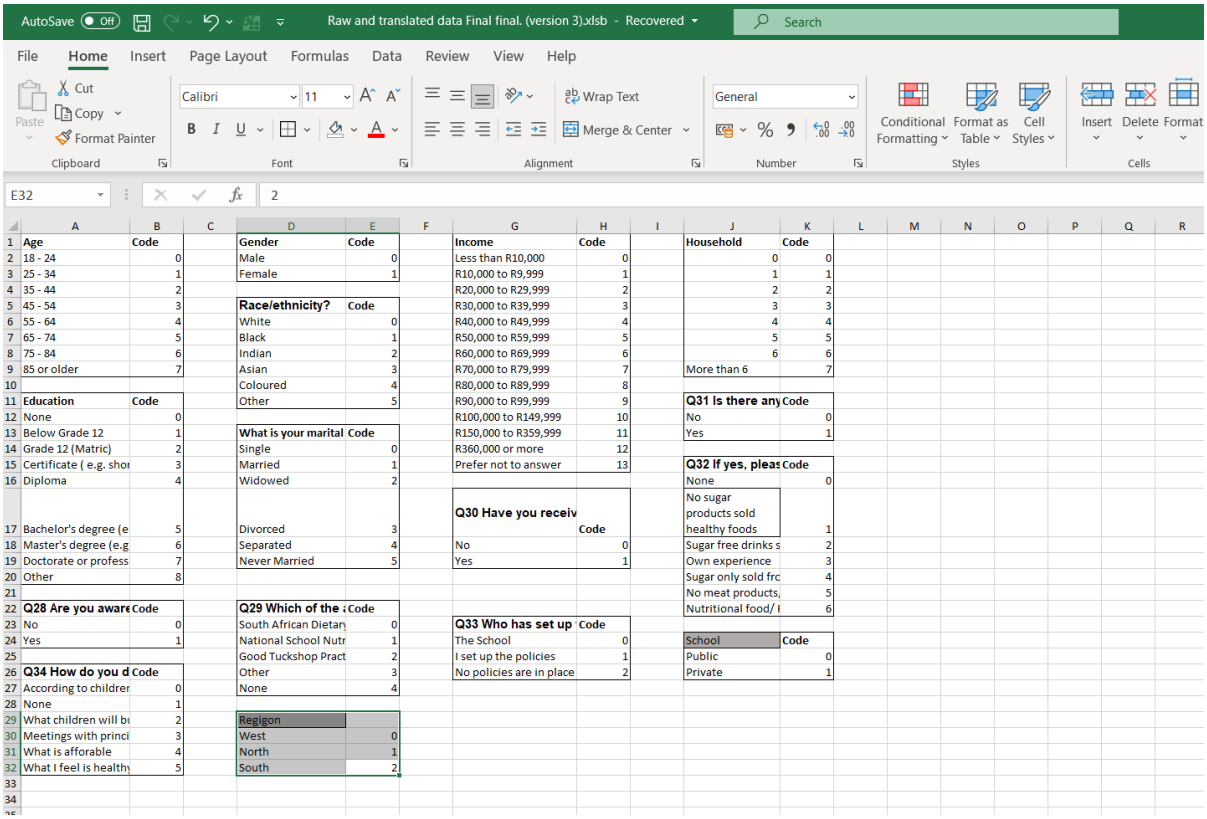
FIGURE 33: GANTT CHART

ADDENDUM I: BUDGET AND RESOURCES

TABLE 19: BUDGET AND RESOURCES

Item	Expected expense
Printing of checklists and questionnaires (x 35)	R300
Traveling costs (33 schools)	R600
Language editing	R2500
Printing of Report (+- 310p x R1,5)	R465
Report Binding	R420
Total budget amount	R4285

ADDENDUM J: MICROSOFT EXCEL SPREADSHEET FOR QUANTITATIVE DATA CODING



Age	Code
18 - 24	0
25 - 34	1
35 - 44	2
45 - 54	3
55 - 64	4
65 - 74	5
75 - 84	6
85 or older	7

Education	Code
None	0
Below Grade 12	1
Grade 12 (Matric)	2
Certificate (e.g. shor	3
Diploma	4
Bachelor's degree (e	5
Master's degree (e.g	6
Doctorate or profess	7
Other	8

Q28 Are you aware	Code
No	0
Yes	1

Q34 How do you d	Code
According to childrer	0
None	1
What children will bu	2
Meetings with princi	3
What is afforable	4
What I feel is healthy	5

Gender	Code
Male	0
Female	1

Race/ethnicity?	Code
White	0
Black	1
Indian	2
Asian	3
Coloured	4
Other	5

What is your marital	Code
Single	0
Married	1
Widowed	2
Divorced	3
Separated	4
Never Married	5

Q29 Which of the	Code
South African Dietary	0
National School Nutr	1
Good Tuckshop Pract	2
Other	3
None	4

Regigon	
West	0
North	1
South	2

Income	Code
Less than R10,000	0
R10,000 to R9,999	1
R20,000 to R29,999	2
R30,000 to R39,999	3
R40,000 to R49,999	4
R50,000 to R59,999	5
R60,000 to R69,999	6
R70,000 to R79,999	7
R80,000 to R89,999	8
R90,000 to R99,999	9
R100,000 to R149,999	10
R150,000 to R359,999	11
R360,000 or more	12
Prefer not to answer	13

