UNIVERSITI PUTRA MALAYSIA

THE COMPARISON OF NUTRITION FACTS AND COMPOSITION CLAIMS BY DIFFERENT CATEGORIES OF COMMERCIAL COMPLEMENTARY FOOD PRODUCTS IN JOHOR BAHRU

ANIS HAZIRAH BINTI MOHD ROSLAN

THE COMPARISON OF NUTRITION FACTS AND COMPOSITION CLAIMS BY DIFFERENT CATEGORIES OF COMMERCIAL COMPLEMENTARY FOOD PRODUCTS IN JOHOR BAHRU

BY

ANIS HAZIRAH BINTI MOHD ROSLAN

A project submitted as a partial fulfilment of the requirement for the degree of Bachelor of Science (Nutrition and Community Health) from the Faculty of Medicine and Health Sciences, University Putra Malaysia

SUPERVISOR'S SIGNATURE

This project entitled "The comparison of nutrition facts and composition claims by different categories of commercial complementary food products in Johor Bahru" was prepared by Anis Hazirah Binti Mohd Roslan and submitted to the Faculty of Medicine Sciences as a partial fulfilment of the requirement for the degree of Bachelor of Science (Nutrition and Community Health) from the Faculty of Medicine and Health Sciences, University Putra Malaysia

Received and examined by

_____

(Dr Nurul Husna Binti M Shukri)

Date: 24/9/2021

ACKNOWLEDGEMENT

First and foremost, praises and thanks to God, the Almighty, for His showers and blessings throughout my research journey to complete my research with ease and success.

I would like to express my sincere gratitude to my research supervisor, Dr Nurul Husna M Shukri for her continuous support, motivation, and invaluable guidance throughout this research journey. Her determination and sincerity have deeply encouraged me to learn and improve my writing and method to carry out scientific research. It was a great privilege to learn and work under her guidance. I would also like to thank her for all the effort, time, and dedication she had given to me throughout this journey.

I would also like to express my gratitude to my parents Mohd Roslan and Robiah Abu, including my siblings for their continuous support and encouragement which allows me to complete my research thesis. Next, my special appreciation to my final year project colleagues, Nursaleha Sobri and Nurul Humairah, and all my friends for their support and encouragement throughout the journey. I would also like to thank all lecturers of the Department of Nutrition for their invaluable knowledge and continuous guidance in completing this research and my degree study. Finally, I would like to thank everyone who was involved directly or indirectly throughout my research journey.

CONTENTS

LIST OF FIGURES AND TABLES

List of figures

List of tables

ABSTRACT

Previous research found that some Commercial Complementary Foods (CCFs) have high levels of sugar and sodium, but this has not been studied in the Malaysian market. This study aims to compare nutrition facts and composition claims according to the products category in Johor Bahru. Using stratified sampling method, the food labels, ingredient list and composition claims of 250 CCFs products were recorded through photography method in five randomly selected supermarkets in Johor Bahru. Products were categorized into dry cereals, simple purees, and finger foods, and were classified into low/high sugar and sodium contents according to the cut-off amount by WHO. There were 63 (25.2%) dry cereals, 86 (34.4%) simple purees and 101 (40.4%) finger foods products that were available at selected supermarkets. Calories content was higher in finger foods (403.10 kcal ± 45.35 kcal) than dry cereals (367.30 kcal ± 76.37 kcal) and simple purees (80.80 kcal ± 62.57 kcal), ($p<0.001$). Contrarily, protein was higher in dry cereals (10.36g ± 4.06g) than finger foods (7.40g ± 4.31g) and simple purees (1.39g ± 2.35g), ($p<0.001$). Total fat was higher in finger foods (6.27g ± 7.16g) than dry cereals (4.50g ± 3.96g) and simple purees (1.16g ± 2.00g), ($p<0.001$). Consistently, carbohydrate was higher in finger foods (77.44g ± 15.30g) than dry cereals (71.34g ± 18.02g) and simple purees (14.74g ± 10.12g), ($p<0.001$). Finger foods also had higher total sugar (13.95g ± 12.83g), followed by simple purees (10.64g ± 4.5g) and dry cereals (6.51g ± 8.9g), ($p<0.001$). Additionally, finger foods had higher sodium levels (145.92g ± 145.9g) than dry cereals (89.48g ± 120.1g) and simple purees (31.72g ± 48.4g), ($p<0.001$). Most of the products (84.4%) had composition claims. Based on the WHO cut-off, eight (3.8%) products were excess in sugar which was all finger foods. Whereas 88 (37.6%) CCFs contained excessive sodium, the highest number was finger foods (54.5%), followed by dry cereals (22.7%) and simple

purees (22.7%). Early consumption of high-sugar and sodium foods increases the risk of developing obesity, hypertension, and dental cavities later in life.

ABSTRAK

Penyelidikan sebelumnya mendapati bahawa beberapa Makanan Pelengkap Komersial (MPK) mempunyai kadar gula dan natrium yang tinggi, tetapi ini belum dikaji di pasaran Malaysia. Kajian ini bertujuan untuk membandingkan fakta pemakanan dan akuan komposisi mengikut kategori produk di Johor Bahru. Dengan menggunakan kaedah pensampelan berstrata, label makanan, senarai ramuan dan komposisi 250 produk MPK direkodkan melalui kaedah fotografi di lima pasar raya terpilih secara rawak di Johor Bahru. Produk dikategorikan ke dalam bijirin kering, puri ringkas, dan makanan jari, dan diklasifikasikan ke dalam kandungan gula dan natrium rendah / tinggi mengikut jumlah potongan oleh WHO. Terdapat 63 (25.2%) bijirin kering, 86 (34.4%) puri ringkas dan 101 (40.4%) produk makanan jari yang terdapat di pasar raya terpilih. Kandungan kalori lebih tinggi pada makanan jari (403.10 kcal±45.35 kcal) daripada bijirin kering (367.30 kcal±76.37 kcal) dan puri ringkas (80.80 kcal±62.57 kcal), ($p < 0.001$). Sebaliknya, protein lebih tinggi dalam bijirin kering (10.36g±4.06g) daripada makanan ringan (7.40g±4.31g) dan puri ringkas (1.39g±2.35g), ($p < 0.001$). Jumlah lemak lebih tinggi pada makanan jari (6.27g±7.16g) daripada bijirin kering (4.50g±3.96g) dan puri ringkas (1.16g±2.00g), ($p < 0.001$). Secara konsisten, karbohidrat lebih tinggi dalam makanan jari (77.44g±15.30g) daripada bijirin kering (71.34g±18.02g) dan puri ringkas (14.74g±10.12g), ($p < 0.001$). Makanan jari juga mempunyai gula total gula yang lebih tinggi (13.95g±12.83g), diikuti dengan puri ringkas (10.64g±4.5g) dan bijirin kering (6.51g±8.9g), ($p < 0.001$). Selain itu, makanan jari mempunyai kadar natrium yang lebih tinggi (145.92g±145.9g) daripada bijirin kering (89.48g±120.1g) dan puri

ringkas (31.72g±48.4g), ($p < 0.001$). Sebilangan besar produk (84.4%) mempunyai tuntutan komposisi. Berdasarkan pemotongan WHO, lapan (3.8%) produk berlebihan gula yang semuanya makanan ringan. Manakala 88 (37.6%) CCF mengandung natrium berlebihan, yang paling banyak adalah makanan jari (54.5%), diikuti oleh bijirin kering (22.7%) dan puri ringkas (22.7%). Pengambilan awal makanan tinggi gula dan natrium meningkatkan risiko terkena obesiti, darah tinggi, dan gigi berlubang di kemudian hari.

CHAPTER 1

INTRODUCTION

1.1 Background

After birth, the duration until two years old is crucial as it is a "critical window" period to promote optimal growth, health, and behaviour development. According to the World Health Organization (WHO), infants are recommended to be exclusively breastfed for the first six months of life, followed by nutritionally adequate and safe complementary food, while breastfeeding continues until two years of age or beyond (WHO, 2003). Infant and young child feeding are crucial during pregnancy, and a child's two years of age to ensure child survival, prevent growth faltering. It is an essential factor contributing to child ability to reach their full growth potential and economic growth and productivity (United Nations Children's Fund, 2011). Several global recommendations have been initiated to assure optimal breastfeeding and enhance complementary feeding to improve child nutrition (Badham, 2013). For this reason, it is crucial to provide caregivers with appropriate guidance on optimal feeding for infants and young children (Colby et al., 2010).

The WHO recommends exclusive breastfeeding for 6 months followed by the introduction of complementary food. Complementary feeding begins when infants receive liquid or solid food to complement breastmilk. Complementary food (except syrup or drops of medicine, vitamins, and supplements) can be given in the form of puree, mashed and semi-solid foods as a beginning of complementary feeding by the age of 6 months. Finger foods such as snacks that can be held and consumed by them can be given at 8 months of age. Family foods can be given to them when they reach 12 months (WHO, 2003). Introducing different types of complementary food to infants is essential because infants and young children are prone to nutrient

deficiencies and excesses during the complementary feeding period as it is a rapid growth and development period (Fewtrell et al., 2017).

Moreover, offering various foods with different flavours and textures to infants will enhance the acceptance of new foods (Nicklaus, 2011). Newborn infants may positively respond to sweet and umami taste and negatively respond to bitter and sour tastes (De Cosmi et al., 2017). The importance of introducing different types of complementary food to children subsequently increases the variety of types and categories of commercial complementary foods in the market. Commercial complementary food is any type of food that is manufactured for young children less than 36 months (WH), 2109). Commercial complementary foods may be convenient to include in children's diets and can be easily purchased in large stores such as supermarkets and hypermarkets compared to small stores (Hadihardjono et al., 2019). Many types of commercial complementary foods can be obtained in the market, such as infant cereals, simple pureed/blended food, dry finger food/snacks, and juices/other drinks (WHO, 2019).

1.2 Problem Statement

A study in the United States showed that more than 70% of children's food products include nutrition marketing, and almost 60% of those products were high in sugar, sodium, and saturated fat (Colby et al., 2010). More than half of commercial complementary food products have high sugar content exceeding 10% of the daily recommended calorie intake in Taiwan (Koo et al., 2018). Furthermore, more than 20% were high in sodium exceeding 130 mg of sodium per 100g. Products that include health claims contain high sugar and sodium compared to other products without claims (Koo et al., 2018). Few commercial complementary food products in Phnom Penh, Cambodia, Kathmandu Valley, Nepal, and Dakar Department showed exceeds

daily energy recommendations for infants aged 6 to 8.9 months who were breastfed (Sweet et al., 2016).

Commercial complementary food products that may be nutritionally inappropriate containing high sugar and salt may displace intake of other nutritious food. One of the reasons parents feed their children with a commercial complementary food product is because their children like it (Feeley et al., 2016). Exposure to less healthy foods in early life, which are high in sugar, salt, and fat, may lead to several health consequences. Early introduction of sweet food to infants can increase preference for sweet food and, consequently, result in poor eating habits (Mennella, 2014; Mennella & Ventura, 2011). Poor eating habits may lead to food neophobia or picky eating behaviour, which results in insufficient diet variation and impairs nutrient intake such as meat, fruits, and vegetables. Some picky eaters who failed to resolve picky eating behaviour may have thinning problems during adolescence (Taylor & Emmett, 2019).

A longitudinal study showed infants that frequently fed with sweetened water (n=27%) during early life exhibited a greater preference for sweetened water than those who had no or less experience fed with sweetened water (Beauchamp & Moran, 1982). Moreover, high sugar intake among children may contribute to the overweight or obesity problem and dental caries (Moynihan et al., 2019). Another study conducted by Strazullo et al. (2012) showed that infants that have been introduced to starchy foods tend to choose salty solution at 6 months (P=0.007) and tend to lick salt on the surface of food at preschool age (P=0.007) and prefer to eat plain salt (P=0.08). Salt intake during early childhood was also related to high blood pressure later in life (Strazzullo et al., 2012).

Most parents perceived that children's food that includes claims were more nutritious and gave health-related benefits to their children and resulted in purchasing the products (Harris et al., 2011). To avoid confusion and misunderstanding among parents, the Codex Alimentarius Commission state that "composition claims (that is nutrition claims) and health claims shall not be permitted for foods for infants and young children except where specifically provided for in relevant Codex standards or national legislation" (CODEX Alimentarius, 1997). Composition claim is defined as an overarching explanation of food such as " “organic food” or elimination of ingredient types such as “no preservatives” and “gluten-free”. In addition, food additives are also prohibited to be included in commercial complementary food products, such as colouring agents, sweetening agents, and added sugar (WHO, 2019). Food preservatives are included as previous studies reported that artificial preservatives may lead to severe health hazards such as hyperactivity, hypersensitivity, allergy, asthma, cancer, and neurological damage (Anand & Sati, 2013). In addition, food colouring has resulted in several health effects, including hypersensitivity reactions, carcinogenicity, and behavioural outcomes (Okafor et al., 2016). Other than food preservatives and colourants, it is also important to examine the presence of sweetening agents and added sugar because according to the guidelines from WHO (2019), these two ingredients are prohibited to include in commercial complementary food products. However, this guideline is not implemented or conducted adequately in some countries, including Malaysia, which lacks regulations on nutrition and health claims for infants and young children’s foods. Besides, Malaysia has only a general guideline on food products. It lacks proper guidelines, especially on nutrient content and food labelling of commercial complementary food products for infants and young children.

RESEARCH QUESTIONS:

1. What are the available product categories of commercial complementary food in Johor Bahru and their composition claims?
2. What are the differences in nutrition content (calories, protein, total fat, carbohydrate, sugar, and sodium) per 100g by product category?
3. Is there an association between sugar/sodium/ other composition claims and its ingredient value content of products?

1.3 Significance of the Study

There is no published study that has been done on commercial complementary food available in Malaysia. Hence, this study will give benefits in several aspects. The first benefit is that it will provide information about the types and categories of commercial complementary food available in certain parts of Malaysia, such as in Johor Bahru. Based on previous studies conducted in Indonesia, the common types of commercial complementary food products that available in the market are infant cereals (44%), infant snacks/ finger foods (32.7%), puree or infant meals (17.3%), puddings (3.2%) and liquid form (2.7%) (Hadihardjono et al., 2019). Next, it will give data about the number of products with high sugar and sodium content and related findings of composition claims and high sugar and sodium content. According to Codex guidelines (CAC/GL 23-1997), compositional claims, nutritional claims, and health claims are not allowed to be included in commercial complementary food products (CODEX Alimentarius, 1997). However, few commercial complementary food products include food claims on their packaging, and 50% of the food products that include nutrition and composition claims have a higher amount of sugar content than food products that did not include composition claims (Koo et al., 2018).

Consumers with young children are particular about nutrition claims, which influence them to buy products with such requests (Cavaliere et al., 2015). Thus, the findings from this study could be used as baseline data for the government to set up future guidelines for commercial complementary food products available in Malaysia. This guideline is essential to regulate the food claims and nutrition facts for commercial complementary food products available in the market to ensure accurate information about the food products to the caregiver and promote a healthy diet. Hence, this study will provide a current issue about nutrition facts and food claims compliance with available international guidelines for commercial complementary food available in the market.

1.4 Objectives

General objective

To compare nutrition facts and composition claims according to the products category of commercial complementary food in Johor Bahru.

Specific objectives

1. To determine the number of commercial complementary food products by product category

2. To determine the nutrient content (calories, protein, total fat, carbohydrate, sugar, and sodium) per 100g by product category.

3. To determine the number of food additives added in the commercial complementary food products.

4. To compare the nutrition facts per 100g (calories, protein, total fat, carbohydrate, sugar, and sodium) by product category.

5. To determine the number of composition claims in the commercial complementary food products by product category.

6. To examine the association between composition claims with products that have high sugar and sodium content.

1.5 Hypothesis

1.5.1 Alternative Hypothesis

- There are significant differences in nutrition content and composition claims between different product categories of commercial complementary food products available in Johor Bahru.
- There is an association between sugar/sodium/other composition claims and its ingredient value content of products.

1.6 Research Framework

As shown in Figure 1, availability of commercial complementary food in the market, nutrition facts per 100 g, and food claims are the variables to be compared with different categories of commercial complementary food products (infant cereals, simple pureed/blended food, dry fingers food/snacks, and juices/other drinks) in Johor Bahru.

The availability of commercial complementary food in supermarkets and hypermarkets in Johor Bahru was determined in frequency and percentage. It is categorised according to its types: infant cereals, simple pureed/blended food, dry fingers food/snacks, and juices/other drinks. The categorisation is based on various infants and young children's food products available in several countries from previous studies conducted by WHO (WHO, 2019). Most commercial complementary food products can be easily obtained in supermarkets and hypermarkets (Dreyfuss et al.,

2019). The nutrient content such as calories, protein, total fat, carbohydrate, sugar, and sodium per 100 g will be recorded and compared with each product category. There will be differences in nutrient content for each type of product. Food claims consist of composition claims, nutrition claims, and health claims. This study only recorded the composition claims on food products based on the examples of composition claims from a previous study (Koo et al., 2018).