Q30 Have you receiv	Code
No	0
Yes	1

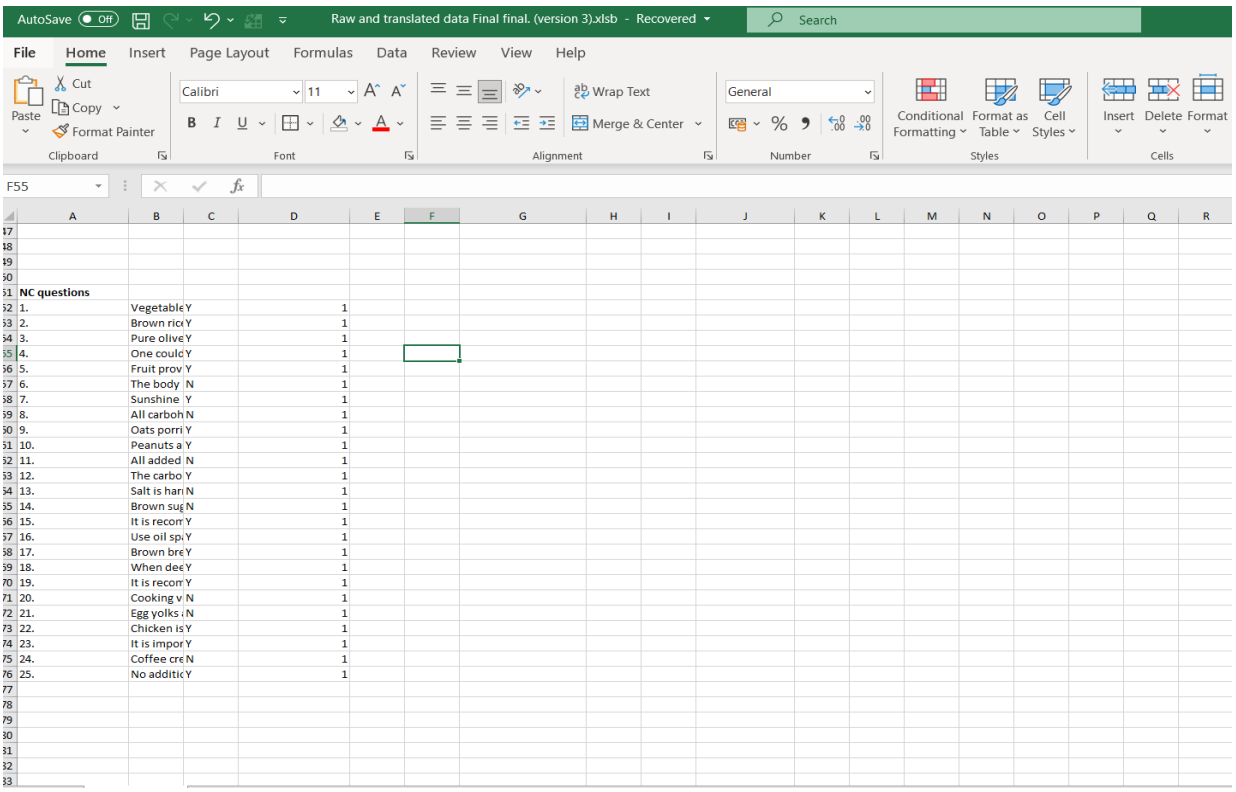
Q33 Who has set up	Code
The School	0
I set up the policies	1
No policies are in place	2

Household	Code
0	0
1	1
2	2
3	3
4	4
5	5
6	6
More than 6	7

Q31 Is there any	Code
No	0
Yes	1

Q32 If yes, pleas	Code
None	0
No sugar products sold healthy foods	1
Sugar free drinks s	2
Own experience	3
Sugar only sold frc	4
No meat products,	5
Nutritional food/ I	6

School	Code
Public	0
Private	1



NC questions			
1.	Vegetable	Y	1
2.	Brown rice	Y	1
3.	Pure olive	Y	1
4.	One could	Y	1
5.	Fruit prov	Y	1
6.	The body	N	1
7.	Sunshine	Y	1
8.	All carboh	N	1
9.	Oats porri	Y	1
10.	Peanuts a	Y	1
11.	All added	N	1
12.	The carbo	Y	1
13.	Salt is har	N	1
14.	Brown sug	N	1
15.	It is recom	Y	1
16.	Use oil spi	Y	1
17.	Brown bre	Y	1
18.	When dee	Y	1
19.	It is recom	Y	1
20.	Cooking v	N	1
21.	Egg yolks	N	1
22.	Chicken is	Y	1
23.	It is impor	Y	1
24.	Coffee cre	N	1
25.	No additic	Y	1

ADDENDUM K: NUTRIENT PROFILING SUMMARY OF PARTICIPANTS TUCK SHOPS

Food Name		Average energy		Saturated fatty acids		Total sugars		Sodium (mg)		Base line points	% Concentrated fvln		% fvln		Protein (g)		Fibre (g)		Final Score	Healthy ?
Category 1	Original quantity	100g/100 ml	Points	100 g	Points	100g	Points	100g	Points		%	Points	%	Points	100g	Points	100 g	Points		0- yes, 1- No
Beverages		(kJ)																		
Powerade	500 ml	77	0	0	0	4.1	0	13	0	0	0	0	0	0	0	0	0	0	0	Yes
Boss Sports	500ml	91	0	0	0	4.5	0	30	0	0	0	0	0	0	0.4	0	0	0	0	Yes
Sparkling water	500ml	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	Yes
Still water	500 ml	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	Yes
Flavoured water	500 ml	98,8	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	Yes
Starletta	330ml	189	0	0	0	11	2	8	0	2	0	0	0	0	0	0	0	0	2	No
Sprite	330ml	176	0	0	0	11	2	0	0	2	0	0	0	0	0	0	0	0	2	No
Coke light	330ml	1	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	Yes
Fanta	330ml	211	0	0	0	12.89	2	13	0	2	0	0	0	0	0	0	0	0	2	No
Cream soda	330ml	212	0	0	0	13.9	3	13	0	3	0	0	0	0	0	0	0	0	3	No
Tab	330ml	1	0	0	0	0	0	11	0	0	0	0	0	0	0.03	0	0	0	0	Yes
Coke	330ml	161	0	0.02	0	9.92	2	4	0	2	0	0	0	0	0.07	0	0	0	2	No
Sprite Zero	330ml	4,3	0	0	0	0.29	0	48	0	0	0	0	0	0	0.11	0	0	0	0	Yes
Kingsley drink	500ml	276	0	0	0	10	2	14	0	2	0	0	0	0	0	0	0	0	2	No
Iron brew	330ml	544	1	0	0	8,4	1	11	0	2	0	0	0	0	0	0	0	0	2	No
Lemon Twist	330ml	193	0	0	0	11.8	0	26	0	2	0	0	0	0	0	0	0	0	2	No
Energade	500ml	81	0	0.10	0	5	0	32	0	0	0	0	0	0	0.20	0	0	0	0	Yes
Tropika, various flavours	500ml	136	0	0	0	7,5	1	32	0	1	40	1	0	0	0.4	0	0	0	0	Yes
Cappy Canned fruit juice	330 ml	209	0	0	0	11.8	2	2	0	2	0	0	100	8	0.3	0	0	0	-6	Yes
Mixed fruit blends (Oros ready to drink)	250 ml	110	0	0	0	8.1	1	0.01	0	1	0	0	10	0	0	0	0	0	1	No
Flavoured milk	275 ml	300	0	1,05	1	3,5	0	39.2	0	1	0	0	0	0	3,2	2	0	0	-1	Yes