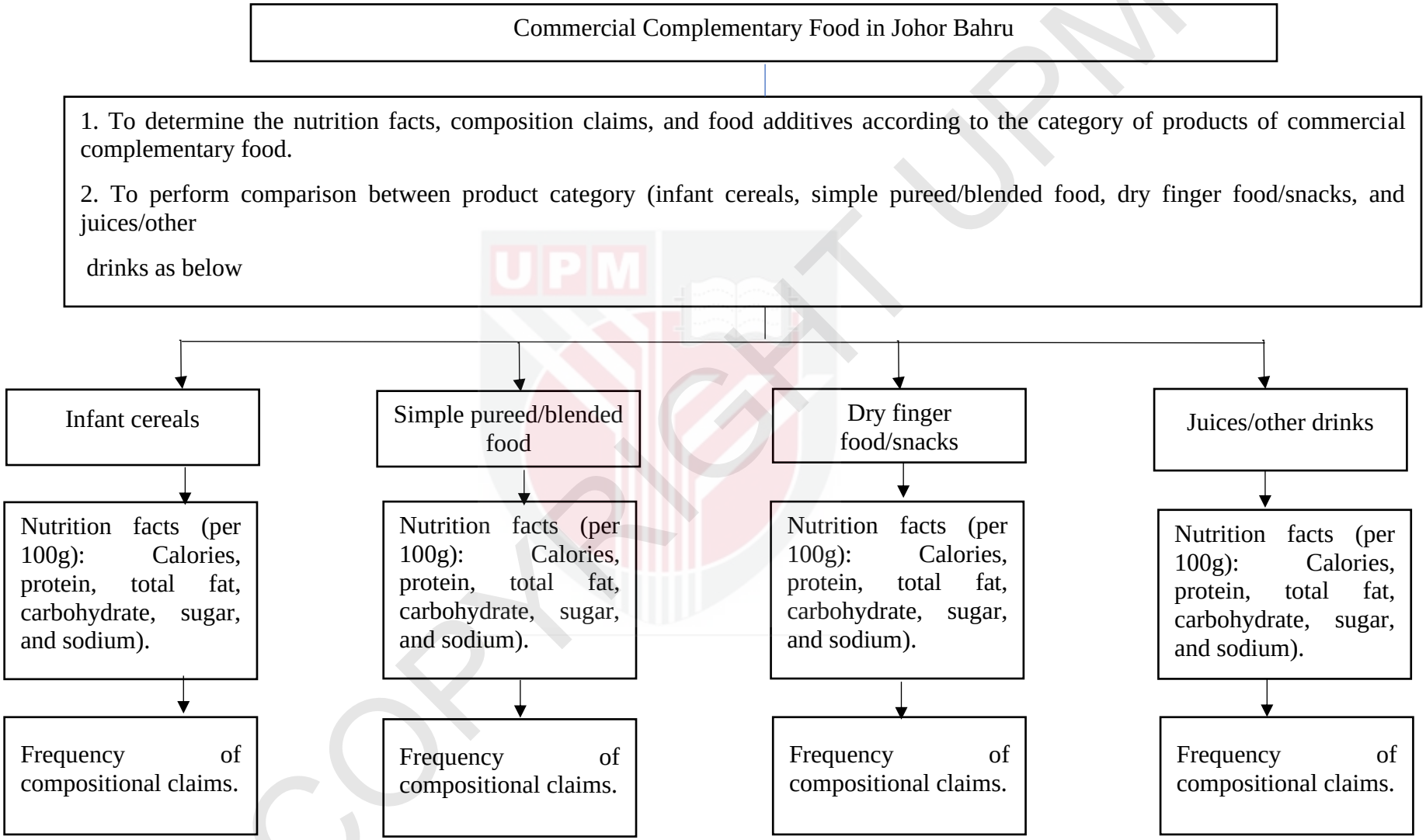

Figure 1. Research Framework

CHAPTER 2

LITERATURE REVIEW

2.1 Complementary Feeding

Complementary feeding can be defined as "a process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, hence other foods and liquids are needed along with breast milk". The average age range to initiate complementary feeding is between 6 months to 24 months (WHO, 2003).

2.2 Complementary Food

WHO states that any liquid or solid other than drops or syrups, which includes medicines, vitamins, or mineral supplements, is considered complementary food, including infant formula. Thus, infants who are fed with infant formula are considered to have consumed complementary food even if they start from birth. On the contrary, the European Society of Pediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) does not include infant formula as complementary food as it may confuse parents. The reason is that most infants who lived in Europe consumed infant formula from the first week of life (Agostoni et al., 2008).

There are four guidelines for complementary food, which are *timely, adequate, appropriate,* and *variety*. The guideline for timely indicates complementary food should be introduced at a suitable age. The recommended age range for complementary food processes starts from 6 to 24 months of age, and breastfeeding may continue until two years of age. WHO recommendations on age for the initiation of complementary food are referring to the consideration of exclusive breastfeeding (WHO, 2003). It is different from the recommendation by ESPGHAN (The European Society for Paediatric Gastroenterology, Hepatology and Nutrition) which stated that complementary food should not be initiated before 4 months and not exceed 6 months.

The recommendation is based on previous studies from developed countries that showed no changes in growth between infants exclusively breastfed for 3 to 4 months and 6 months (Agostoni et al., 2008).

Guidelines of complementary food for *adequate* indicates to ensure sufficient complementary food according to the children's age. During the initiation of complementary food at 6 months, food can be given in a small amount and increase the quantity from time to time while continuing breastfeeding. Infants in developing countries with average breastmilk intake require approximately 200 kcal (6-8 months), 300 kcal (9-11 months), and 550 kcal (12-23 months) energy per day from complementary food according to age. Infants in a developed country have different energy per day, approximately 130 kcal (6-8 months), 310 kcal (9-11 months), and 580 kcal (12-23 months) due to a different average intake of breastmilk. The meals for complementary foods shall be given according to age, which is 2-3 times per day at 6-8 months and 3-4 times per day at 9-24 months with the addition of snack 1-2 times between meals (WHO, 2003). However, if the infants consume more or less amount of breastmilk than average, the amount of required energy will be different.

Besides, *appropriate* complementary food can be initiated with pureed, mashed, and semi-solid foods for 6 months infants until the ability for munching (up and down movement of mandibular) or chewing (bite with teeth) develop. At the age of 8 months, most infants can be given "finger foods," which is food that can be held and eaten by the infants alone. By the time they reach 12 months, most young children can eat the same foods as their family. When the infant is given inappropriate food consistency, it may result in low intake of food consumption and choking. There is a "critical window" for the duration to introduce solid food. It should not be delayed as it may increase the risk of feeding difficulties in the future (Dewey, 2005).

Complementary food should be *varied* and include all food groups to ensure the infant's requirements are met. Foods that are a source of protein and rich in iron and zinc such as meat, poultry, fish, or eggs should be given daily or frequently as the amount of iron and zinc in breast milk decreases as the infants get older. Fibre such as fruits and vegetables must be given to the infants as they contain vitamin A and other vitamins which prevent vitamin A deficiency illnesses. Besides protein and fibre, fats are crucial in infants and young children's diet as it provides essential fatty acids that promote the absorption of fat-soluble vitamins and improve dietary energy density and sensory qualities. The average amount of fat that needs to be achieved in complementary food is between 30-45% (WHO, 2003).

2.3 Method of feeding

Most parents have difficulties measuring the accurate amount of breastmilk and energy required by infants in daily life. Hence, parents can apply responsive feeding principles while ensuring the amount of energy density and meal frequency meet the child's energy requirement. Responsive principles apply the psycho-social care principle which consists of five practices. Firstly, parents or caretakers must feed infants directly and assist older children during mealtime. They need to be alert with hungry and satiety cues from infants and children. For example, infants are hungry when they lean toward food and open their mouth, contrarily they are full when they spit out or push food away. Secondly, parents or caretakers need to slowly feed the children, encourage them to eat, and avoid forcing them to eat. Established routines around mealtimes such as eating at the same place and times are one of important elements of responsive feeding. Thirdly, parents and caretakers may expose different textures, tastes, food combinations, and other methods of encouragement if the children refuse to eat. For example, provide them with food from different colours to

attract their appetite Fourthly, distractions during mealtime must be minimised to avoid the children becoming lost interest in eating. Any distractions such as television or smart phone should be avoided. Lastly, parents or caretakers are encouraged to talk with the children and have eye-to-eye contact as mealtime is a process of love and learning (WHO, 2003).

2.4 Complementary feeding in Malaysia

According to the National Health and Morbidity Survey (2006), 41.5% of infants aged 6 months to below 9 months have received complementary feeding. In addition, more than half of infants from a rural area (53.8%) had received complementary foods than infants in the urban area (35.6%). Breastfed infants started complementary feeding earlier (before 2 months) compared to non-breastfed children (at the age of 2-3 months). Introducing infants to complementary foods as early as 2 months of age was deviant from the recommendation from WHO which stated that infants should be introduced with complementary foods at least at 6 months of age. Most infants consumed high amounts of cereal-based foods, fruits, and vegetables, but less than 40% of infants aged 4-6 months consumed foods such as meat, fish, and eggs. It is important for infants at this age to consume foods high in iron, zinc, calcium and vitamin B12 as the iron stores have been depleted and they are prone to iron deficiency diseases. In terms of meal frequency, most infants aged 6-8 months consume two meals per day which are appropriate minimum meals for their age. On the contrary, only half of the infants aged 9-23 months consume appropriate meals per day for their age which is three meals per day (National Health and Morbidity Survey, 2006).

Another study conducted among 295 children in the rural district of Kelantan showed that 70.5% (n=208) of infants have complementary food before 6 months of age whereas 29.5% (n=87) after 6 months of age (Whye Lian et al., 2012). Despite the

early introduction of complementary feeding (at 4 to 5 months), there was a high prevalence of undernutrition. The average age of undernutrition children was early compared to the recommended age by WHO which were 4.93 ± 1.75 months (underweight), 4.71 ± 1.61 months (stunting), 5.0 ± 2.05 months (low MUAC-for-age), and 5.03 ± 2.05 months (wasting). However, the mean percentage for calorie intake was low (17.34% ± 7.54%) compared to Recommended Nutrient Intake (RNI) and the mean percentage for protein intake was high (305.2% ± 134.97%) compared to RNI.

A recent study conducted among 121 Penan children in a rural area of Sarawak found that 85.7% (n=12) of infants aged 6 months to 8 months have been introduced to complementary foods in the form of solid, semi-solid, or soft foods. The prevalent children aged 6 to 23.9 months achieved minimum dietary diversity (MDD) was 76.6%. The proportion of children who received at least four food groups were 41.5%, five food groups were 23.4%, and less than four food groups were 23.4%. The study also showed that only half (55.3%) had achieved minimum adequate dietary (MAD) for breastfed and non-breastfed children. Overall, the minimum dietary diversity (MDD) was satisfactory at 76.6%, almost the same as Sarawak state (76.4%) as stated in the National Health Morbidity Survey (2016). Besides, the achievement of MAD was still low at 55.3%. Results from this study were not significant with infant and young children feeding (IYCF) and nutritional status as several other factors may cause undernutrition among infants and children (Bong et al., 2018).

2.5 Commercially Available Complementary Food

Commercially available complementary food (CACF) are all foods and beverages products that are produced and marketed specifically for infants and young children feeding until aged 36 months and complement breastmilk or infant formula.

They are marketed for infants and young children if they are labelled with any of these words such as "young child", "infant", "toddler" and "baby". Besides, the recommended introduction age is below 36 months, including the image of a child younger than 36 months or feeding with a bottle, and any other means that indicate it is suitable for children younger than 36 months (WHO, 2019).

There are a variety of categories for commercial complementary food that are available in market-based on previous studies in Europe countries (WHO, 2019) such as:

- Dry, powdered, and instant cereal/starchy food
- Soft-wet, ready-to-eat food
- Meals with chunky pieces
- Dry finger foods and snacks
- Juices and other drinks

Some of the categories of commercial complementary food stated above may not be available or common in Asia countries. For example, previous studies conducted in Taiwan and Indonesia showed that the most common categories that are available in the market of Asia countries are infant cereal, snack/finger foods, purees and infant meals (Hadihardjono et al., 2019; Koo et al., 2018).

2.6 Concerns on the promotion of commercial complementary food (CCF)

Concerns have been growing about the promotion of commercial complementary food among infants and young children, especially on their growth and health. The concerns include, complementary foods may displace breast milk consumption. However, there was no high-quality evidence to prove this concern

based on a systematic review published in 2015 (Tzioumis et al., 2015). The review only found eight studies that met their criteria, and the selected studies have a low quality of evidence base. Other studies showed that breastmilk intake is sensitive to the feeding frequency and energy density of all complementary foods (including commercial complementary food) and conclude that displacement of breastmilk is possible depending on the frequency of feeding and characteristics of complementary food.

Another concern on the promotion of commercial complementary food products is some products contain high sugar, salt, fat, or other unnecessary nutrients. Previous studies have shown that commercial complementary food promoted in the market contains added sugar or excess sugar from total calorie and high sodium content. A study conducted in Canada found that more than 60% of products have either an excessive percentage of total calories derived from sugar and a high amount of sodium (Elliott, 2011). An excessive amount of sugar from total calories can also be found in Taiwan (Koo et al., 2018), where more than half (54.4%) of commercial complementary foods were high in sugar and more than 20% were high in sodium. Some of the commercial complementary food products contain added sugar which should be avoided in infant and young children's foods. Added sugar can be found in a study conducted by Theurich, Koletzko, and Grote (2020) among cereal-based commercial complementary food in which 32% of commercial cereals contain added sugar such as sucrose, fruit juice concentrates, chocolate powder, vegetable juice concentrates, fructose, glucose, and honey. Another study conducted in New Zealand showed 34% of commercial complementary food products have added sugar (Padarath et al., 2020). Exposure to foods that are high in sugar at an early age repeatedly may

influence their preferences on sweet and salty foods as they are born with innate preferences for sweet tastes (Ventura & Worobey, 2013).

2.7 Inappropriate promotion of commercial complementary food

Inappropriate promotion of commercial complementary foods has become a concern as it may confuse and mislead caregivers about the nutritional qualities, health-related qualities, and appropriate age of consumption. According to WHO (2019), inappropriate promotion of foods and young children has been considered to interfere with breastfeeding, contributes to obesity and non-communicable diseases, cause dependency on commercial products or misleading information. The common types of promotions are summarised in Table 1

Table 1. Common types of promotion for commercial complementary food (CCFs).

Types of promotion	Examples
Online promotions, as well as advertising actions and materials (e.g Facebook, Twitter, and other social media).	- Media advertisement (e.g radio, TV, print materials and online). - Audio-visual materials used to promote relevant products (e.g TV, billboards, radio, posters, newspapers, pamphlets, magazines, newsletters, journals, and advertisements in books).
Non-advertising promotion actions.	- Promotion at the point of sale (e.g., special displays, deals, and offers tie-in sales, loss-leaders, discount coupons and rebates). Promotional activities that are organized in communities and public areas (e.g banners, discount coupons, free products distribution, and company gifts). Promotion in health centres and health-care staff (e.g., gifts/other incentives/company equipment, use of health-care facilities for functions, coupons distributions or gifts).
Labelling, packaging, and messaging.	- Structural claims and health claims, advising or supporting bottle-feeding. - Image, picture, and text suggest that a product is suitable for infants under the age of 6 months.
Cross-promotion of products.	- Labelling that is misleading (e.g using similar logos, colours and labelling formats on food products and infant formula). Direct interaction of company representatives with mothers and other caregivers in social media.

Adapted from WHO. (2019). Ending inappropriate promotion of commercially available commercial food for infants and young children between 6 and 36 months in Europe.

Inappropriate promotion of commercial complementary food has been found in several Southeast Asia countries based on previous studies. A study conducted in Cambodia reported that almost all mothers (96.5%) had noticed the promotion of commercial complementary snack food products and 30% of mothers had noticed the promotion of commercial complementary food products. This situation results in the high consumption of commercial complementary snack food among 6-23 months children in which more than half of them (55%) on the prior day and 80.6% of them consumed at least once in the prior week (Pries, Huffman, Mengkheang, et al., 2016). A study conducted by Yi Chun, Jung Su and Yu Tang (2015) reported that many formula products (n=794) and toddler food (n=400) were advertised, from the total number of infant and toddler foods advertised, 756 food advertisements were found in a magazine (Chen et al., 2015). More than 40% of the promoted complementary food products were intended for infants aged 4 months, contrary to the recommended age for complementary feeding by WHO. The result is consistent with another study conducted in Kathmandu Valley, Nepal reported that 85.4% of mothers had noticed the promotion of commercial complementary snack food products, and the consumption of commercial complementary snacks among children aged 6-23 months was high at 74.1% (Pries, Huffman, Adhikary, et al., 2016). Recent study conducted in Bandung, Indonesia reported almost all (97.7%) commercial complementary food products were found in stores and 81.0% of the products found had a promotion. The common type of promotion used was a joint promotion (49.0%), combining breastmilk substitute, commercial complementary food, and commercial complementary snacks (Hadihardjono et al., 2019).

2.8 Food Labelling

2.8.1 Function of food labels

A food label is defined as any tag, brand, mark, pictorial, or other descriptive matter, written, printed, stencilled, marked, embossed, or impressed on, or attached to, a container of food (CODEX, 1999). According to the Canadian Food Inspection Agency (Canada Food Inspection Agency, 2013), a food label has three primary functions. The functions of food labels are to provide basic information about the product and provide health, safety, and nutrition information. The food label is not only providing information but also acts as a vehicle for food marketing, promotion, and advertising such as the use of claims, for example, composition, nutrition, and health claims.

2.8.2 General requirements for food labels

According to Codex principles for food labels (CODEX, 1999), food labels should not mislead the public by describing or presenting the product in a manner that is false, misleading, or deceptive or is likely to create an incorrect impression regarding its character. The information that is mandatory to be included: name of food, ingredient list, net content, and drained weight, name and address, country of origin, lot identification, date marking and storage instructions, instructions for use, quantitative ingredient declaration, and irradiated food statement. This information should have appeared on the label of food products except if it stated otherwise in individual Codex standards.

2.8.3 International and national guidelines on food labelling

The Codex Alimentarius Commission (CAC) is an intergovernmental body that was established in the 1960s by the WHO and the Food and Agriculture Organization of the United Nations (FAO) to implement the Joint FAO/WHO Food Standards

Programme (WHO & FAO, 2018). The purpose of the commission is to protect the consumer's health, ensure fair practices in the food trade, and promote the coordination of all standard work undertaken by an international governmental and non-governmental organisation. The Codex Alimentarius or "food code" is a collection of international food standards, guidelines, and codes of practice that are adopted by the consensus of the Codex Alimentarius Commission. It consists of two texts (general and specific) where general text focuses on matters related to hygiene, food additives or labelling. The specific text deals with detailed requirements that are related to food or food groups for example the essential composition of these foods (WHO & FAO, 2018). Codex text is an international standard that has been adopted partially or wholly in national regulations or standards. It is useful for developing countries that may not have complete and appropriate guidelines. In Malaysia, the main administrative body for food safety is the Food Safety and Quality Division (FSQD). The regulations that ensure the public is protected from health hazards and fraud in the preparation, sale and use of foods are Food Act 1983 and Food Regulation 1985 in which food labelling guideline is under Food Regulations 1985 (Food Safety and Quality Division, 2004).

2.8.4 Food labelling regulation of commercial complementary food

National regulation for commercial complementary food is under Food Regulations 1985 which are Regulation 390 (canned food for infants and children) and Regulation 391 (cereal-based food for infants and children) adopted from Codex Alimentarius Standard (CODEX Alimentarius, 1981b). International regulation such as Codex Alimentarius Standards has established few regulations established for commercial complementary food:

- Codex standard for canned baby foods (CODEX STAN 73-1981. Amendment 1983, 1985, 1987, 1989, 2017) (CODEX Alimentarius, 1981a).

- Codex standard for processed cereal-based foods for infants and young children (CODEX STAN 74-1981, REV. 1-2006. Amendment 2017,2019) (CODEX Alimentarius, 1981b).
- Guidelines on formulated supplementary foods for older infants and young children (CAC/GL 8-1991) (CODEX Alimentarius, 1991).

According to the Codex Alimentarius (CODEX Alimentarius, 1997) regulation, any nutrition claims (including composition) and health claims shall not be permitted for foods and young children except where specifically provided for in relevant Codex standards or national legislation. Nonetheless, there is no regulation on nutrition claims and health claims for infants and young children's foods in Food Regulations 1985. A nutrition claim is defined as any representation which states, suggests, or implies that a food has nutritional properties including but not limited to the energy value and the content of protein, fat, and carbohydrates, along with vitamins and minerals. It is excluded as nutrition claims if:

- the mention of substance in the list of ingredients.
- the mention of nutrients as a mandatory part of nutrition labelling.
- quantitative or qualitative declaration of certain nutrients or ingredients on the label if required by national legislation.

Composition claims refer to the overarching description of food ingredients or food quality (e.g organic food) or the exclusion of ingredient types (e.g gluten-free, no preservatives) (Canada Food Inspection Agency, 2013). Health claims are defined as any description that suggests a relationship between the constituents of food and health, for example, nutrition function claims. It also includes claims that consumption of any food can influence the biological activities or normal functions of the body in

the context of a wider diet (CODEX Alimentarius, 1997). Table 2 is the list of examples for composition, nutrition, and health claims.

Table 2. Examples of composition, nutrition, and health claims.

Type of food claims	Examples
Composition claims	No added preservatives, no added colouring agents, no added seasoning, dairy-free, no added condiments, natural, organic food, fresh, gluten-free, contains vegetables, no food additives, non-GMO food, no allergens, no maltodextrin or modified starch, no added artificial flavour, whole grain, contains meat.
Nutrition claims	Contains calcium, contains iron, contains a host of nutrients, contains vitamin C, contains dietary fibre, no added sugar, contains multiple vitamins, no added salt, contains vitamin E, contains vitamin A/β-carotene, contains vitamin B1, contains multiple minerals, contains ω- 3, low sodium, contains probiotics or prebiotics, contains zinc, contains protein or amino acids, contains phospholipid, contains vitamin B2, contains iodine, contains phosphorus, contains DHA, contains lactose, contains carbohydrate, contains vitamin D, contains magnesium, contains arachidonic acid, contains selenium.
Health claims	Nutritionally balanced, improve appetite, provides good nutrition to children, suitable for picky eaters, improves growth, supports healthy growth, good for digestion and absorption, supports learning to chew, supports learning to hold, combats constipation, good for bones and teeth, good for enteric flora, good for the brain, good for the eyes, supports vision and skin health, good for defecation, good for thyroxine synthesis, good for red blood cell synthesis and preventing iron-

	deficiency anaemia, good for metabolism, good for collagen synthesis.

Adapted from WHO. (2019). Ending inappropriate promotion of commercially available commercial food for infants and young children between 6 and 36 months in Europe.

Codex regulation (1991) on the prohibition of compositional, nutritional, and health claims for commercial complementary food products was adopted in the WHO Guidance on Ending Inappropriate Promotion of Foods for Infants and Young Children. The guidance was established in 2016 by WHO and has been approved by the World Health Assembly through resolution WHA 69.9. The guidance uses the nutrient profiling model (NPM) according to the steps recommended by WHO and collection of data from other sources, including referring to the existing European Commission directives and Codex standards. The purpose of the nutrient profiling model is to categorise commercial complementary food products, identify food products that may be suitable for children below 36 months of age and ensure the permitted food product are promoted appropriately. To achieve these purposes, the model constructs a compositional limit and provide guidance for promotion and product labelling. It emphasises the marketing of commercial complementary foods containing high saturated fats, trans-fatty acids, free sugar, and salt as addressed in the WHO guidance.

2.8.5 Inappropriate practice of food claims

There have been rising food claims among commercial complementary food products for infants and young children in the market. The rise of inappropriate food claims may cause confusion among parents who may perceive that commercial complementary food products are nutritionally superior to homemade complementary food. A rapid evidence assessment conducted by WHO-commissioned identified that marketing strategies were implemented based on the concerns of mothers about the nutrition and health needs of their children (WHO, 2019). The study found that marketing can convey misleading information and cause confusion to caregivers regarding nutritional, health-related qualities, and appropriate age of use for commercial complementary food. Besides, marketing was found to affect knowledge, preferences, attitudes, and behaviours of caregivers and lead to increased consumption of products and negative impact of exclusive breastfeeding, duration of breastfeeding or introduction of complementary food at an early age (Smith et al., 2015).

CHAPTER 3

METHODOLOGY

3.1 Study Design

The cross-sectional study design was conducted to analyse the packaging information on commercial complementary food products.

3.2 Study Location

This study was conducted in Johor because it has the third-highest population in Malaysia which is estimated at 3.76 million. Johor Bahru was chosen among other districts in Johor as it has the highest population in Johor (Department of Statistics Malaysia, 2020). Data collection was conducted at supermarkets and hypermarkets as they have other branches across Malaysia (Roslan et al., 2016) and carry a variety of commercial complementary food products. A supermarket can be defined as a self-service store offering a wide variety of food and household merchandise, organised into departments. It is larger and has a variety of selections than a traditional grocery store. The area of the supermarket is measured to be around 300 – 2500 square meters (Pwc, 2015). On the contrary, a hypermarket can be defined as a self-service modern store that sells a wide range of product brands, manufacturer product brands, and generic brands under one roof which is equipped with a free and spacious parking area. The area of a hypermarket is measured to be more than 2500 square meters to over 8000 meters which are larger than a supermarket and grocery store (Hassan et al., 2013). Examples of hypermarkets that have several branches across Malaysia are Aeon Big, Tesco, and Giant.

3.3 Sample Size Determination

The sample size was determined using G*Power software version 3.1.9.7 for Windows XP (Erdfelder et al., 2009). G*Power is a free software used to calculate

statistical power for various tests, including t-test, F-test, and chi-square test. For this study, the test family used was F-test and the statistical test used is ANOVA: Fixed effects, omnibus, one way. The type of power analysis is a priori, which computes the required sample size by using significance level (α), power (1-β) and effect size. Number of groups is a number for comparison groups used. The effect size was adjusted at 0.25, significance level (α) at 0.05, power (1-β) at 0.85 and the number of groups as four. The total sample size obtained for this study was n=204 samples.

3.4 Sampling Design

The stratified sampling method was used in this study Figure 2. The area in Johor Bahru was divided into four strata which were Tebrau, Pasir Gudang, Johor Bahru, and Pulai, according to the council boundaries (Majlis Bandaraya Johor Bahru, 2018). There were 60 supermarkets and hypermarkets in Johor Bahru. The list of supermarkets and hypermarkets was collected from the official website of supermarkets or hypermarkets and Google Maps. The supermarkets and hypermarkets that were identified by Google Maps and selected if stated "supermarket" or "hypermarket" at the address details. Two strata were selected purposively based on the highest number of supermarkets and hypermarkets in the area which was Johor Bahru (n=27) and Pulai (n=12). Supermarkets and hypermarkets were chosen using simple random sampling by the stratified proportion which is 1/2 for Johor Bahru and 1/4 for Pulai. The total number of the supermarkets randomly selected was n=9 for Johor Bahru and n=3 for Pulai. For each supermarket and hypermarket, at least 17 samples were collected to meet the total sample size (n=204).

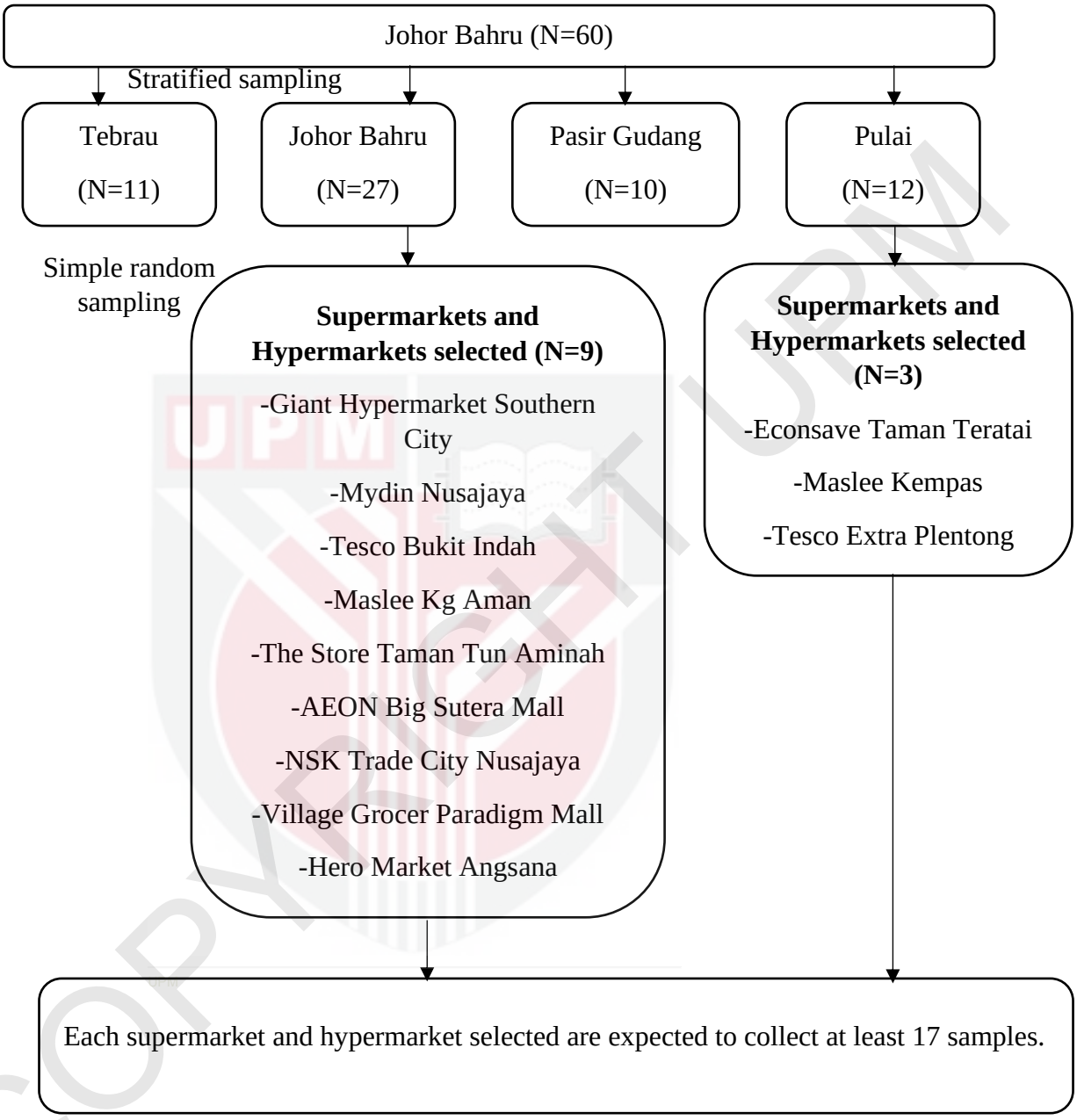

Figure 2. Sampling Design

3.5 Research Procedure

Research procedure explained a process on how the study was conducted. It encompasses data collection, coding process, and statistical analysis. Before the collection of data, permission was obtained from the store manager. The food products were identified from the sections labelled "infants" or "baby" foods and selected according to the inclusion criteria. The data were collected through a snapshot of the front, back and side of the packaging. The information from the snapshot was transferred to the codebook to determine composition claims and the calculation of sodium and sugar content. After the information has been analysed, the information was further input into Microsoft Excel according to the product information, product types, recommended age, nutrition facts information (calories, protein, total fat, carbohydrate, sugar, and sodium) and any inclusion of composition claims on food packaging.