Fruit juice, zoom	200ml	110	0	0	0	8,3	1	0.001	0	1	0	0	0	0	0	0	0	0	1	No
fruit juice (Liqui)	300ml	216	0	0,1	0	12	2	0	0	2	0	0	100	8	0,1	0	0,21	0	-6	Yes
Fruit Juice-grape tizer	330ml	220	0	0	0	17.2	3	14,4	0	3	80	5	0	0	0	0	0	0	-3	Yes
Ice tea (Lipton)	500ml	82	0	0	0	4.5	0	0.2	0	0	0	0	0	0	0.5	0	0	0	0	Yes
Tea	250ml	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	Yes
Coffee	250ml	0	0	0	0	0	0	2	0	0	0	0	0	0	0.1	0	0	0	0	Yes
Hot chocolate (nestle)	250ml	308	0	1,4	1	10	2	44	0	3	0	0	0	0	3.5	2	1	1	0	Yes
Whole milk	330ml	262	0	1,9	1	4,8	0	48	0	1	0	0	0	0	3,2	2	0	0	-1	Yes
Vitamin Water	500ml	55	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	Yes
Cappuccino	250ml	22	0	0.9	0	7	1	50	0	2	0	0	0	0	3	1	0.1	0	0	Yes
Dragon energy drink	500ml	67	0	0	0	3.9	0	13	0	0	0	0	0	0	0	0	0	0	0	Yes
Lemonade, homemade with minimum sugar	250ml	241	0	0.1	0	13.4	2	7	0	2	0	0	30	0	0.1	0	0.2	0	2	No
Mountain dew	500ml	205	0	0	0	29	6	40	0	6	0	0	0	0	0	0	0	0	6	No
Pepsi	500ml	200	0	0	0	26	5	20	0	5	0	0	0	0	0	0	0	0	5	No
Slush puppies, blue	250ml	157	0	0	0	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	Yes
Milo	250ml	1640	4	5.3	5	50	10	260	2	21	0	0	0	0	8.9	0	3.8	4	17	No
Category 2: Food Items																				
Pies, prime steak	170 g	1258	3	7,7	7	0	0	445,29	4	14	0	0	0	0	8,8	0	1,4	1	13	No
Pies, Chicken mushroom	170g	997	2	3,6	3	0	0	445	4	9	0	0	30	0	9.2	5	2,1	2	2	Yes
Pies, Steak and Kidney	170g	1255	3	9,4	9	3,8	0	452	5	17	0	0	0	0	9,8	0	3,7	3	14	No
Pies, burger	195g	1313	2	12.3	10	0	0	588	6	19	0	0	0	0	6.9	0	4,7	4	15	No

Pies, spinach, and feta	150g	627	1	3,5	3	3,7	0	366	4	8	0	0	30	0	5,3	3	3,3	3	2	Yes
Hot dogs	1 each (95-105g)	805	2	0,35	3	0	0	756	8	13	0	0	0	0	7,9	0	0,9	0	13	No
Assorted salad rolls (meat)	1 each	1264	3	4,4	4	0,6	0	775	8	15	0	0	40	0	12,1	0	3,3	3	12	No
Assorted salad rolls (vegetarian)	1 each	679	2	3,4	3	0,1	0	286	3	8	0	0	100	8	5,5	3	3,4	3	-6	Yes
Toasted sandwiches white bread (cheese and tomato)	1 each (83-100g)	1 224	3	5.7	5	0.9	0	170	1	9	0	0	0	0	13	5	4	4	0	Yes
Toasted sandwiches white bread (Ham and cheese)	1 each (83-100g)	1 083	3	3.7	3	0	0	370	4	10	0	0	0	0	12,1	5	0	0	1	Yes
Toasted sandwiches white bread (chicken mayo)	1 each (83-100g)	1 516	4	2.4	2	1,2	0	468	5	11	0	0	0	0	24,4	5	5	5	1	Yes
Wrap, Chicken (greens, tomato, and mayo)	90-100g	950	2	2,3	2	1	0	324	3	7	0	0	40	0	9,4	5	4,4	4	-2	Yes
Wraps, roasted veg and halloumi	245g	990	2	4.8	4	4,7	0	477	5	11	0	0	60	1	10,4	5	5,9	5	-2	Yes
Pizzas (Margherita), Homemade, thin base	80 g	980	2	4,5	4	3,6	0	598	6	12	0	0	0	0	11	5	4.2	4	3	Yes
Beef burgers, patty, greens,	1 each	1180	3	3,6	3	5	0	440	4	10	0	0	5	0	15	5	1,2	1	4	No

tomato, gherkins																				
Bacon and cheeseburger, homemade	1 serving	1159	3	4,2	4	1,7	0	531	5	12	0	0	10	0	10,5	5	3	3	4	No
Chicken burger, Chicken breast, greens	1 serving	1043	3	3	2	5,7	1	409	4	10	0	0	30	0	12,6	5	4,8	5	0	Yes
Rib burger (boneless rib on bread)	1 serving	912	2	2	1	4,5	0	439	4	7	0	0	0	0	13,4	5	3,2	3	-1	Yes
Cheeseburger, greens, tomato (homemade)	Per serving	1155	3	5,2	5	4,7	0	460	5	13	0	0	10	0	11,4	0	3,2	3	10	No
Hot chips	250 g	1277	3	4,7	4	0,3	0	495	5	12	0	0	0	0	5,3	3	4,8	5	4	No
Sausage rolls	165 g	1660	4	10,8	10	0	0	730,3	8	22	0	0	0	0	9,6	0	1,4	1	21	No
Salads, French (greens, tomato, no dressing)	1 each	277	0	1,3	0	0,01	0	115,9	1	2	0	0	100	8	2,2	1	2,2	2	-9	Yes
Salads, Greek (greens, tomato, olives, feta cheese)	190g	84	0	0	0	2,2	0	7	0	0	0	0	100	8	1,2	0	1,2	1	-9	Yes
Salads (Chicken, greens, tomato, chicken, light dressing)	370g	650	1	0,8	0	2,7	0	302	3	4	0	0	60	1	6,5	4	1,4	1	-2	Yes
Chicken nuggets, fried from frozen	80g	861	2	2,8	2	1,1	0	773	8	12	0	0	0	0	18,7	5	5,8	5	2	Yes