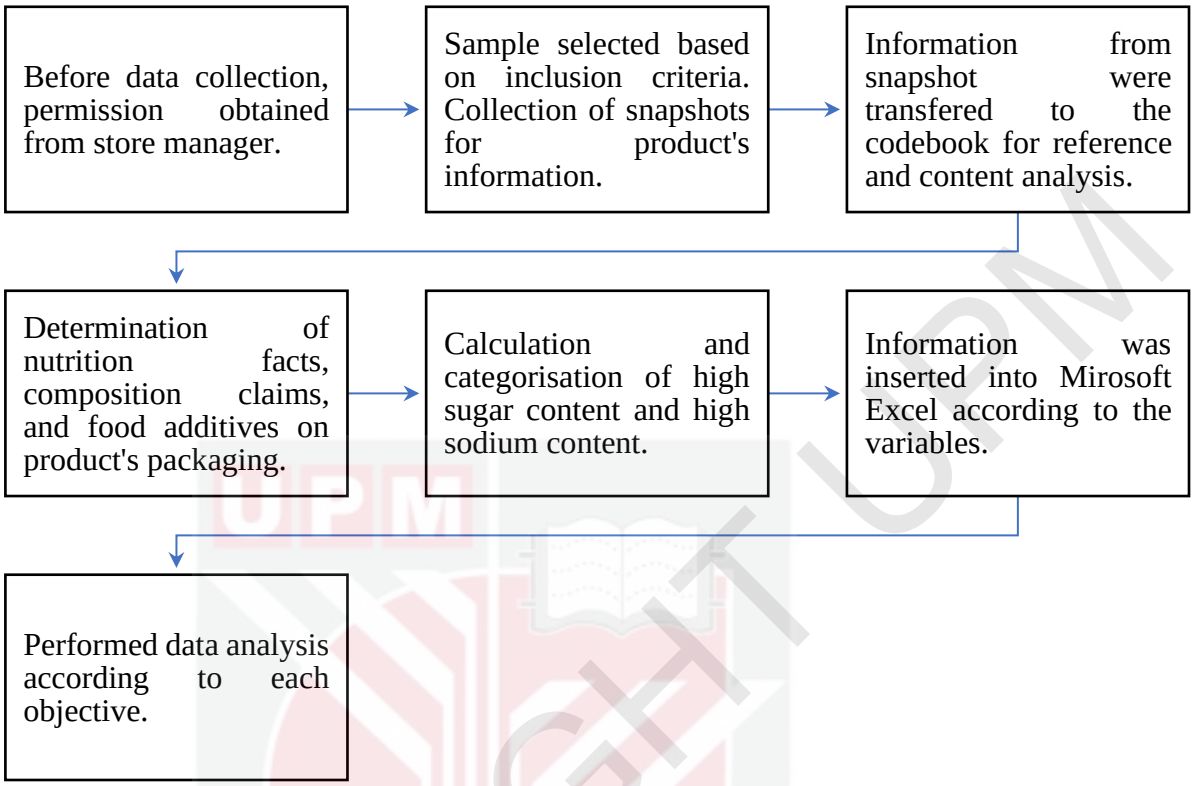

Figure 3. Research procedure of this study.

3.5.1 Data collection

Data collection was conducted at the selected supermarket and hypermarket. The food products were identified from the sections labelled "infants" or "baby" foods and selected according to the inclusion criteria.

3.5.1.1 Inclusion and exclusion criteria

Products were selected based on the following criteria in Table 3. All products that met the criteria were selected and the information on the products was recorded.

Table 3. Inclusion and exclusion criteria for the sample in this study.

Inclusion criteria	Exclusion criteria
All liquid, solid and semi-solid products found in the non-perishable section with labelled infants/baby/toddler/young child or label/image of a child who appeared to be younger than 3 years of age.	Products that do not specify for baby/ infant/ toddler/ young children on food packaging
All liquid, solid and semi-solid products are found in the refrigerated or frozen section with labelled infants/baby/toddler/young child.	● Infant formula, follow-up formula, infant or follow-up formula for special dietary or medical purposes, and other milk and milk products (liquid or powdered form). ● Meal replacements, nutritional supplements, and micronutrient supplements.

3.5.1.2 Study Instruments

Data collection was conducted using a codebook adapted from previous studies (Koo et al., 2018; WHO, 2019). The codebook has four sections which are section A to section D. Section A consists of the product ID, product name, product brand, manufacturer, name of the store, type of the store, location of the store and recommended age. Section B consisted of product categories including infant cereals, simple pureed/blended food, dry finger food/snacks and juices/other drinks. Section C consisted of information on nutrition facts, food additives and added sugar. Section D consisted of the inclusion of composition claims and examples of composition claims on the product's packaging.

3.5.2 Coding process and categories

The codebook as attached in Appendix A and snapshot of product information were reviewed and recorded. Information coded according to the variables: product information, product category, recommended age, nutrition facts, high sodium

content, high sugar content, contain food additives, contain added sugar, and composition claim.

3.5.2.1 Product Information

The product information included the product ID, product name, brand, manufacturer, name of the store, type of store, location of the store, and recommended age.

3.5.2.2 Product Category

Product categories included infant cereals, simple pureed/blended food, dry finger food/snacks, and juices/other drinks that are available in supermarkets and hypermarkets in Johor Bahru. Product categories were categorised and adapted from the WHO guidelines (WHO, 2019).

Table 4. Product category and their definition and examples.

Product Category	Definition and examples
1. Infant cereals	
1.1 Dry or infant cereals/starch.	- Include dry rice, pulverised rusks, cereal, or starchy root (not less than 25% cereal and/or starch root content) without or with naturally sweet foods (such as powdered fruit juice and dry fruit), whey powder, or milk powder. - Include products mixed with liquid such as dry breakfast cereals (such as puffed rice or cereal hoops) and dry instant-type porridges if marketed as suitable for infants and young children. -Exclude wet ready-to-eat cereals.
2. Simple Pureed/Blended food	
2.1 Dairy-based desserts and cereal products.	-Include yoghurt, fromage frais, porridge, custards, or rice pudding, made with or without other naturally sweet foods including fresh fruit, dried fruit, or fruit juice.
2.2 Fruit puree with or without the addition of vegetables, cereals, or milk.	-Include products containing the largest ingredient, single or mixed fruit and may include vegetables, cereals, and dairy. -Include any fruit-and-vegetable purée or spoonable fruit, high-fruit breakfast foods (for example fruit-based breakfast rice/porridge), and desserts (such as apple crumble or fruit-based baby rice). -May include some products labelled as "smoothies", without the addition of juice or water.
2.3 Vegetable only puree.	-Include products containing more than 95% single or mixed vegetables or legumes and water combined. -Exclude products containing any fruit, or more than 5% cereals or other ingredients. -May include some products with the label "smoothies", without the inclusion of vegetable or fruit juice.
2.4 Pureed vegetables and cereals.	-Include products containing pureed vegetables/legumes (largest ingredient by weight include vegetables, legumes, cereals, or pseudo-cereals), with more than 5% cooked weight in cereal (such as

Table 4 (cont.).

Product Category	Definition and examples
	rice, pasta, barley), or a pseudo-cereal (such as quinoa, buckwheat, and chia). -Include savoury-type meals with cereals (such as pasta with courgette and tomato) or pseudo-cereal (such as butternut squash, quinoa, and carrot). - Exclude meat or fish. -Include vegetable-based foods containing cheese (cheese is not declared in the product name).
2.5 Pureed meal with cheese (but no meat or fish) mentioned in the name	-Include pureed meals containing cheese, vegetables, starchy carbohydrates, where cheese is mentioned in the name (such as "Cheesy pasta with tomato and vegetables" or "Cauliflower cheese" or "Macaroni cheese"). -Exclude meat or fish.
2.6 Pureed meal with meat or fish mentioned as the first food in the product name.	-A pureed meal containing fish or meat in addition to vegetables and starchy carbohydrates. May contain other ingredients. -Include products that declare fish or meat as the first food in the product name, for example, "Tasty fish pie" or "Salmon and pea risotto" or "Chicken and potato pie" or "Hearty beef hotpot".
2.7 Pureed meals with meat or fish (but not named as the first food in the product name)	-Include puree meal containing fish or meat, vegetables, and starchy carbohydrates (fish/meat protein source is not listed as the first food in the product name (such as "Hearty shepherd's pie", "Cottage pie" or "Carrot, potato and lamb hotpot"). -May contain other ingredients.
2.8 Purees with only meat, fish, or cheese in the name.	- Include pureed meat, fish, or cheese products where they are the only food listed in the product name and constitute the single largest.
3. Dry finger food/snacks	
3.1 Confectionery, sweet spreads, and fruit chews.	-Include confectionery such as chocolate and other products containing cocoa; white chocolate; boiled sweets and jelly sweets; bubble gum and chewing gum; liquorice sweets; caramels; marzipan; sweetened or "yoghurt"-coated fruit and others

	- Include sweet spreads such as spreadable chocolate and sweet sandwich/toast toppings such as marmalade, jam, honey, sweet nut spreads and others. -Include fruit chews such as dried and processed fruit products (fruit gums, bars, or fruit strips/leathers/roll-ups for example, a dense, chewy food made up from fruit juice and dehydrated/dried fruit), including fruit pieces coated in sugar or oils/fats (such as banana chips, yoghurt raisins or, sweetened cranberries).
3.2 Fruit (fresh or dry whole fruit or pieces).	- Includes fresh whole or peeled fruit and dried fruit. - Includes foods such as savoury biscuits and pretzels, baked chips/crisps (such as potato, grains, and starchy food), rice cakes coated in powdered fruit or vegetables, cereal bars.
3.3 Other snacks and finger foods.	-Includes any rusks/teething biscuits, sweet, fried, dried, baked, or dehydrated food intended to be eaten between meals, -Includes sweet pastries, sponge cakes croissants, cookies/biscuits, sweet buns wafers, fruit pies, chocolate-covered biscuits, cake mixes and batters; cereal/energy bars (such as cereal/ granola or muesli bars); and crisps/puff products made from fruit, vegetables or starchy foods (which may be coated in fat/oil) strawberries, raisins, dry apricots, prunes).
4. Juices/other drinks	
4.2 Cow's milk and milk alternatives with added sugar or sweetening agent.	-Include whole cow's milk and milk replacement including soy, almond, or oat milk with added sugar or sweetening agent. -Exclude other products that function as breast-milk substitutes.

Adapted from WHO (2019). Ending inappropriate promotion of commercially available commercial food for infants and young children between 6 and 36 months in Europe.

3.5.2.3 Recommended Age

Recommended age was recorded according to the recommended age information displayed on the packaging. The maximum age, not more than 36 months,

and the minimum age not less than 6 months. The information was recorded in the codebook if the product has stated any recommended age from 4 to 12 months or beyond. Recommended age can be defined as a suitable age for the introduction of commercial complementary food to infants. According to WHO, recommended age must be included on commercially produced complementary foods packaging. Recommended ages for consumption were divided into three stages: stage 1 (4-6 months), stage 2 (7-9 months) and stage 3 (10-12 months).

3.5.2.4 Nutrition Facts

Nutrition labelling or nutrition facts is information provided for the customer about the nutritional properties of food products (Food and Agricultural Organization, 1985). According to Food Regulation 1985, there are several types of foods that require mandatory nutrition labelling which are prepared cereal food and bread, milk product, flour confection, canned meat, fish and vegetable, canned fruit and fruit juices, salad dressing and mayonnaise, and soft drinks. Nutrition facts consist of a listing of nutrients on the food label. Nutrients that must be declared on nutritional facts are energy, protein, carbohydrate, and fat. Energy value has to be expressed as kcal (kilocalories) per 100g/100ml of the food or per package if the package contains only a single portion and be given energy value for each serving of food. Carbohydrate, protein, and fat value should be expressed as gram per 100 gram/100ml of the food or per package if it contains only a single portion, and the value should be given for each serving of food. Other nutrients that can be included are minerals, vitamins, dietary fibre, sodium, cholesterol, and fatty acids. This regulation provided in Food Regulation 1985 is applicable for general food products, however, it may not be suitable for infants and young children food products. The recommended number of macronutrients and micronutrients content in commercial complementary foods has

been provided by WHO in a discussion paper "Ending inappropriate promotion of commercially available complementary foods for infants and young children between 6 and 36 months in Europe" (WHO, 2019). The information from nutrition facts collected in this study was compared with the recommended number of macronutrients and micronutrients provided by WHO. The guidelines are summarised in Table 3.5.3

3.5.2.5 Sodium Content

According to Food Regulation 1985, sodium content in nutrition facts must be labelled in milligram (mg). WHO recommendation for the maximum acceptable amount for sodium should be low in infants and young children's foods below 36 months, which is 50mg/100 kcal and 50mg/100g for all foods except cheese purees and meals. The maximum amount of sodium for cheese purees and meals is 100mg/100kcal and 100mg/100g per product (WHO, 2019). Sodium content in nutrition facts of commercial complementary food products collected in the study was recorded and compared in milligram (mg) with recommended sodium content in WHO guidelines. Any products that exceeded the sodium content recommended by WHO were considered as high sodium content in this study.

3.5.2.6 Sugar Content

According to Food Regulation 1985, the amount of total sugar is not compulsory to be stated in nutrition facts. Some food products displayed the amount of sugar in the form of a percentage of total energy. Based on the WHO guidelines, the recommended intake of energy from total sugar is different according to the product types of commercial complementary food. For example, dry cereals and fruit/vegetable purees (30%), dairy-based (40%), vegetable purees with cereals or milk (20%), and savoury and meal-type foods (20%) (WHO, 2019). The information on sugar content included the total sugar per total energy in gram (g) from nutrition facts

of commercial complementary food products. They were recorded and compared with the recommended amount in the guidelines. The total sugar exceeded the specified limits and were considered as high sugar content.

3.5.2.7 Food Additives

Food additives included in this study were food preservatives, colourants, flavouring, sweetening agents and added sugar. Food preservatives, colourants, and flavouring consisted of artificial and natural sources. Previous studies showed that some artificial preservatives and colourants may result in several health consequences. In addition, sweetening agents were also included in this study because of the prohibition of these substances in commercial complementary food products (WHO, 2019). Examples of sweetening agents were saccharin, acesulfame, sucralose, aspartame, and stevia.

3.5.2.8 Composition claims

According to WHO, compositional, nutritional, and health claims are prohibited for commercial complementary foods. Compositional claims are not permitted to prevent misleading information that indicates that commercial complementary foods are nutritionally superior compared to home-prepared food (WHO, 2019). Any commercial complementary food products collected in this study that contain any of the compositional claims, as mentioned in Table 5 were considered as disregarding the guidelines.

Table 5. Examples and permissible statements for composition claims of commercial complementary food.

	Examples of claims that would not be permitted[1]	**Permissible Statement[2]**
Composition claims	No added preservatives, no added seasoning, organic food, no added colouring agents, dairy-free, no added condiments, fresh, natural, gluten-free, contains vegetables, no food additives, no allergens, no maltodextrin or modified starch, non-GMO food, whole grain, contains meat, no added artificial flavour.	-Statements relating to common allergens (such as gluten-free/ contains gluten, dairy/lactose-free, contains dairy/lactose and nut-free/contains nuts). -Statements relating to religious or cultural food requirements (such as meat-free/vegetarian/contains meat, Kosher and Halal) -Descriptive words are included within the ingredient list (such as whole grain wheat flour and organic carrots).

Adapted from,

1. Koo, Y. C., Chang, J. S., & Chen, Y. C. (2018). Food claims and nutrition facts of commercial infant foods. *PLoS One*, *13*(2), e0191982.

2. WHO (2019). Ending inappropriate promotion of commercially available complementary foods for infants and young children between 6 and 36 months in Europe.

3.5.2.7 Added sugar

Regulation on added sugar in commercial complementary foods is available for cereal-based products as mentioned in Codex Standard for Processed Cereal-Based Food for Infants and Young Children (CODEX Alimentarius, 1981). Added sugars listed in the regulation were fructose, sucrose, glucose, glucose syrup or honey. The maximum amount of added carbohydrate derived from the added sugar listed is 1.8g/100kJ equivalent to (7.5/100 kcal). Additionally, the maximum amount of added fructose is 0.6g/100kJ equivalent to (2.5g/100kcal). Added sugars that were included in this study were syrups, sugars, honey, sucrose, glucose, dextrose, fructose, chocolate, fruit juice concentrate and vegetable concentrate. Based on the Nutrient

Profile Model (NPM) suggested by WHO, added sugar should not be included in commercial complementary food products for young children less than 36 months. For example, fruit juice or fruit juice concentrate is not permitted to include in these products, however, it is allowed to include fruit juice such as lemon juice as preservatives. In addition, the inclusion of added sugar during the complementary feeding period is not suggested by ESPGHAN (Fewtrell et al., 2017).

3.5.3 Statistical Analysis

Statistical analysis was conducted through SPSS Statistics version 25 and Microsoft Office Excel version 2016. Results are presented as frequencies (n), percentages (%), or the mean and standard deviation (SD) for commercial complementary foods products, nutrient content (calories, protein, total fat, carbohydrate, sugar, and sodium), composition claims and food additives. Pearson's Chi-Square test was used to examine the association between composition claims and high sugar or high sodium content. One way ANOVA test was used to compare the mean for calories, protein, total fat, carbohydrate, sugar, and sodium per 100g by product category.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Product distribution

The primary aim of this study was to assess nutrition facts and composition claims of commercial complementary food (CCF) according to the products category. There were 250 CCF products included in the study which were presented in Table 6. These products were categorized into three main categories in which dry cereals were 63 (25.2%) products, simple purees were 86 (34.4%) products and finger foods were 101 (40.4%) products. There were further categories of different types of products, for example, simple purees were categorised into fruit puree with/without vegetables were 62 (72.1%), vegetable puree was 8 (9.3%), dairy with/without fruit was 7 (18.6%), whereas finger foods were categorised into savoury, rusk, teething/ others were 94 (93.1%) and sweet finger foods were 7 (6.9%).

Table 6. Categories and types of products (n=250).

Product Categories	***N* (%)**
Dry cereals	63 (100.0)
Cereal, dry/ instant	63 (100.0)
Simple purees	86 (100.0)
Fruit puree with/without vegetables	62 (72.1)
Vegetable puree	8 (9.3)
Dairy with/without fruit	16 (18.6)
Finger foods	101 (100.0)
Savoury, rusk, teething/others	94 (93.1)
Sweet finger food	7 (6.9)

The information of the samples was photographed (Figure 4 – Figure 6) and recorded from six different supermarkets in Johor Bahru which were 164 (65.6%)

products from Village Grocer, 18 (7.2%) products from Hero Market, 7 (2.8%) products from Maslee, 19 (7.6%) products from Aeon and 42 (16.8%) products from Jaya Grocer as presented in Table 7. The recommended age of the products was divided into three stages. Among all the products, only 213 products stated the recommended age on the packaging. The number of products for Stage 1 was 115 (54.0%), Stage 2 were 53 (24.9%) and Stage 3 were 45 (21.1%). The number of products that had high sugar was smaller which was 8 (3.8%) as compared with low sugar products which were 203 (96.2%). Furthermore, the number of products that had high sodium was 88 (37.6%) and low sodium was 146 (62.4%). Most of the products which were 156 (62.4%) contain food additives and composition claims which were 212 (84.8%). Almost half of the products which were 113 (45.2%) products contain added sugar.

Figure 4. Example of dry cereal and nutrition facts

Figure 5. Example of simple puree and nutrition facts.

Figure 6. Example of finger food and nutrition facts.

Table 7. Distribution of CCF products according to product categories[1]

	***N* (%)**	**Dry cereals**	**Simple purees**	**Finger foods**	**χ^2**	**P-value**
Total	250 (100.0)	63 (25.2)	86 (34.4)	101 (40.4)		
Store*	250 (100.0)				18.25	0.013
Village Grocer	164 (65.6)	42 (25.6)	53 (32.3)	69 (42.1)		
Hero Market	18 (7.2)	3 (16.7)	11 (61.1)	4 (22.2)		
Maslee	7 (2.8)	0 (0.0)	0 (0.0)	7 (100.0)		
Aeon	19 (7.6)	8 (42.1)	4 (21.1)	7 (36.8)		
Jaya Grocer	42 (16.8)	10 (23.8)	18 (42.9)	14 (33.3)		
Stage[2]	213 (85.2)				37.77	<0.001
1	115 (54.0)	28 (24.3)	51 (44.3)	36 (38.7)		
2	53 (24.9)	21 (39.6)	9 (17.0)	23 (43.4)		
3	45 (21.1)	7 (15.6)	4 (8.9)	34 (75.6)		
Sugar Level[a]	211 (84.4)				11.43	<0.001
High Sugar	8 (3.8)	0 (0.0)	0 (0.0)	8 (100.0)		
Low Sugar	203 (96.2)	44 (21.7)	86 (42.4)	73 (36.0)		
Sodium Level	234 (93.6)				18.78	<0.001
High Sodium	88 (37.6)	20 (22.7)	20 (22.7)	48 (54.5)		
Low Sodium	146 (62.4)	40 (27.4)	66 (45.2)	40 (27.4)		
Contain additives	156 (62.4)	32 (20.5)	51 (32.7)	73 (46.8)	8.17	0.017
Contain added sugar	113 (45.2)	20 (17.7)	13 (11.5)	80 (70.8)	83.19	<0.001
Include composition claims	212 (84.8)	48 (22.6)	76 (35.8)	88 (41.5)	4.90	0.086

[1]Chi-square test and Fisher's Exact Test used for product categories.

[2] Recommended ages for consumption: stage 1 (4-6 months), stage 2 (7-9 months) and stage 3 (10-12 months)

[a] Fisher's Exact test used.

- The recommended sugar level: dry cereals are <30%, simple purees are <30% (except dairy

with/without food is 40%); finger food is <15% from total calories.
-The recommended sodium level is <50mg/100 kcal or <50mg/100g for all categories

Commercial complementary foods (CCFs) that comply with dietary recommendations and regulations are considered suitable sources of nutrition for infants and young children. This study, however, demonstrated that there were 213 (85.2%) products that include recommended age and the other 37 (14.8%) products that did not include recommended age on the packaging which had inappropriate age usage among the infants. According to WHO (2019) in "Ending Inappropriate Promotion of Commercially Available Complementary Foods", the appropriate age of introduction must be stated on the packaging. It is important to consume products according to children's age to ensure the texture and nutrients in the food is suitable for infants. There were 115 (54.0%) CCF products available for 4-6 months infants (Stage 1), however, early introduction to CCF products may not be suitable for exposure because they had a sweet taste which seldom includes bitter vegetables or single food flavours (WHO, 2019). Similar to most countries, marketing regulation on infant products in Malaysia was only available for infant formula through the "Code of Ethics for the Marketing of Infants Food and Related Products" and there is lacking marketing regulation for CCF products in this country. Therefore, there is a need to develop and implement marketing regulations for CCF products to avoid the potential of replacing breast milk due to the early initiation of complementary food.

4.2 Nutrition facts of different product categories and product types

Table 8 shows the mean and standard deviation for nutrition facts across the product categories. There was a statistically significant difference in calories between product categories as determined by one-way ANOVA ($F(2,247) = 743.88$, $p < 0.001$). A Scheffe post hoc test revealed that the calories (kcal) per 100g for finger foods (403.10kcal ± 45.35kcal) was statistically higher than dry cereals (367.30kcal ± 76.37kcal) and simple purees (80.80kcal

± 62.57kcal). For protein content, it was found to be a statistically significant difference ($F(2,247) = 118.81$, $p < 0.001$) in which dry cereals (10.36g±4.06g) was statistically higher than simple purees (1.39g±2.35) and finger foods (7.40g±4.31g). Total fat was significantly different by product categories ($F(2,247) = 23.53$, $p<0.001$), as finger foods showed the significantly higher than others (6.27g±7.16g, $p<0.001$) and simple purees showed significantly lower than others (1.16g ± 2.00g, $p < 0.001$), while no significant difference of fat within dry cereals (4.50g ± 3.96g, $p > 0.05$). The content of carbohydrates showed a significant difference among the product categories ($F(2,247) = 489.09$, $p < 0.001$), which finger food was statistically higher (77.44g±15.30g) than dry cereals (71.34g±18.02g) and simple purees (14.74g±10.12g). In addition, total sugar between product categories showed a significant difference ($F(2,211) = 9.13$, $p < 0.001$) specifically when finger foods were statistically higher (13.95g±12.83g) compared to dry cereals (6.51g±8.89g). Finally, sodium content also showed a significant difference ($F(2,231) = 22.59$, $p < 0.001$) between all product categories in which finger foods was statistically higher in sodium (145.92mg±145.85mg) compared to dry cereals (89.48mg±120.07mg) and simple purees (31.72mg± 48.44mg). Finger foods were also found to be high in calories, total fat, carbohydrate, total sugar, and sodium content based on a study conducted in Taiwan (Koo et al., 2018). Other studies conducted in the United Kingdom, Denmark and Spain found a similar result for calorie content in which snacks and dry cereals had higher calories than other categories (WHO, 2019). A recent study conducted in Australia showed a similar result for finger foods as they were the highest energy-dense food compared to other categories (Moumin et al., 2020).

Table 8. Mean and standard deviation for nutrient facts (calories, protein, total fat, carbohydrate, sugar, and sodium) per 100g by product categories (n=250).

Variables	Dry cereals (n=82)	Simple Purees (n=84)	Finger foods (n=84)	F value	P-value
Calories (kcal)	367.30±76.37[a]	80.80± 62.57[b]	403.10± 45.35[c]	743.88	<0.001
Protein (g/100g)	10.36± 4.06[a]	1.39± 2.35[b]	7.40± 4.31[c]	118.81	<0.001
Total fat (g/100g)	4.50± 3.96[a]	1.16± 2.00[a]	6.27± 7.16[b]	23.53	<0.001
Carbohydrate (g/100g)	71.34 ± 18.02[a]	14.74± 10.12[b]	77.44± 15.30[c]	489.09	<0.001
Total sugar (g/100g)[2]	6.51± 8.89[c]	10.64± 4.53	13.95± 12.83[c]	9.13	<0.001
Sodium content (mg/100g)[3]	89.48± 120.07[a]	31.72± 48.44[b]	145.92± 145.85[c]	22.59	<0.001

[1]One way ANOVA, with Scheffe's test and reported mean ± SD and F value
[2]Only 214 products with total sugar content are accounted for in this table
[3]Only 234 products with sodium content data are accounted for in this table.
-The recommended sugar level: dry cereals are <30%, simple purees are <30% (except dairy with/without food is 40%); finger food is <15% from total calories.
-The recommended sodium level is <50mg/100 kcal or <50mg/100g for all categories.
[a] Significant difference between dry cereals and simple purees, [b] Simple purees and finger foods, [c] Dry cereals and finger foods

Table 9 shows the mean and standard deviation for nutrition facts across the product types using one-way ANOVA. There were significantly difference in calories (F (2,247) = 316.102, p <0.001), protein (F (2,247) = 53.87, p <0.001), total fat (F (2,247) = 10.74, p <0.001), carbohydrate (F (2,247) = 198.13 p <0.001), total sugar (F (2,247) = 12.31, p <0.001) and (F (2,247) = 10.57, p <0.001). Post-hoc Scheffe test showed sweet finger foods were statistically the highest in calories (430.74kcal±32.80kcal), protein (12.64g±7.84g), total fat (8.00g±9.26g), total sugar (32.91g±22.84g) and sodium (246.49mg±134.51mg) except for carbohydrate which the highest among savoury, rusk, teething/other finger foods (77.94g±15.70g). This result is consistent with a study in Taiwan which found infant cookies had the highest mean for calorie, carbohydrate, protein, total fat, total sugar, and sodium (Koo et al., 2018). Another study conducted in Australia found that almost consistent results where savoury and sweet finger foods had higher calories compared to other categories. Savoury

finger foods were also found to be excess in the amount of sodium which was contrary to this study (Moumin et al., 2020). In the United Kingdom, Denmark and Spain, the savoury snacks were also found to have excess sodium levels that exceed 50 mg/100 kcal (WHO, 2019).

Table 9. Mean and standard deviation for nutrient facts (calories, protein, total fat, carbohydrate, sugar, and sodium) per 100g by product types (n=250).

Variables	Cereal, dry/instant (n=63)	Fruit puree with/without vegetables (n=62)	Vegetable puree (n=8)	Dairy with/ without fruit (n=16)	Savoury, rusk, teething/ other finger foods (n=94)	Sweet finger foods (n=7)	F value	P-value
Calories (kcal)	367.30 ± 76.37[b-e]	72.42 ± 43.71[a, d-f]	49.82 ± 23.36 [a, e, f]	128.81 ± 104.40 [a-f]	401.04 ± 45.61[a-e]	430.74± 32.80[b-d]	316.10	<0.001
Protein (g/100g)	10.36 ± 4.0[b-e]	1.12 ± 2.57 [a, e, f]	1.64 ± 0.89 [a, e, f]	2.33 ± 1.72 [a, e, f]	7.01 ± 3.71[a-f]	12.64 ± 7.84[b-e]	53.87	<0.001
Total fat (g/100g)	4.50 ± 3.96[b]	0.53 ± 0.98 [a, e, f]	0.85 ± 1.03	3.77 ± 3.03	6.14 ± 7.03[b]	8.00 ± 9.26[b]	10.75	<0.001
Carbohydrate (g/100g)	71.34 ± 18.02[b-d]	14.21 ± 7.18 [a, e, f]	8.91 ± 4.28 [a, e, f]	19.72 ± 17.78 [a, e, f]	77.94 ± 15.70[b-d]	70.67 ± 4.88[b-d]	198.13	<0.001
Total sugar (g/100g)[2]	6.51 ± 8.89 [e, f]	11.38 ± 3.78[f]	4.94 ± 3.29[f]	10.59 ± 5.80[f]	12.23 ± 10.12 [a, d]	32.91 ± 22.84[a-e]	12.31	<0.001
Sodium (mg/100g)[3]	89.48 ± 120.07[f]	25.83 ± 45.86 [e,f]	40.13 ± 38.03[f]	50.26 ± 59.32[f]	137.23 ± 144.27[b]	246.49 ± 134.51[a-d]	10.57	<0.001

[1]OneWay ANOVA, with Scheffe's test and reported mean ± SD and F value.
[2]Only 214 products with total sugar content are accounted for in this table.
[3]Only 234 products with sodium content data are accounted for in this table.
[a] Significance difference with cereal, dry/instant. [b] Significance difference with fruit puree with/without vegetables. [c] Significance difference with vegetable puree. [d] Significance difference with dairy with/without fruit. [e] Significance difference with savoury, rusk, teething/ other finger food. [f] Significance difference with sweet finger food.
-The recommended sugar level according to product types: cereals, dry/instant (<30%) fruit puree with/without vegetables and vegetable purees (<30%); dairy with/without fruit (<40%), finger food (<15%) from total calories.
-The recommended sodium level is <50mg/100 kcal or <50mg/100g for all categories

According to WHO complementary feeding guidelines, infants aged 6-8 months require 67-100 kcal per meal whereas infants aged 9-11 months require 75-100 kcal per meal through complementary food. The mean calories for dry cereals and finger foods of CCF found in the study have exceeded the recommended intake per meal by WHO. The previous study in the United Kingdom and Denmark found most (70%) of savoury finger foods and half (50%) of sweet snacks exceeds the recommended energy for dry products by WHO Codex CAC/GL 8-1991 guidelines (WHO, 2019) Excessive consumption of CCF products more than the recommended serving size on the packaging may lead to excessive intake of calories from complementary food among infants. Infants that have excess energy density from complementary food and excess feeding frequency have the potential to displace breast milk intake (Tzioumis, Kay, Wright, & Adair, 2015). In addition, WHO indicated that CCFs promotion affected optimal feeding practices, with some evidence of movement away from exclusive breastfeeding for up to 6 months and indications of a reduction in duration of breastfeeding (Smith et. al, 2015). Apart from excessive calories and energy density, the minimum energy density in CCFs shall be addressed to provide an optimum nutrient needed by the infants. A recommendation from WHO (2019) suggests that the minimum calories for soft-wet spoonable foods are 60 kcal/100g and it should not consist of water or very low-energy foods. Soft-wet spoonable foods or infant's puree inside pouch packaging usually adds water to allow the foods to flow smoothly. The addition of water will lessen the nutrient density, which indicates a larger amount of food must be eaten to get the same amount of nutrients (Crawley & Westland, 2017). The result from this study showed that only vegetable puree had low calories as suggested by WHO which was 49.82 kcal/100g. Because these products are less energy-dense than breast milk, they may not offer enough energy for infants under the age of 12 months if they are their sole source of solid food. Hence, it is recommended for the manufacturers to state the proportion of ingredients (including water) on the CCFs product's

packaging to avoid misleading information among the parents. Additionally, it is suggested for the manufacturers to ensure the product's energy density is sufficient for consumption among infants. Alternatively, adding proper serving size with calories contribution would be optimal to guide parents in feeding the amount and frequency of the product according to their infant's age.

4.3 Sugar and sodium level versus product categories

Table 10 compares the sugar and sodium level between the product categories. There was a significant difference in sugar level between product categories ($P < 0.001$, Fisher's Exact test). Finger foods had a higher percentage of food products that contain high sugar (100.0%) and low sugar (90.1%) compared to other categories. A Chi-Square test performed showed significant association [$\chi^2(2,211) = 18.78$, $p < 0.001$] between sodium level and product categories where finger food had a high percentage of high sodium products (54.5%) whereas simple pureed had a high percentage of low sodium products (76.7%).

Table 10. Results of Chi-Square test and Fisher Exact test of product categories and sugar level (n=211) and sodium level (n=234).

Variables	N (%)	Dry cereals (n=56)	Simple purees (n=84)	Finger foods (n=71)	χ^2	P-value
Sugar Level	211 (84.4)				11.43	<0.001[a]
High Sugar	8 (3.8)	0 (0.0)	0 (0.0)	8 (100.0)		
Low Sugar	203 (96.2)	44 (21.7)	86 (42.4)	73 (36.0)		
Sodium Level	234 (93.6)				18.78	<0.001
High Sodium	88 (37.6)	20 (22.7)	20 (22.7)	48 (54.5)		
Low Sodium	146 (62.4)	40 (27.4)	66 (45.2)	40 (27.4)		

-The recommended sugar level: dry cereals are <30%, simple purees are <30% (except dairy with/without food is 40%); finger food is <15% from total calories.
- The recommended sodium level is <50mg/100 kcal or <50mg/100g for all categories.
[a]Fisher Exact test used.