Pancakes, homemade (light sprinkling of cinnamon and sugar)	2 servings (55g each)	809	2	1,2	1	13,5	2	177	1	6	0	0	0	0	6,2	3	0.1	0	3	Yes
Boiled egg (homemade)	1 (45g)	596	1	3.3	3	0.3	1	136	1	5	0	0	0	0	12,2	5	0	0	0	Yes
Mince and rice (basmati rice w/t lean mince)	350g	535	1	3,1	3	0,9	0	326	3	7	0	0	0	0	5,4	3	3,7	3	1	Yes
Granola and yogurt (homemade granola, full cream yogurt)	140g	416	1	2,6	2	5,3	1	63	0	4	0	0	30	0	4,6	2	1	1	1	Yes
Jelly and custard	145g	394	1	0,9	0	11,2	2	25	0	3	0	0	0	0	3.8	2	0	0	1	Yes
Melkkos, homemade, low fat milk	250ml	494	1	4.2	4	11.5	2	127	1	8	0	0	0	0	2.9	1	0	0	7	No
Chicken soup (shredded chicken, corn, and noodle), homemade	250ml	178	0	1	0	0.9	0	329	3	3	0	0	20	0	5	3	1.1	1	-1	Yes
Mac and cheese, mature cheddar and low-fat milk	300g	530	1	3	2	0.3	0	289	3	6	0	0	0	0	4.1	2	1.5	1	3	Yes
Russian roll, no butter, tomato sauce and mustard	120g (1 roll)	1053	3	4.3	4	2.5	0	78	0	7	0	0	0	0	12.02	5	1	1	1	Yes
Pizza, BBQ Chicken, homemade	200g	1028	3	5.7	5	7.7	1	340	3	12	0	0	0	0	13.8	5	4	4	3	Yes

Pizza, Ham and cheese, homemade, thin base	200g	941	2	5.9	5	2	0	495	5	12	0	0	0	0	12.2	5	4	4	3	Yes
Toasted sandwiches, white bread, bacon, cheese and egg	per sandwich (150g)	1289	3	11.3	10	2.3	0	461	5	18	0	0	0	0	13.4	0	4	4	14	No
Wraps (sweet chilli chicken)	per wrap	1151	3	2.2	2	1.5	0	382	4	9	0	0	0	0	8.4	5	4.5	4	0	Yes
Wraps (eggs, bacon and cheese)	per wrap	1143	3	6.7	6	0	0	228	2	11	0	0	0	0	9.2	5	4.8	5	1	Yes
Milk tart, homemade	125g	934	2	6.1	6	14.2	3	97	1	12	0	0	0	0	4.3	2	1	1	9	No
Lasagne, lean beef, minimal cheese, homemade	350g	569	1	3.2	3	1.5	0	395	4	8	0	0	0	0	10.8	5	1.8	1	2	Yes
Omelette, filled with bacon and cheese	per serving	1103	3	8.4	8	0	0	228	2	13	0	0	0	0	12.1	0	0	0	13	No
Chicken and bacon pasta, tomato sauce	350g	616	1	2	1	1.4	0	370	4	6	0	0	0	0	9.1	5	2.5	2	-1	Yes
Fish fingers and chips	150g	788	2	3	2	2	0	668	7	11	0	0	0	0	17.1	5	1.4	1	5	No
Falafel, homemade	150g	1141	3	1.6	1	4.3	0	561	6	10	0	0	0	0	5.6	3	5.4	5	2	Yes
Snacks																				
Popcorn (packaged not home popped)	500 ml	2306	6	17	10	3,6	0	637	7	23	0	0	0	0	7,7	0	6,9	5	18	No

Popcorn, home popped, with canola oil	250ml	2101	6	5,6	5	0,5	0	9	0	11	0	0	0	0	7,5	4	7,9	5	2	Yes
Doritos chips (all flavours)	45g	1944	5	8,3	8	3,1	0	634	7	20	0	0	0	0	6,7	0	5,4	5	15	No
Simba chips (all flavours, including Fritos)	36g	1830	5	7	6	2,6	0	527	5	16	0	0	0	0	7	0	10,7	5	11	No
Lays chips	36g	2203	6	13,6	10	0,7	0	528	5	21	0	0	0	0	7,4	0	4,8	5	16	No
Niknaks	20 g	2198	6	13	10	0,9	0	489	5	21	0	0	0	0	5,3	0	3,4	3	18	No
Samosas	75 g	1048	3	7,1	7	1,6	0	423	4	14	0	0	20	0	3,5	0	2,1	2	12	No
Salted Peanuts and raisins	32 g	604	1	10,4	10	18,1	4	156	1	16	0	0	100	8	19,4	5	7,4	5	-2	Yes
Doughnuts, homemade	45 g	1808	5	13	10	27	5	326	3	23	0	0	0	0	4,9	0	1,9	1	22	No
Coconut ice, homemade	16g	1861	5	14,3	10	42,1	9	37	0	24	0	0	46	1	2,5	0	1	1	22	No
Fudge, homemade	20g	1644	4	6	5	73	10	45	0	19	0	0	0	0	2,4	0	1,7	1	18	No
Salted Peanuts	32 g	2520	7	11,8	10	4,8	0	480	5	22	0	0	100	8	25,5	5	7,7	5	4	No
Tinkie	45g	1610	4	6,4	6	32	7	4	0	17	0	0	0	0	2	0	1,6	1	16	No
Chocolate muffins, homemade	48 g	1360	4	4,02	4	21,5	4	353,8	3	15	0	0	0	0	5,4	0	2,3	2	13	No
Packets of biscuits, Gingersnap	33 g	1772	5	5,3	5	21,7	4	377	4	18	0	0	0	0	8,3	0	1,7	1	17	No
Packets of biscuits, BAKERS Topper	33 g	1772	5	5,3	5	21,7	4	377	4	18	0	0	0	0	8,3	0	1,7	1	17	No
Dried fruit stick	25 g	1436	4	0,7	0	58	10	403	4	18	0	0	100	8	1	0	1	1	9	No
Homemade crunchies	25 g	1872	5	8,8	8	36,8	8	480	5	26	0	0	60	1	6	0	3,9	4	21	No
Health muffins,	48 g	1080	3	1,1	1	8	1	393	4	9	0	0	0	0	7	4	4,6	4	1	Yes

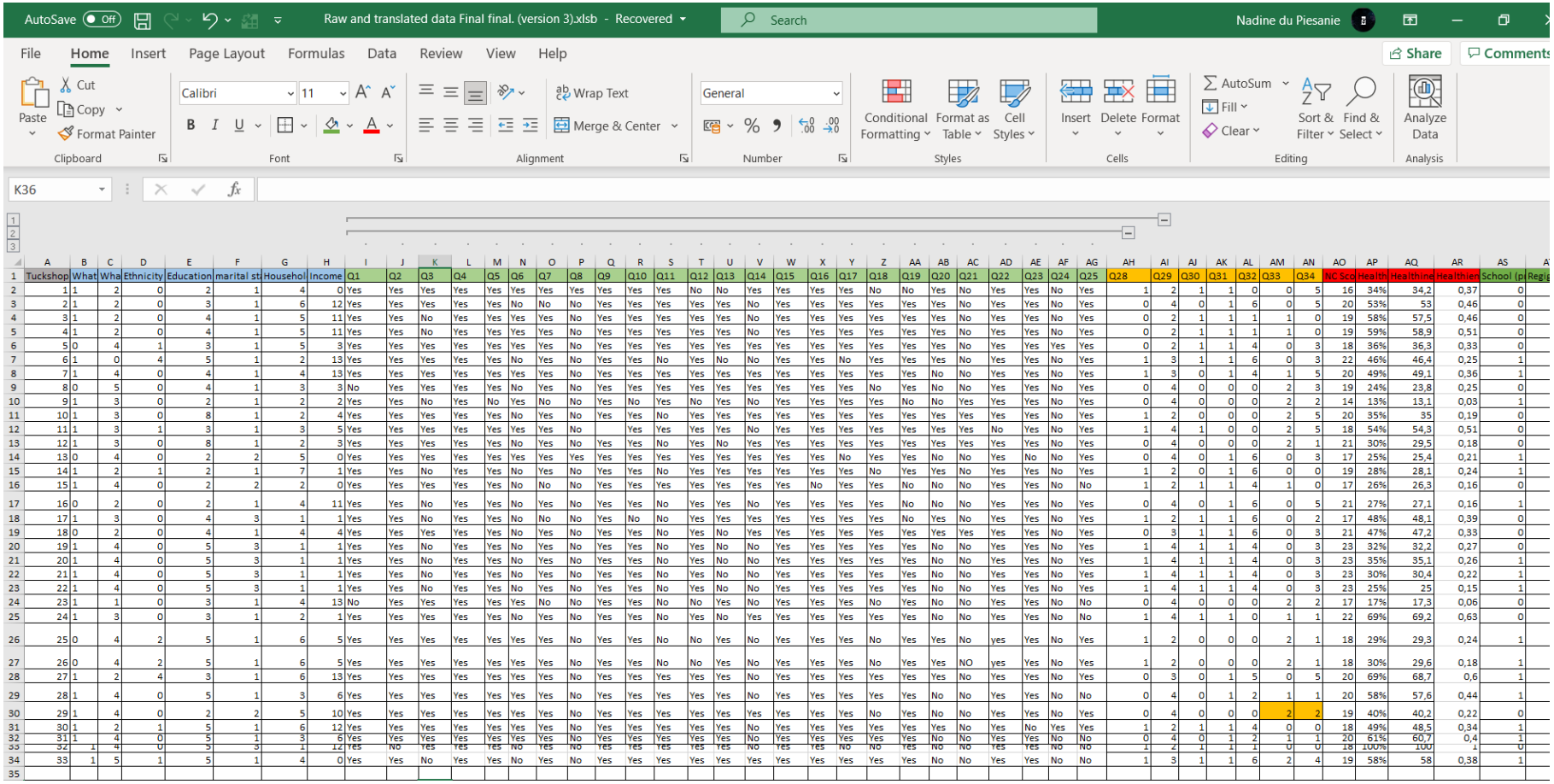
homemade, bran																				
Pretzels, Simba brand	25 g	1670	4	0,9	0	11,1	2	1370	10	16	0	0	0	0	10,4	0	2,9	3	12	No
Bananas	75 g	356	1	0,1	0	12	2	1	0	3	0	0	100	8	1,1	0	2,6	2	-7	Yes
Fruit salad	375 ml	201	0	0	0	12	2	5	0	2	0	0	100	8	0,5	0	1	1	-7	Yes
Drinking Yoghurt, Yogi sip	100 ml	283	0	1	0	11	2	35	0	2	0	0	0	0	2,2	1	0	0	0	Yes
Yogurt, clover, full cream	175ml	237	0	0,7	0	7,1	1	63	0	1	0	0	0	0	2,4	1	0	0	0	Yes
Puff Chips (all flavours)	75g	1756	5	5,1	5	4	0	872	9	19	0	0	0	0	6	0	0	0	19	No
Foxi Nax (all flavour)	50g	2028	6	23,9	10	6	1	2471	10	27	0	0	0	0	4,7	0	0	0	27	No
Biltong, beef, sliced	55g	1022	3	3,3	3	0	0	1763	10	16	0	0	0	0	44	0	0,8	0	16	No
Diddle daddle, caramel popcorn	45g	1620	4	5	4	60.6	10	463	5	23	0	0	0	0	2.9	0	2.1	2	21	No
Pringles, original	60g	2253	6	3.4	3	1.1	0	840	9	18	0	0	0	0	3.4	0	2.4	2	16	No
Packets of biscuits (Choc mint, bakers' toppers)	55g	2022	6	12.1	10	35.5	7	331	3	26	0	0	0	0	6.2	0	1.1	1	25	No
Oranges	350g	125	0	0	0	1	0	8	0	0	0	0	100	8	2.4	1	2.8	2	-11	Yes
Watermelon	250g	110	0	0	0	4.4	0	14	0	0	0	0	100	8	2	1	0.1	0	-9	Yes
Cake pops, homemade	25g	1582	4	5.3	5	41.1	9	186	2	20	0	0	0	0	5	0	1.1	1	19	No
Rice Krispy treats	30g	1443	4	12	10	28.23	6	273	2	23	0	0	0	0	3.1	0	3	3	20	No
Brownies, chocolate, homemade, dark chocolate	55g	1734	5	12.2	10	46.8	10	51	0	25	0	0	0	0	5.4	0	5.4	5	20	No