According to the European Commission directive, there were no regulations relating to total sugar in CCF products, however, it does regulate total carbohydrate content in specific CCF products such as cereal products. WHO (2019) through "Ending inappropriate promotion of CACFs for infants and young children" proposed the total-sugar thresholds for different CCF product types as the previous regulation

for CCF products were said to be too lenient. Any CCF products that exceed the percentage of the total sugar threshold are required to display the percentage of total energy from sugar on the product packaging. In this study, the total sugar threshold is used to categorize the CCF products into low sugar or high sugar. As shown in Table 4.3.1, only 8 CCF products exceed the total sugar threshold, which was lower than the expected result where a high number of CCF products contain high sugar.

Table 11 shows a Mann-Whitney test indicating that the low sugar products (n=203) had a larger mean rank (1470.00) than high sugar products (n=8) with a mean rank (20896.00). A statistically significant difference was found (U=190.00, $p < 0.001$) between high sugar and low sugar products. There was a consistent result with sodium level where a statistically significant difference was found (U=3366.00, $p < 0.001$) between high sodium and low sodium products. Low sodium products (n=139) had a larger mean rank (13096.00) than high sodium products (n=73) with a mean rank (9842.00).

Table 11. Results of Mann-Whitney test to examine the mean difference of sugar content with sugar level (n=211), sodium level (n=234).

Variables	***N (%)***	**Rank Average**	**Rank Total**	**U**	**P-value**
Sugar Level	211			190.00	<0.001*
High Sugar	8	183.75	1470.00		
Low Sugar	203	102.94	20896.00		
Sodium Level	234			3366.00	<0.001*
High Sodium	73	129.89	9842.00		
Low Sodium	139	94.22	13096.00		

*Significant difference at 0.05

The difference in the total sugar threshold used in this study affects the frequency of CCF products that are high in sugar in the market to be lesser than in

previous studies. For example, a previous study on total sugar in CCF products conducted in the US (Cogswell et al., 2015) showed that 35 products were high in sugar where the study limits less than 35% calories from sugar. Another study in Taiwan (Koo et al., 2018) showed more than 50% of CCF products were high in sugar where the study limits less than 10% total sugar per 100g. High sugar content in CCF products. Aside from the total sugar threshold, WHO also proposes the sodium content threshold for CCF products in which it is required to be less than 50mg/100 kcal except for products that contain cheese. The amount of sodium content threshold proposed by WHO is lower compared to other previous studies conducted in the US and Taiwan. The result of this study which follows the suggestion by WHO revealed that 37.6% of CCF products had high sodium content. This is contrary to a study conducted in the US where 72% of CCF products had high sodium content (contain more than 210 mg of sodium per eating occasion). Nevertheless, a similar study in Taiwan showed consistent results where 40% of CCF products had high sodium content (contain more than 130 mg per 100g).

4.4 Sugar and sodium level versus composition claims

As shown in Table 11, 88.2% of low sugar products include composition claims whereas only 87.5% of high sugar products include composition claims. There was no significant association observed between composition claims and sugar level (p = 1.00, Fisher's Exact test). No significant association was also observed between composition claims with sodium level [$\chi^2(1,234) = 0.85$, p = 0.461] where a higher percentage of low sodium products (62.0%) include composition claims compared to high sodium products (38.0%).

As shown in Table 12, there was no association between composition claims and products that had high sugar (p=1.00) or sodium (p=1.461). The percentage of high sodium products that include composition claims was 38.0% whereas high sugar products were 3.8% only. The result was contrary to the previous study from Taiwan when there was an association between high sodium product and health claim (p <0.001) and high sugar product and health claim (p=0.002)(Koo et al., 2018). Furthermore, more than 30% of products that include health claims were found to have high sodium whereas 46.6% of products that include health claims were high in sugar. Other significant findings from the study also found CCF products that include "no added sugar" claim which was 72.9% of products that had high sugar levels. The result from a study in Taiwan was also consistent with one study in the US which reported that among 70% of products with a nutritional content claim, 58.6% of them were excessive in sugar and sodium (Colby et al., 2010). There is a regulation issued by the Codex Alimentarius Commission (CAC) which is to not permit the inclusion of nutrition and health claims for toddlers younger than 3 years old food products unless there is permission by relevant Codex standards or national legislation. It is important to ensure the enforcement of this regulation to avoid any misconception among parents regarding the actual nutrient content and the food claims of the products.

Table 12. Results of Chi-Square test and Fisher Exact test of composition claims and sugar level (n=211) and sodium level.

Variable	*N* (%)	Include composition claims N (%)		χ^2	P
		Yes	No		
Sugar level	211 (84.4)				1.00[a]
High sugar		7(87.5)	1(12.5)		
Low sugar		179 (88.2)	24(11.8)		
Sodium level	234 (93.6)			0.85	0.461
High sodium		76 (86.4)	12 (13.6)		
Low sodium		124 (84.9)	22 (15.1)		

[a] Fisher Exact test was used.
-The recommended sugar level: dry cereals are <30%, simple purees are <30% (except dairy with/without food is 40%); finger food is <15% from total calories.
- The recommended sodium level is <50mg/100 kcal or <50mg/100g for all categories

Table 13 shows a result of the Mann-Whitney test in which no statistically significant difference was found (U=1827.50, p = 0.066) between products that include composition claims and products that did not include composition claims. Products that did not include composition claims (n=25) had a larger mean rank (128.90) than products that include composition claims (n=189) with mean rank (19782.50).

Table 13. Results of Mann-Whitney test to examine the mean difference products that include composition claims (n=214).

Variables	*N*	Rank Average	Rank Total	U	P-value
Include composition claims	214			1827.50	0.066
Yes	189	104.67	19782.50		
No	25	128.90	3222.50		

Table 14 revealed that 84.4% of CCF products had composition claims, such as "no added preservatives", "no added colouring agents", "no added artificial flavouring" and "no food additives". The result was consistent with a study in Taiwan where 88.2% of composition claims among CCF products consisted of 41.6% nutrition claims and 49.6% health claims (Koo et al., 2018). Composition claims were included as a marketing strategy as a previous study in Milan found that nutrition claims in CCF products tend to attract the attention of families with young children (Cavaliere et al., 2015). Some parents believe that products that include health claims and realistic pictures on packaging to be healthier (Abrams et al., 2015).

4.5 Food additives versus product categories and product types

Table 14 shows the percentages of products that contain food additives such as antioxidants (45.6%), conditioner (38.0%), colourants (1.2%) and flavourings (21.6%). Products that include colourants consist of natural colourants whereas flavourings consist of natural flavourings (n=34) and artificial colourings (n=20).

Table 14. Amount of food additives added in commercial complementary food products.

Variables	Contain food additives N (%)	
	Yes	No
Food additives		
Antioxidants	114 (45.6)	136 (54.4)
Conditioner	95 (38.0)	155 (62.0)
Colourants	3 (1.2)[1]	247 (98.8)
Flavourings	54 (21.6)[2]	196 (78.4)

[1]Contain natural colourants only.
[2]Consist of natural flavouring n=34 (13.6%) and artificial flavouring n=20 (8.0%)

Table 15 compares the presence of food additives and product categories. A chi-square test showed that finger foods were significantly higher in food additives which were 29.2% as compared with dry cereals (12.8%) and simple purees (20.4%). There was a significant association observed between food additives and product categories [$\chi^2(2,250) = 8.17$, $p = 0.017$].

Table 15. Results of chi-square between food additives and product categories (n=250.

Variable	Contain food additives *N* (%)		χ^2	P-value
	Yes	No		
Product category				
Dry cereal	32(12.8)	31 (12.4)	8.17	0.017
Simple purees	51 (20.4)	35 (14.0)		
Finger foods	73 (29.2)	28 (11.2)		

Table 15 compares the presence of food additives and product types. Savoury finger foods, rusk, teething/ others contain significantly higher products that contain food additives which were 26.4% compared to cereal, dry/instant (12.8%), fruit puree with/without vegetables (14.4%), vegetable puree (1.6%), dairy with/without fruit

(4.4%) and sweet finger food (2.8%). There was a significant association observed between food additives and product types ($p < 0.05$, Fisher's Exact test).

Table 16. Results of Fisher Exact test between food additives and product types (n=250).

Variable	Contain food additives *N* (%)		P-value
	Yes	No	
Product types			
Cereal, dry/instant	32 (12.8)	31 (12.4)	0.034
Fruit puree with/without vegetables	36 (14.4)	26 (10.4)	
Vegetable puree	4 (1.6)	4 (1.6)	
Dairy with/without fruit	11 (4.4)	5 (2.0)	
Savoury, rusk, teething/ others	66 (26.4)	28 (11.2)	
Sweet finger food	7 (2.8)	0 (0.0)	

As shown in Table 15 above, food additives such as antioxidants, conditioners, colourings, and flavourings are commonly added to food products. Most of the CCF products (62.4%) include food additives such as antioxidants to prevent the quality of its lipid components from deteriorating. (Shahidi, 2000). Aside from antioxidants, food colourants were included in 1.2% of CCF products in this study and only natural colourants were included. The usage of natural colourants has been proven to be reasonably safe to humans as compared to synthetic colourants which have significant toxicological effects (Okafor et al., 2016). In addition, flavouring compounds were found to be added in almost 22% of CCF products in this study in which 13.6% were natural flavouring and 8.0% were artificial flavouring. Flavouring compounds are included in processed foods and beverages to impart desirable organoleptic properties and to give the distinct flavour profile associated with certain foods (Munro, Kennepohl & Kroes, 1999).

4.6 Added sugar versus product categories and product types

Table 17 shows a comparison of added sugar between product categories by using a Chi-Square test. There were a significant association between added sugar and product categories [χ^2 (2,113) = 8.17, $p < 0.05$] where finger foods had a higher percentage of products that contain added sugar which was 32% compared to dry cereals which were 8.0% and simple purees which were 29.2%.

Table 17. Results of chi-square test of independence of association between added sugar and products categories (n=113).

Variables	Contain added sugar n (%)		χ^2	P-value
	Yes	No		
Product Categories				
Dry cereals	20 (8.0)	43 (17.2)	83.19	< 0.001
Simple Purees	13 (5.2)	73 (29.2)		
Finger foods	80 (32.0)	21 (8.4)		

Table 18 shows a comparison of added sugar between product types. There was a significant association between added sugar and product types [$p < 0.001$, Fisher's Exact test] were savoury, rusk, teething/others had a higher percentage of products that contain added sugar which was 29.2% compared to cereal, dry/instant (8.0%), fruit puree with/without vegetables (1.6 %), vegetable puree (0.0%), dairy with/without fruit (3.6%) and sweet finger food (2.8%).

Table 18.Results of Fisher Exact test between added sugar and product types (n=113).

Variables	Contain added sugar n (%)		χ^2	P-value
	Yes	No		
Product types				
Cereal, dry/instant	20 (8.0)	43 (17.2)	107.34	< 0.001
Fruit puree with/without vegetables	4 (1.6)	58 (23.3)		
Vegetable puree	0 (0.0)	8 (3.2)		
Dairy with/without fruit	9 (3.6)	7 (2.8)		
Savoury, rusk, teething/ others	73 (29.2)	21 (8.4)		
Sweet finger food	7 (2.8)	0 (0.0)		

Almost half of CCF products that are available in the market contain added sugar (all syrups, added fructose, chocolate, honey, fruit juice concentrates and vegetable concentrates) which were 45.2%. This finding was consistent in a survey conducted in Spanish in which 44% of products contained added sugar (WHO, 2019). Table 18 shows finger foods contain more added sugar than dry cereals and simple purees. This finding was contrary to a previous study conducted by Theurich, Koletzko and Grote (2020) which found that 32% of CCF products containing added sugar while milk-based porridge had significantly higher sweetened products ($p < 0.001$) when compared with breakfast cereal and grain porridges. There is a regulation for added sugar by Codex Alimentarius Commission (CAC) for processed cereal-based foods, however, there is still lacking other product categories (CODEX Alimentarius, 1981).

According to Codex (2019), if fructose, sucrose, glucose, glucose syrup or honey are added, the amount of added fructose should be less than 3.75g/100 kcal for cereal products eaten with milk or other nutritious liquid and 2.5g/100 kcal for cereal with added high protein food that can be eaten with water, milk, or other suitable liquids.

The inclusion of added sugar during the complementary feeding period is not suggested by ESPGHAN (Fewtrell et al., 2017) through a position paper on complementary feeding. In addition, WHO (2019) suggested that added sugar (syrups, honey, fruit juice and fruit juice concentrates) as well as sweetening agents (saccharin, acesulfame, sucralose, aspartame, and stevia) should not be added in CACFs for infants and young children aged 36 months and below. The presence of added sugar in infants and young children's food is a concern as they have innate preferences for sweet taste. Early exposure to sugary food only will enhance their preference for sweet food (Mennella, 2014). Children with high sugar intake have a higher risk of childhood overweight or obesity and dental caries (Moynihan et al., 2019).

CHAPTER 5

CONCLUSION, LIMITATIONS, RECOMMENDATION

5.1 Conclusion

This study aims to compare the nutrition facts and composition claims between different product categories available in a supermarket located in Johor Bahru. Based on a quantitative survey of the nutrition facts, it can be concluded that finger food products were found to be a higher proportion in the supermarket at Johor Bahru which was 40.4% than dry cereals which were 25.5% and simple purees which were 34.4%. In addition, most of the products which were 84.8% include composition claims. Among the three product categories, finger foods were found to have higher calories, sugar, and sodium levels than dry cereals and simple purees.

Although 96.2% of CCF products available in Malaysia's supermarket had acceptable sugar content, 37.6% had high sodium content. Finger foods had a higher percentage of products that contain high sugar which was 54.5% compared to dry cereals and simple purees which were 33.3%. This study also showed that the number of CCF products that include added sugars was 45.2% and among the product categories, finger foods had a high number of products that have added sugar which was 32.0%. There was no association found between the inclusion of composition and sugar or sodium levels as the previous study found most products that include composition claims had higher sugar and sodium levels. In contrast, an association was found between food additives and product categories in which 29.2 % of finger foods had a higher amount of food additives than 12.3% for dry cereals and 20.4% for simple purees.

The result from this study gives the information about the nutrient content and composition claims of CCF products whether it is appropriate for the infants. The results obtained from this study can be used as baseline data for future studies on CCF products in Malaysia because this is the first study conducted in Malaysia focusing on CCF products. The samples were collected from six different supermarkets around Johor Bahru because they have a variety of CCF products and are easily accessed by the customers. Due to the variation of CCF products, this study comprised different product categories as samples to ensure most of the CCF products that are available in the market can be included in this study.

5.2 Limitations

This study, however, is subject to several limitations. The first limitation is that not all CCF products in Malaysia were included despite the step taken to include as many CCF products in the market by including six different supermarkets around Johor Bahru, there is a possibility that some of the products were missed. The CCF products that were not included in this study were cheese meal puree, fish meal puree, meat meal puree and fruit juices/drinks. These products were not included as they were less available in Malaysia and more common in Western countries. Secondly, this study only evaluated the nutrient content from food labels, hence a laboratory analysis would provide more accurate nutrient content in CCF products. Thirdly, some CCF products lacked information on total sugar level and sodium content because it is not compulsory to state total sugar and sodium content in Malaysia. Lastly, this study only included composition claims but not included health claims.

5.3 Recommendations

To better understand the nutrient content of CCF products that are available in Malaysia, future studies can include the micronutrients content for example iron,

calcium as they are essential in infant and young children's food. Based on the Southeast Asian Nutrition Surveys (SEANUTS) in Malaysia found that 50% of children in both rural and urban settings, did not fulfil the Malaysian Recommended Nutrient Intake (RNI) for calcium and vitamin D. Also, less than 10% of children did not fulfil the RNI for vitamin A, vitamin C and iron (Poh et al., 2013) Next, future studies on CCF products shall be conducted in other states or rural parts of Malaysia to ensure all the products were included. This includes expanding the study sample collection to minimarket or local markets beyond the urban area. Furthermore, the association between health claims and nutrient content of CCFs products may also be included in the future study. Other recommendations include the education on food labelling that can be given to parents and caretakers by a health professional to raise the awareness on the importance of reviewing the nutrient content. Finally, it is important to ensure the establishment and enforcement of the regulation on CCF products in Malaysia as there was no available regulation on CCF products in this country.

REFERENCES

Abrams, K. M., Evans, C., & Duff, B. R. L. (2015). Ignorance is bliss. How parents of preschool children make sense of front-of-package visuals and claims on food. *Appetite*, *87*, 20–29. https://doi.org/10.1016/j.appet.2014.12.100

Agostoni, C., Decsi, T., Fewtrell, M., Goulet, O., Kolacek, S., Koletzko, B., Michaelsen, K. F., Moreno, L., Puntis, J., Rigo, J., Shamir, R., Szajewska, H., Turck, D., van Goudoever, J., & Ferreira, H. (2008). Complementary feeding: A commentary by the ESPGHAN committee on nutrition. *Nascer e Crescer*, *17*(2), 87–89.