Jelly and custard	120g	303	0	2	1	17.7	3	49	0	4	0	0	0	0	1	0	0.1	0	4	No
Sweets and Chocolates																				
Packets of sweets, speckled eggs	75 g	2030	6	4,5	4	67,3	10	39	0	20	0	0	0	0	4,4	0	1,3	1	19	No
Packets of sweets, Whispers (chocolate)	125g	2070	6	14	10	53	10	86	0	26	0	0	0	0	8,4	0	2,5	2	24	No
Sour Jellies, Maynard's	75g	1440	4	0,2	0	38,8	8	46	0	12	0	0	0	0	5,8	3	0	0	9	No
Jelly babies, Maynard's	75g	1150	3	0,2	0	46,1	10	23	0	13	0	0	0	0	6,1	0	0	0	13	No
Liquorice Twists, Beacon	35g	1419	4	0.3	0	32,5	7	112	1	12	0	0	0	0	5,5	3	0	0	9	No
Liquorice, rainbow strips, king candy	25g	1398	4	0	0	62	10	64	0	14	0	0	0	0	3	0	0	0	14	No
Wine gums, Maynard	125g	1495	4	0,1	0	46,7	10	59	0	14	0	0	0	0	10,5	0	0,8	0	14	No
Jellybeans, Maynard	75g	1227	3	0,1	0	60,01	10	23	0	13	0	0	0	0	0	0	0,2	0	13	No
KitKat Chocolate	53g	2103	6	13,7	10	51	10	23	0	26	0	0	0	0	6,7	0	2,1	2	24	No
Tempo Chocolate	53g	2103	6	13,7	10	51	10	23	0	26	0	0	0	0	6,7	0	2,1	2	24	No
Flake chocolate	32g	2232	6	18	10	56	10	14	0	26	0	0	0	0	7,3	0	2,1	2	24	No
PS Chocolate	46g	2012	6	12,6	10	46,2	10	840	9	35	0	0	0	0	0	0	0	0	33	No
Bar-one Chocolate	55g	1858	5	21,2	10	59	10	105	1	26	0	0	0	0	2,9	0	1,1	1	25	No
Lunch bar chocolate	80g	2270	6	19,1	10	52,6	10	34	0	26	0	0	0	0	10,6	0	0	0	26	No
Milky bar	80g	1874	5	9,5	9	61,4	10	100	1	25	0	0	0	0	10,6	0	0	0	25	No
Smarties	125g	2004	5	8,4	8	64,9	10	55	0	23	0	0	0	0	4,8	0	1,8	1	22	No
Jaffa cake	55g	1598	4	4,2	4	53,9	10	130	1	19	0	0	0	0	1,1	0	2,1	2	17	No

Chocolates (normal), Cadbury	48 g	2140	6	19	10	52	10	372	4	30	0	0	0	0	8	0	3,5	3	27	No
Lollipops	13 g	1648	4	0,2	0	62,9	10	38	0	14	0	0	0	0	0	0	0	0	14	No
Muesli energy bars, Nature valley	45 g	1884	5	2,4	2	29	6	294	3	16	0	0	46	1	10	0	5	5	10	No
Frozen popsicles (Dairy based)	109g	1400	4	13	10	33	7	70	0	21	0	0	0	0	5	0	0	0	21	No
Frozen popsicles (fruit flavoured)	70 g	316	0	0	0	14	3	7	0	5	0	0	0	0	0	0	0	-5	5	No
Toffee, Champion (Wilsons)	15g	1953	5	15,7	10	30,6	6	101	1	22	0	0	0	0	0,9	0	0	0	22	No
Fizzers, toffee	11g	1653	4	3	2	85,7	10	2,1	1	16	0	0	0	0	0	0	0	0	16	No
Sherbet	10g	1625	4	0,7	0	95,4	10	0	0	14	0	0	0	0	0	0	0	0	14	No
Marshmallows	30g	1506	4	0,2		83.9	10	0	0	14	0	0	0	0	3,4	0	0	0	14	No
Oreos	24g	1997	5	5,4	5	38	8	73	0	18	0	0	0	0	5,3	0	2,7	2	16	No
Candyfloss	26g	1552	4	0	0	99	10	0	0	14	0	0	0	0	0	0	0	0	14	No
Kinder joy eggs	20g	2200	6	15	10	50	10	125	1	27	0	0	0	0	10	0	0	0	27	No
Beacon Easter eggs (Marshmallow)	17g	1380	4	8,5	8	33,5	7	5	1	19	0	0	0	0	3,5	0	0	0	19	No
Tex Chocolate bar	58g	2105	6	15.9	10	44.6	9	85	0	25	0	0	0	0	6.2	0	2.6	2	23	No
Nosh Chocolate bar	58g	2270	6	19,1	10	52,6	10	34	0	26	0	0	0	0	10,6	0	0	0	26	No
Funny faces, sweets (sold individually)	125g	1702	5	5.8	5	54.3	10	81	0	20	0	0	0	0	2.3	0	0.9	0	20	No
Apricot, sweets	125g	1470	4	0	0	71.6	10	43	0	14	0	0	0	0	1.4	0	0.2	0	14	No

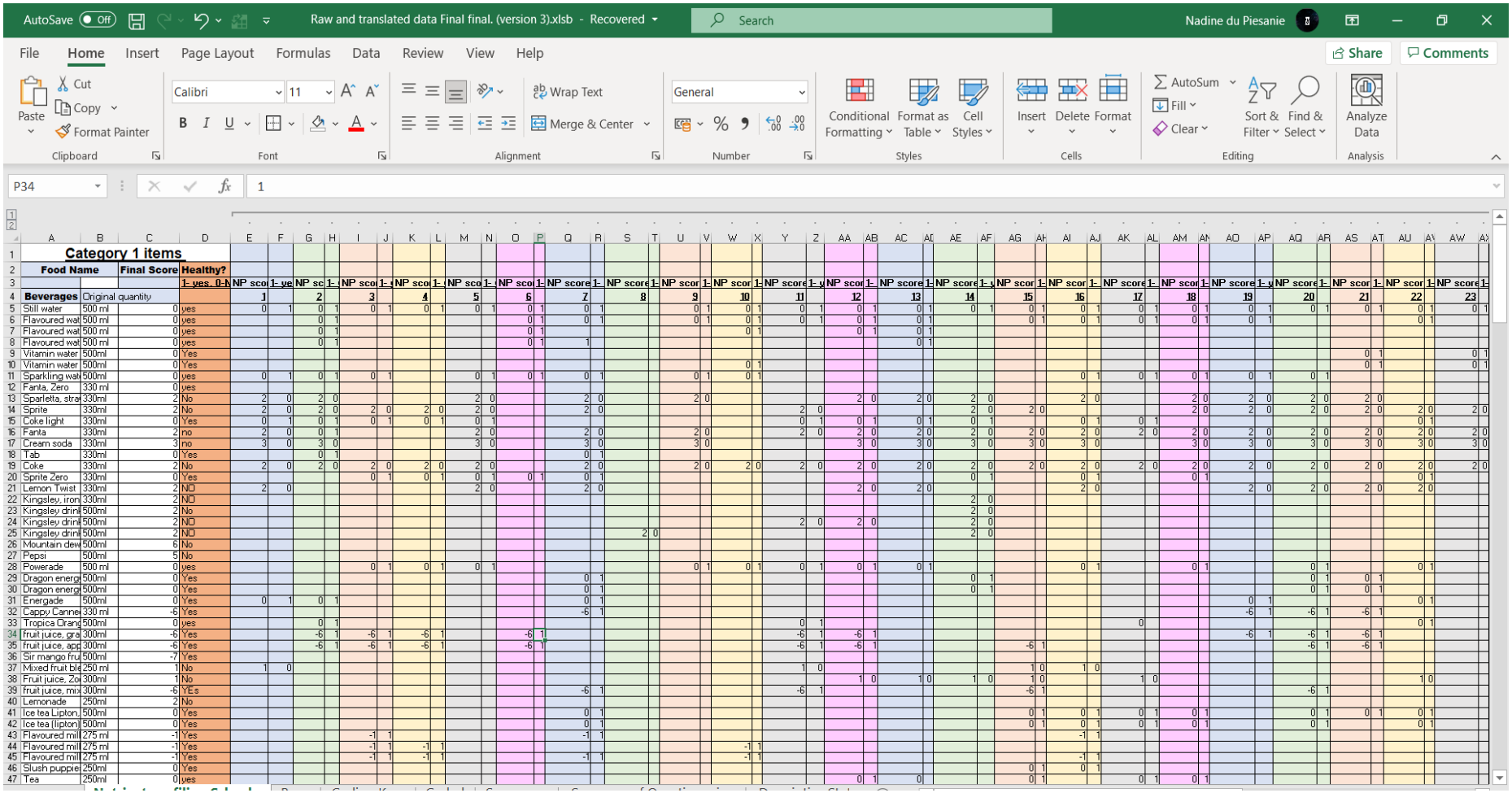
Candy Necklaces	21g	1505	4	0	0	76	10	0	0	14	0	0	0	0	0	0	0	0	14	No
Magic spray (alien spray)	80ml	624	1	0.1	0	31.8	7	3	0	8	0	0	0	0	0.1	0	0	0	8	No
Jaw breakers	25g	1426	4	0.2	0	50.5	10	60	0	14	0	0	0	0	0.1	0	0.3	0	14	No
Packet of sweets, Liquorice all sorts	125g	1470	4	3		60.1	10	37	0	17	0	0	0	0	4.9	0	0.6	0	17	No
Packet of sweets, Milk bottles, Maynard	125g	1243	3	0.1	0	65.1	10	89	0	13	0	0	0	0	0.5	0	0	0	13	No
Five-star chocolate	55g	2125	6	15.5	10	56.5	10	122	1	27	0	0	0	0	6.6	0	2.1	2	25	No
Aero Chocolate, mint	55g	2203	6	19.4	10	51.1	10	125	1	27	0	0	0	0	4.6	0	2.1	2	25	No
TV bar, chocolate	55g	2266	6	20.4	10	56.3	10	106	1	27	0	0	0	0	6.5	0	0.4	0	27	No
Crunchy, Cadbury	55g	1960	5	10	9	65	10	244	2	26	0	0	0	0	3.1	0	1.3	1	25	No
Rolo	50g	2106	6	17.6	10	37.6	8	151	1	25	0	0	0	0	3.7	0	1.4	1	24	No
Jelly tots	175g	1350	4	0	0	62.9	10	56	0	14	0	0	0	0	2.9	0	0.1	0	14	No
Jelly sweets	125g	1251	3	0.2	0	65.1	10	64	0	13	0	0	0	0	0.4	0	0.5	0	13	No
Assorted sweets	125g	1454	4	0.2	0	52.1	10	20	0	14	0	0	0	0	6.2	0	1.5	1	13	No
Yogurt sweets	125g	1383	4	6.1	6	54.6	10	93	1	21	0	0	0	0	3.7	0	0.5	0	21	No
Mint imperials	125g	1342	3	0	0	75.9	10	48	0	13	0	0	0	0	1.5	0	0	0	13	No
Fruit pastilles	125g	1440	4	0.2	0	38.8	8	46	0	12	0	0	0	0	5.8	3	0	0	9	No
Mentos	125g	1342	4	0	0	75.6	10	48	0	14	0	0	0	0	1.5	0	0	0	14	No
Gold coins	48g	2309	6	21.8	10	49.6	10	108	1	27	0	0	0	0	6.5	0	3.1	3	24	No
Astro, chocolates	150g	2145	6	7.9	7	72.6	10	85	0	23	0	0	0	0	4.1	0	1	1	22	No

ADDENDUM L: MICROSOFT EXCEL SPREADSHEET FOR CAPTURING RAW QUANTITATIVE DATA (QUESTIONNAIRES)