Badham, J. (2013). Ensuring optimal breastfeeding and improvements in complementary feeding to improve infant and young child nutrition in developing countries. *Maternal and Child Nutrition*, *9*(SUPPL. 1), 1–5. https://doi.org/10.1111/mcn.12003

Beauchamp, G. K., & Moran, M. (1982). Dietary experience and sweet taste preference in human infants. *Appetite*, *3*(2), 139–152. https://doi.org/10.1016/S0195-6663(82)80007-X

Bong, M. W., Karim, N. A., & Noor, I. M. (2018). Nutritional status and complementary feeding among Penan infants and young children in rural Sarawak, Malaysia. *Malaysian Journal of Nutrition*, *24*(4), 539–550.

Canada Food Inspection Agency. (2013). Guide to Food Labeling and Advertising. *Guide to Food Labeling and Advertising*. http://www.inspection.gc.ca/english/fssa/labeti/guide/ch7ae.shtml#a7_18

Cavaliere, A., Ricci, E. C., & Banterle, A. (2015). Nutrition and health claims: Who is interested? An empirical analysis of consumer preferences in Italy. *Food Quality and Preference*, *41*, 44–51. https://doi.org/10.1016/j.foodqual.2014.11.002

Chen, Y. C., Chang, J. S., & Gong, Y. T. (2015). A content analysis of infant and toddler food advertisements in Taiwanese popular pregnancy and early parenting magazines. *Journal of Human Lactation*, *31*(3), 458–466. https://doi.org/10.1177/0890334415576513

CODEX. (1999). Codex general standard for the labelling of prepackaged foods. *CODEX STAN 1-1985, Revised 1-1991*, 1–7. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:GENERAL+STANDARD+FOR+THE+LABELLING+OF+PREPACKAGED+FOODS#0

CODEX Alimentarius. (1981a). *Codex standard for canned baby foods*. 1–6.

CODEX Alimentarius. (1981b). Codex Standard for Processed Cereal-Based Foods for Infants and Young Children. *CODEX STAN 074-1981, Rev.1-2006*.

CODEX Alimentarius. (1991). *Guidelines on formulated complementary foods for older infants and young children CAC/GL 8-1991*. 1–10.

CODEX Alimentarius. (1997). *Codex guideline for use of nutrition and health claims - CAC/GL 23-1997*. 1–8. http://www.fao.org/ag/humannutrition/32444-09f5545b8abe9a0c3baf01a4502ac36e4.pdf

Cogswell, M. E., Gunn, J. P., Yuan, K., Park, S., & Merritt, R. (2015). Sodium and sugar in complementary infant and toddler foods sold in the United States. *Pediatrics*, *135*(3), 416–423. https://doi.org/10.1542/peds.2014-3251

Colby, S. E., Johnson, L. A., Scheett, A., & Hoverson, B. (2010). Nutrition Marketing on Food Labels. *Journal of Nutrition Education and Behavior*, *42*(2), 92–98. https://doi.org/10.1016/j.jneb.2008.11.002

De Cosmi, V., Scaglioni, S., & Agostoni, C. (2017). Early taste experiences and later food choices. *Nutrients*, *9*(2), 1–9. https://doi.org/10.3390/nu9020107

Dewey, K. (2005). Guiding Principles for Feeding Non-Breastfed Children 6-24 Months of Age. *Children*, 40. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Guiding+principles+for+feeding+non-breastfed+children+6-24+months+of+age#0

Dreyfuss, M. L., Green, M., Agustino, Hadihardjono, D. N., Izwardy, D., & Huffman, S. L. (2019). Commercially produced complementary foods in Bandung City, Indonesia, are often reported to be iron fortified but with less than recommended amounts or suboptimal forms of iron. *Maternal and Child Nutrition*, *15*(S4), 1–10. https://doi.org/10.1111/mcn.12789

Elliott, C. D. (2011). Sweet and salty: Nutritional content and analysis of baby and

toddler foods. *Journal of Public Health*, *33*(1), 63–70. https://doi.org/10.1093/pubmed/fdq037

Erdfelder, E., FAul, F., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Fewtrell, M., Bronsky, J., Campoy, C., Domellöf, M., Embleton, N., Mis, N. F., Hojsak, I., Hulst, J. M., Indrio, F., Lapillonne, A., & Molgaard, C. (2017). Complementary feeding: A position paper by the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) committee on nutrition. *Journal of Pediatric Gastroenterology and Nutrition*, *64*(1), 119–132. https://doi.org/10.1097/MPG.0000000000001454

Food and Agricultural Organization. (1985). Guidelines on Nutrition Labelling. *Cac/Gl 2-1985*, *c*, 8. http://www.fao.org/ag/humannutrition/33309-01d4d1dd1abc825f0582d9e5a2eda4a74.pdf.

Hadihardjono, D. N., Izwardy, D., Green, M., Stormer, A., & Champeny, M. (2019). *Promotions of breastmilk substitutes , commercial complementary foods and commercial snack products commonly fed to young children are frequently found in points - of - sale in Bandung City , Indonesia*. *15*(October 2018), 1–13. https://doi.org/10.1111/mcn.12808

Harris, J. L., Thompson, J. M., Schwartz, M. B., & Brownell, K. D. (2011). Nutrition-related claims on children's cereals: What do they mean to parents and do they influence willingness to buy? *Public Health Nutrition*, *14*(12), 2207–2212. https://doi.org/10.1017/S1368980011001741

Hassan, H., Sade, A. B., & Rahman, M. S. (2013). Malaysian hypermarket retailing development and expansion. *International Journal of Retail and Distribution Management*, *41*(8), 584–595. https://doi.org/10.1108/IJRDM-09-2012-0085

Koo, Y., Chang, J., & Chen, Y. C. (2018). *Food claims and nutrition facts of commercial infant foods*. 1–13.

Mennella, J. A. (2014). Ontogeny of taste preferences: basic biology and implications for health.: ".Start Your Research" *The American Journal of Clinical*

Nutrition, *99*, 704–711. https://doi.org/10.3945/ajcn.113.067694.2

Mennella, J. A., & Ventura, A. K. (2011). Early feeding: Setting the stage for healthy eating habits. *Nestle Nutrition Workshop Series: Pediatric Program*, *68*, 153–168. https://doi.org/10.1159/000325783

Moumin, N. A., Green, T. J., Golley, R. K., & Netting, M. J. (2020). Are the Nutrient and Textural Properties of Australian Commercial Infant and Toddler Foods Consistent with Infant Feeding Advice? *British Journal of Nutrition*, 1–19. https://doi.org/10.1017/S0007114520001695

Moynihan, P., Tanner, L. M., Holmes, R. D., Hillier-Brown, F., Mashayekhi, A., Kelly, S. A. M., & Craig, D. (2019). Systematic Review of Evidence Pertaining to Factors That Modify Risk of Early Childhood Caries. *JDR Clinical and Translational Research*, *4*(3), 202–216. https://doi.org/10.1177/2380084418824262

National Health and Morbidity Survey. (2006). *NHMS 2006.pdf*.

Nicklaus, S. (2011). Children's acceptance of new foods at weaning. Role of practices of weaning and of food sensory properties. *Appetite*, *57*(3), 812–815. https://doi.org/10.1016/j.appet.2011.05.321

Okafor, S. N., Obonga, W., & Ezeokonkwo, M. A. (2016). Assessment of the Health implications of Synthetic and Natural Food Colourants – A Critical Review. *UK Journal of Pharmaceutical Biosciences*, *4*(4), 1. https://doi.org/10.20510/ukjpb/4/i4/110639

Padarath, S., Gerritsen, S., & Mackay, S. (2020). Nutritional aspects of commercially available complementary foods in New Zealand supermarkets. *Nutrients*, *12*(10), 1–13. https://doi.org/10.3390/nu12102980

Poh, B. K., Ng, B. K., Siti Haslinda, M. D., Nik Shanita, S., Wong, J. E., Budin, S. B., Ruzita, A. T., Ng, L. O., Khouw, I., & Norimah, A. K. (2013). Nutritional status and dietary intakes of children aged 6 months to 12 years: Findings of the Nutrition Survey of Malaysian Children (SEANUTS Malaysia). *British Journal of Nutrition*, *110*(SUPPL.3). https://doi.org/10.1017/S0007114513002092

Pries, A. M., Huffman, S. L., Adhikary, I., Upreti, S. R., Dhungel, S., Champeny, M.,

& Zehner, E. (2016). High consumption of commercial food products among children less than 24 months of age and product promotion in Kathmandu Valley, Nepal. *Maternal and Child Nutrition*, *12*(Mohp 2012), 22–37. https://doi.org/10.1111/mcn.12267

Pries, A. M., Huffman, S. L., Mengkheang, K., Kroeun, H., Champeny, M., Roberts, M., & Zehner, E. (2016). High use of commercial food products among infants and young children and promotions for these products in Cambodia. *Maternal and Child Nutrition*, *12*, 52–63. https://doi.org/10.1111/mcn.12270

Pwc. (2015). 2015-16 Outlook for the Retail and Consumer Products Sector in Asia. *Pwc*, 68.

Roslan, A. R., Fauzi, R., & Rohana, J. (2016). *Foreign Retailers' Expansion Strategy to Malaysia: The case of Hypermarket*. *4*(4), 116–130.

Shahidi, F. (2000). Antioxidants in food and food antioxidants. *Nahrung - Food*, *44*(3), 158–163. https://doi.org/10.1002/1521-3803(20000501)44:3<158::AID-FOOD158>3.0.CO;2-L

Smith, J., Sargent, G. M., Mehta, K., James, J., Berry, N., Koh, C., Salmon, L., Blake, M., Cattaneo, A., & Mansfield, P. (2015). *A rapid evidence assessment Does marketing of commercially available complementary foods affect infant and young child feeding? May*, 146. http://www.who.int/nutrition/topics/CF_anu_effects_marketingcommercial.pdf

Strazzullo, P., Campanozzi, A., & Avallone, S. (2012). Does salt intake in the first two years of life affect the development of cardiovascular disorders in adulthood? *Nutrition, Metabolism and Cardiovascular Diseases*, *22*(10), 787–792. https://doi.org/10.1016/j.numecd.2012.04.003

Sweet, L., Pereira, C., Ford, R., Feeley, A. B., Badham, J., Mengkheang, K., Adhikary, I., Gueye, N. Y. S., Coly, A. N., Makafu, C., & Zehner, E. (2016). Assessment of corporate compliance with guidance and regulations on labels of commercially produced complementary foods sold in Cambodia, Nepal, Senegal and Tanzania. *Maternal and Child Nutrition*, *12*, 106–125. https://doi.org/10.1111/mcn.12268

Taylor, C. M., & Emmett, P. M. (2019). Picky eating in children: Causes and

consequences. *Proceedings of the Nutrition Society*, *78*(2), 161–169. https://doi.org/10.1017/S0029665118002586

Tzioumis, E., Kay, M., Wright, M., & Adair, L. (2015). Health Effects of Commercially Available Complementary Foods: a Systematic Review. *Report to the World Health Organization*.

United Nations Children's Fund. (2011). Programming guide infant and young child feeding. *Nutrition Section, UNICEF*, *May*, 173. http://www.unicef.org/nutrition/files/Final_IYCF_programming_guide_2011.pdf

Ventura, A. K., & Worobey, J. (2013). Early influences on the development of food preferences. *Current Biology*, *23*(9), R401–R408. https://doi.org/10.1016/j.cub.2013.02.037

WHO (2019) *Ending inappropriate promotion of commercially available complementary foods for infants and young children between 6 and 36 months in Europe*.

WHO, W. H. O. (2003) *Guiding principles for complementary feeding of the breastfed child*.

Whye Lian, C., Wan Muda, W. A. M., Mohd Hussin, Z. A., & Ching Thon, C. (2012). Factors associated with undernutrition among children in a rural district of Kelantan, Malaysia. *Asia-Pacific Journal of Public Health*, *24*(2), 330–342. https://doi.org/10.1177/1010539510380737

APPENDIX

APPENDIX A

FACULTY OF MEDICINE AND HEALTH SCIENCES

DEPARTMENT OF NUTRITION

PKK 4999A FINAL YEAR PROJECT

CODEBOOK FOR DATA COLLECTION OF COMMERCIAL COMPLEMENTARY FOODS (CCF)

NAME	ANIS HAZIRAH BINTI MOHD ROSLAN
MATRIC NUMBER	192271
PROGRAM	BACHELOR OF SCIENCE (NUTRITION AND COMMUNITY HEALTH
SUPERVISOR	DR NURUL HUSNA BINTI MOHD SHUKRI

This codebook consists of four sections which are section A to section

Date of data collection :

Section A:

Product Information

1. Product ID :_____

2. Product Name :_____

3. Product Brand :_____

4. Manufacturer :_____

5. Name of the store :_____

6. Type of store :_____

7. Location of the store :_____

8. Recommended age : _____

Section B:

This section is about the categories of products available in store. The product types are divided into four main groups: infant cereals, simple pureed/blended food, dry finger food /snacks, and juices/other drinks. Any products that meet the criteria of the product category will be categorised according to the group.

Product categories

Infant cereal

- ☐ Dry rice, cereal, pulverised rusks, or starchy root
- ☐ Products to be made up with liquid (dry instant-type porridges and dry breakfast cereals)

Simple pureed/blended food

- ☐ Dairy-based desserts and cereal products
- ☐ Fruit puree with or without the addition of vegetables, cereals, or milk
- ☐ Vegetable only puree
- ☐ Pureed vegetables and cereals
- ☐ Pureed meal with cheese (but no meat or fish) mentioned in the name
- ☐ Pureed meal with meat or fish mentioned as the first food in product name
- ☐ Pureed meals with meat or fish (but not named as the first food in the product name)

- ☐ Purees with only meat, fish, or cheese in name

Dry finger food/ snacks

- ☐ Confectionery, sweet spreads, and fruit chews
- ☐ Fruit (fresh or dry whole fruit or pieces)
- ☐ Other snacks and finger foods

Juices/other drinks

	Single or mixed fruit juices, vegetable juices, or other non-formula drinks
	Cow's milk and milk alternatives with added sugar or sweetening agent

Section C:

This section is about the information from nutrition facts and the presence of food additives. The information includes total calories (kcal), protein (g), carbohydrate (g), fat (g), total sugar (g), and sodium (mg).

10. Information on nutrition facts (per 100g)	
Calories (kcal):	
Protein (g):	
Total fat (g):	
Carbohydrates (g):	
Total sugars (g):	
Sodium (mg):	

11. Contain food additives	
	Yes
	No
12. List of food additives	
	Artificial preservatives: sulfites, sulfur dioxides, nitrate, chlorine dioxide, chlorine (IV) oxide, chlorine peroxide, and nisin.
	Natural preservatives (algin, grapefruit seed extract, rosemary extract, vitamin E oil, carrageenan, citric acid, erythorbic acid, guar gum, sodium aluminosilicate, honey, basil extract, and neem oil)
	Artificial colourants (allura red AC, amaranth, brilliant black, black PN, brilliant blue, patent blue V, carmoisine, chocolate brown HT, Brown FK, erythrosine, fast green, green S, indigotin, ponceau 4R, quinoline yellow, red 2G, sunset yellow, tatrazine, and indigo carmine)
	Natural colourants (anthocyanins, annatto, betanin, carminic acid, chlorophylls, chlorophyllins, carotenoids, curcumin, riboflavin, carbon black, caramels. cochineal, calcium carbonate, lutein and, canthaxanthin)

	Artificial flavouring
	Natural flavouring
	Added sugar (all syrups, fructose, sucrose, glucose, dextrose, chocolate, honey, fruit juice concentrates, vegetable concentrates)
	Sweetening agents (saccharin, acesulfame, sucralose, aspartame, and stevia)

Section D:

This section is about the presence of composition claims and examples of composition claims in food products**.**

13. Composition claims				
	Yes			
	No			
14. List of composition claims				
	No added preservatives		Fresh	
	No added colouring agents		Gluten-free	
	No added seasoning		Contains vegetables	
	Organic food		No allergens	
	Dairy-free		No food additives	
	No added condiments		Non-GMO food	
	Natural		No maltodextrin/ modified starch	
	Whole grain		No added artificial flavourings	
	Contains meat		Others:	

APPENDIX B

The result for a mean and standard deviation for nutrient facts (calories, protein, total fat, carbohydrate, sugar, and sodium) per 100g by product categories as presented in Table 8 was illustrated in the line graph in Figure 7 to Figure 12 attached in the appendices for easier observation of which product category has the highest or lowest mean.