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
1	Tuckshop	What	Wha	Ethnicity	Education	marital st	Househol	Income	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q28	Q29	Q30	Q31	Q32	Q33	Q34	NC Sco	Health	Healthine	Healthier	School (p	Regi
2	1	1	2	0	2	1	4	0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No	Yes	1	2	1	1	0	0	5	16	34%	34,2	0,37	0	
3	2	1	2	0	3	1	6	12	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	0	4	0	1	6	0	5	20	53%	53	0,46	0	
4	3	1	2	0	4	1	5	11	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	0	2	1	1	1	1	0	19	58%	57,5	0,46	0	
5	4	1	2	0	4	1	5	11	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	0	2	1	1	1	1	0	19	59%	58,9	0,51	0	
6	5	0	4	1	3	1	5	3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	0	2	1	1	4	0	3	18	36%	36,3	0,33	0	
7	6	1	0	4	5	1	2	13	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	1	3	1	1	6	0	3	22	46%	46,4	0,25	1	
8	7	1	4	0	4	1	4	13	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	1	3	0	1	4	1	5	20	49%	49,1	0,36	1	
9	8	0	5	0	4	1	3	3	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	No	Yes	0	4	0	0	0	2	3	19	24%	23,8	0,25	0	
10	9	1	3	0	2	1	2	2	Yes	Yes	No	Yes	No	Yes	No	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	0	4	0	0	0	2	2	14	13%	13,1	0,03	1	
11	10	1	3	0	8	1	2	4	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	1	2	0	0	0	2	5	20	35%	35	0,19	0	
12	11	1	3	1	3	1	3	5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No		Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	1	4	1	0	0	2	5	18	54%	54,3	0,51	0	
13	12	1	3	0	8	1	2	3	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	0	4	0	0	0	2	1	21	30%	29,5	0,18	0	
14	13	0	4	0	2	2	5	0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	0	4	0	1	6	0	3	17	25%	25,4	0,21	1	
15	14	1	2	1	2	1	7	1	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No	1	2	0	1	6	0	0	19	28%	28,1	0,24	1	
16	15	1	4	0	2	2	2	0	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No	No	1	2	1	1	4	1	0	17	26%	26,3	0,16	0	
17	16	0	2	0	2	1	4	11	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	No	Yes	0	4	0	1	6	0	5	21	27%	27,1	0,16	1	
18	17	1	3	0	4	3	1	1	Yes	Yes	No	Yes	Yes	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	1	2	1	1	6	0	2	17	48%	48,1	0,39	0	
19	18	0	2	0	4	1	4	4	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	0	3	1	1	6	0	3	21	47%	47,2	0,33	0	
20	19	1	4	0	5	3	1	1	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	1	4	1	1	4	0	3	23	32%	32,2	0,27	0	
21	20	1	4	0	5	3	1	1	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	1	4	1	1	4	0	3	23	35%	35,1	0,26	1	
22	21	1	4	0	5	3	1	1	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	1	4	1	1	4	0	3	23	30%	30,4	0,22	1	
23	22	1	4	0	5	3	1	1	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	1	4	1	1	4	0	3	23	25%	25	0,15	1	
24	23	1	1	0	3	1	4	13	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	No	No	0	4	0	0	0	2	2	17	17%	17,3	0,06	0	
25	24	1	3	0	3	1	2	1	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	1	4	1	1	0	1	1	22	69%	69,2	0,63	0	
26	25	0	4	2	5	1	6	5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	yes	Yes	No	Yes	1	2	0	0	0	2	1	18	29%	29,3	0,24	1	
27	26	0	4	2	5	1	6	5	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	NO	yes	Yes	No	Yes	1	2	0	0	0	2	1	18	30%	29,6	0,18	1	
28	27	1	2	4	3	1	6	13	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	0	3	0	1	5	0	5	20	69%	68,7	0,6	1	
29	28	1	4	0	5	1	3	6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	0	4	0	1	2	1	1	20	58%	57,6	0,44	1	
30	29	1	4	0	2	2	5	10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	No	Yes	0	4	0	0	0	2	2	19	40%	40,2	0,22	0	
31	30	1	2	1	5	1	6	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	1	2	1	1	4	0	0	18	49%	48,5	0,34	1	
32	31	1	4	0	5	1	3	6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	0	4	0	1	2	1	1	20	61%	60,7	0,4	1	
33	32	1	4	0	5	3	1	12	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No	No	Yes	Yes	No	No	1	2	1	1	1	0	0	18	100%	100	1	0	
34	33	1	5	1	5	1	4	0	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	1	3	1	1	6	2	4	19	58%	58	0,38	1	
35																																													

ADDENDUM M: MICROSOFT EXCEL SPREADSHEET FOR CAPTURING RAW QUANTITATIVE DATA (CHECKLISTS)



ADDENDUM N: APPROVAL LETTER FROM ETHICS COMMITTEE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and Agricultural Sciences
Ethics Committee

E-mail: ethics.nas@up.ac.za

09 September 2020

ETHICS SUBMISSION: LETTER OF APPROVAL

Miss NZ du Piesanie
Department of Consumer and Food Sciences
Faculty of Natural and Agricultural Science
University of Pretoria

Reference number: NAS189/2020
Project title: NUTRITION COMPETENCIES OF TUCK SHOP OWNERS IN RELATION TO FOOD ITEMS SOLD IN TUCK SHOPS IN TSHWANE SOUTH AFRICAN PRIMARY SCHOOLS

Dear Miss NZ du Piesanie,

We are pleased to inform you that your submission conforms to the requirements of the Faculty of Natural and Agricultural Sciences Research Ethics Committee.

Please note the following about your ethics approval:

- Please use your reference number (NAS189/2020) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.
- Please note that ethical approval is granted for the duration of the research (e.g. Honours studies: 1 year, Masters studies: two years, and PhD studies: three years) and should be extended when the approval period lapses.
- The digital archiving of data is a requirement of the University of Pretoria. The data should be accessible in the event of an enquiry or further analysis of the data.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.
- **Applications using Animals:** NAS ethics recommendation does not imply that Animal Ethics Committee (AEC) approval is granted. The application has been pre-screened and recommended for review by the AEC. Research may not proceed until AEC approval is granted.

Post approval submissions including application for ethics extension and amendments to the approved application should be submitted online via the Ethics work centre.

We wish you the best with your research.

Yours sincerely,

ADDENDUM O: TURNITIN DECLARATION

DECLARATION OF ORIGINALITY

UNIVERSITY OF PRETORIA

The **Department of Consumer and Food Sciences** places great emphasis upon integrity and ethical conduct in the preparation of all written work submitted for academic evaluation.

While academic staff teach you about referencing techniques and how to avoid plagiarism, you too have a responsibility in this regard. If you are at any stage uncertain as to what is required, you should speak to your lecturer before any written work is submitted.

You are guilty of plagiarism if you copy something from another author's work (eg a book, an article or a website) without acknowledging the source and pass it off as your own. In effect you are stealing something that belongs to someone else. This is not only the case when you copy work word-for-word (verbatim), but also when you submit someone else's work in a slightly altered form (paraphrase) or use a line of argument without acknowledging it. You are not allowed to use work previously produced by another student. You are also not allowed to let anybody copy your work with the intention of passing if off as his/her work.

Students who commit plagiarism will not be given any credit for plagiarised work. The matter may also be referred to the Disciplinary Committee (Students) for a ruling. Plagiarism is regarded as a serious contravention of the University's rules and can lead to expulsion from the University.

The declaration which follows must accompany all written work submitted while you are a student of the **Department of Food Science**. No written work will be accepted unless the declaration has been completed and attached.

Full names of student: Nadine Zeta du Piesanie

Student number: u16001550

Topic of work: Masters thesis

Declaration

1. I understand what plagiarism is and am aware of the University's policy in this regard.

2. I declare that this Thesis (eg essay, report, project, assignment, dissertation, thesis, etc) is my own original work. Where other people's work has been used (either from a printed source, Internet or any other source), this has been properly acknowledged and referenced in accordance with departmental requirements.

3. I have not used work previously produced by another student or any other person to hand in as my own.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

SIGNATURE 

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