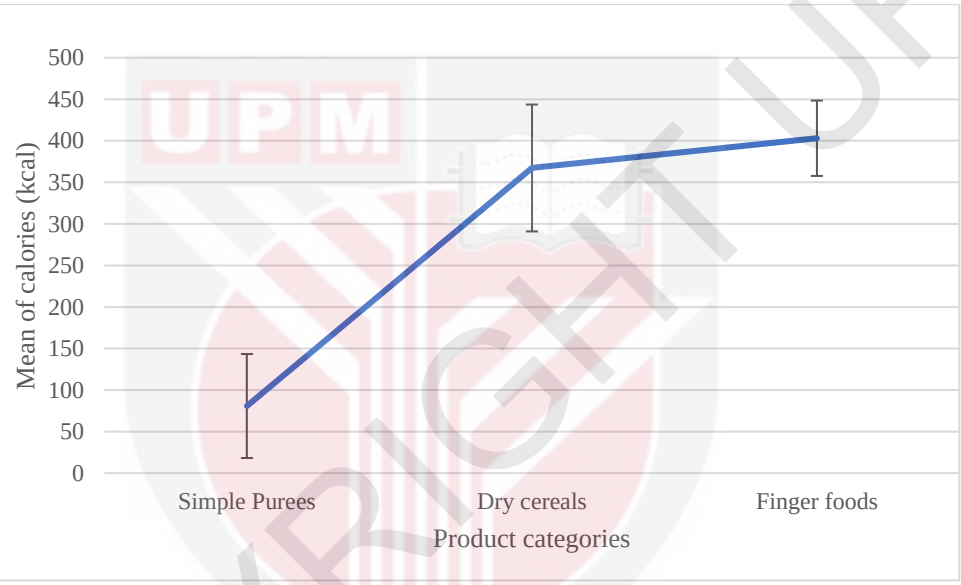

Figure 7. Mean of total calories (kcal) by product categories.

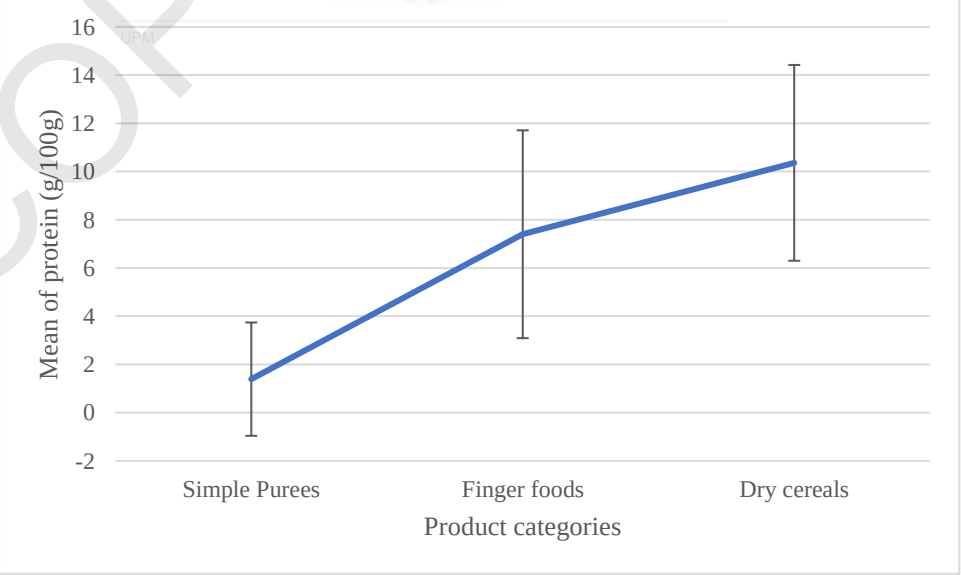

Figure 8. Mean of protein (g) by product categories.

Figure 9. Mean of total fat (g) by product categories.

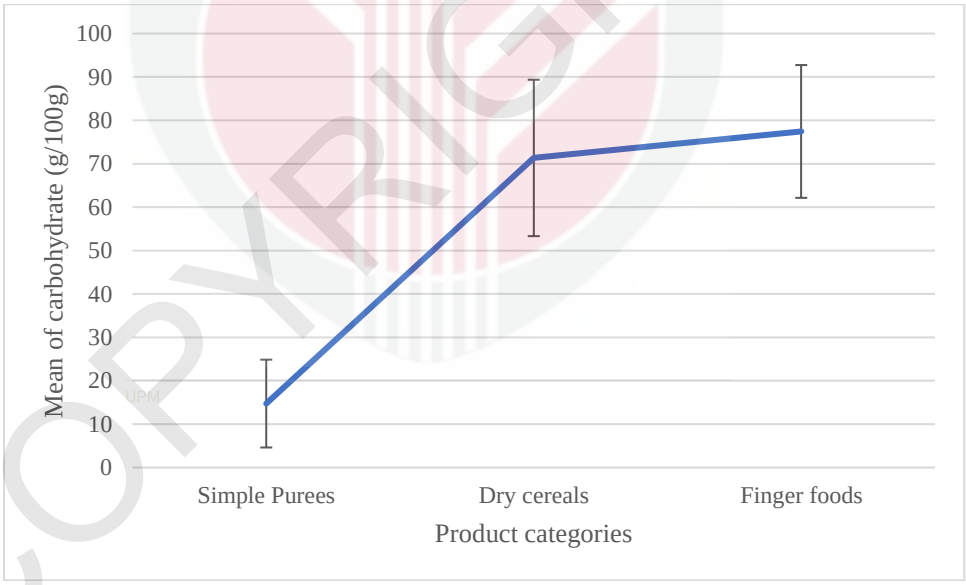

Figure 10. Mean of carbohydrate (g) by product category.

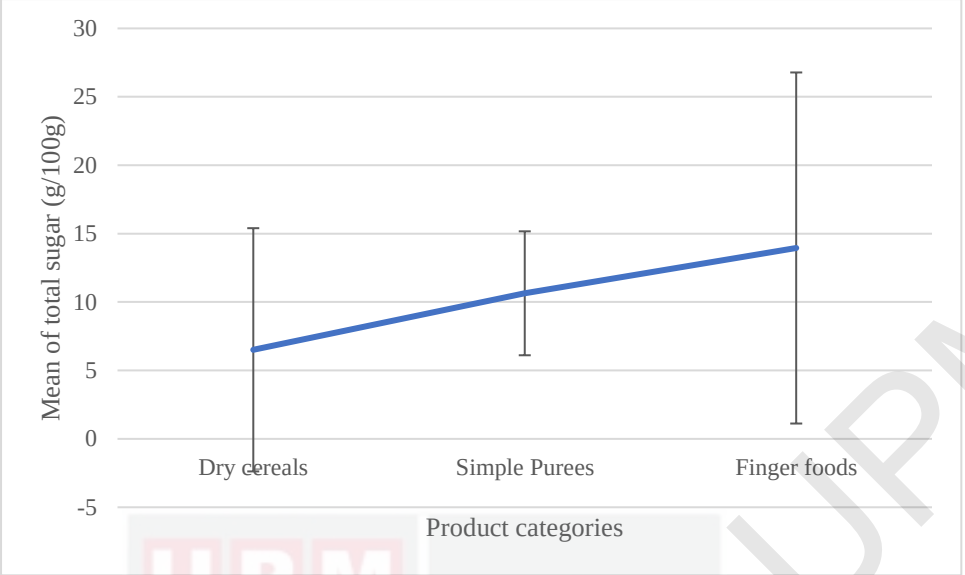

Figure 11. Mean of total sugars (g) by product category.

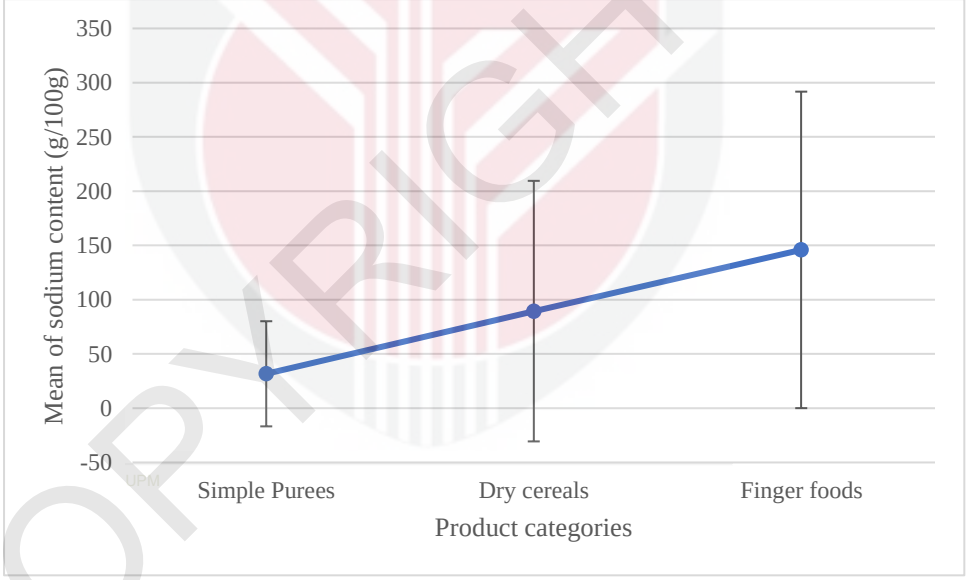

Figure 12. Mean of sodium content (g) by product category.

The result for a mean and standard deviation for nutrient facts (calories, protein, total fat, carbohydrate, sugar, and sodium) per 100g by product types as presented in Table 9 was illustrated in the line graph in Figure 13 to Figure 18 attached in the appendices for easier observation of which product types have the highest or lowest mean. The category for simple purees was further divided into several types which were fruit puree with/without vegetables, vegetable puree and dairy with/without fruit,

whereas finger foods were divided into two types which were savoury, rusk, teething/other finger foods and sweet finger foods.

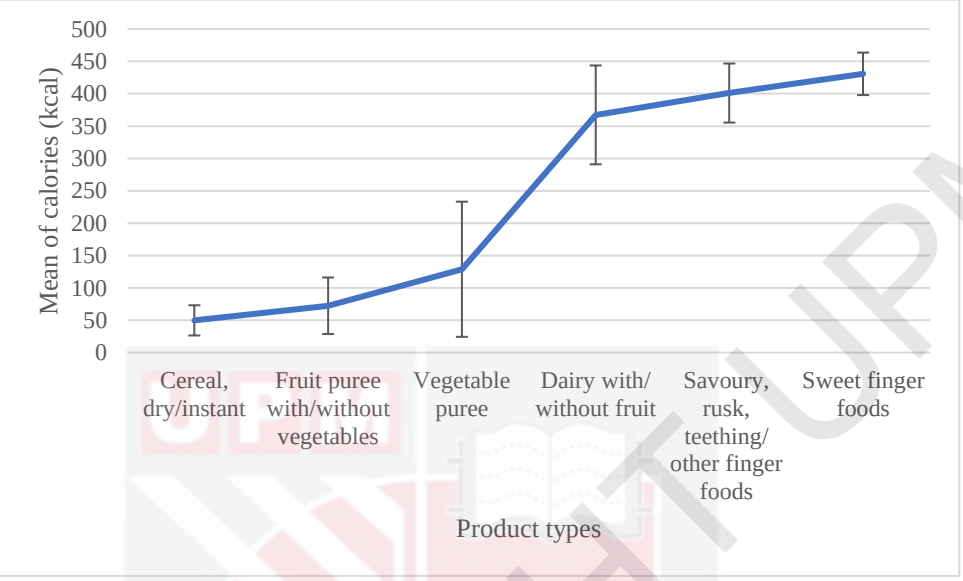

Figure 13. Mean of calories (kcal) by product types.

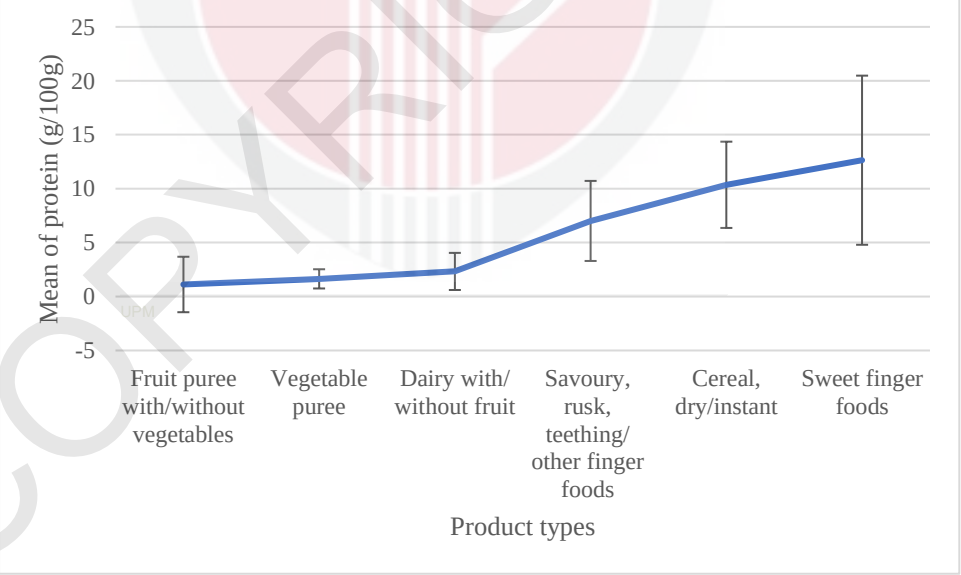

Figure 14. Mean of protein (g/100g) by product types.

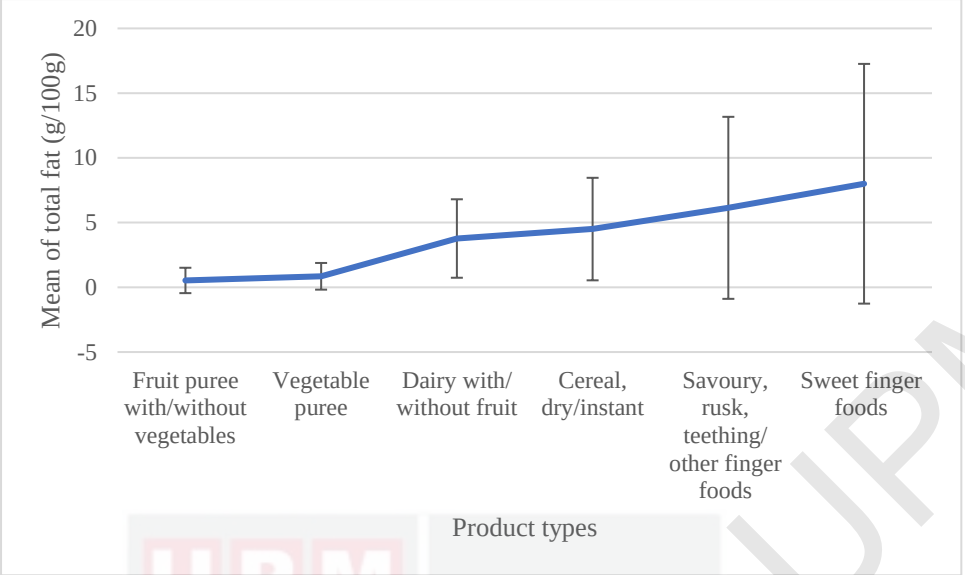

Figure 15. Mean of total fat (g/100g) by product types.

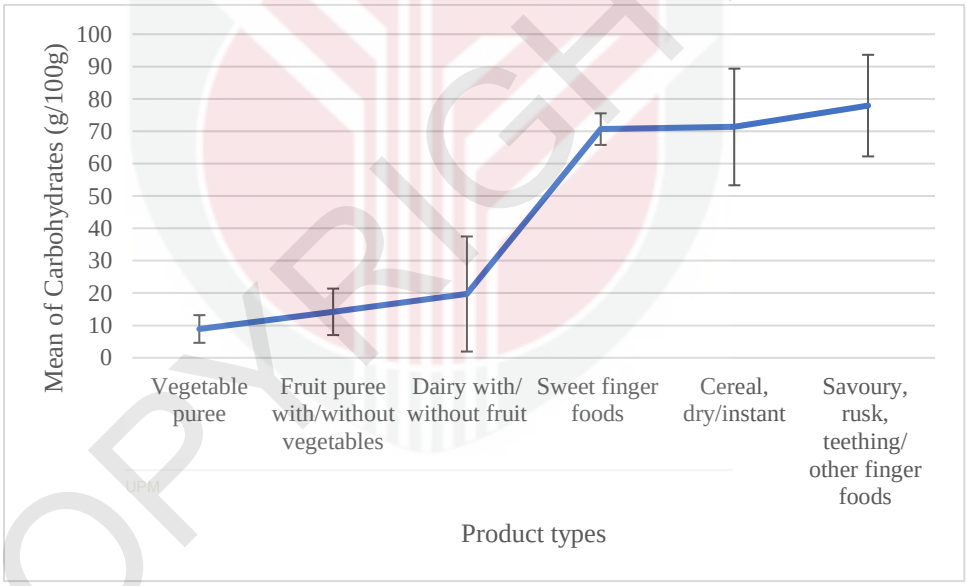

Figure 16.Mean of carbohydrates (g/100g) by product types.

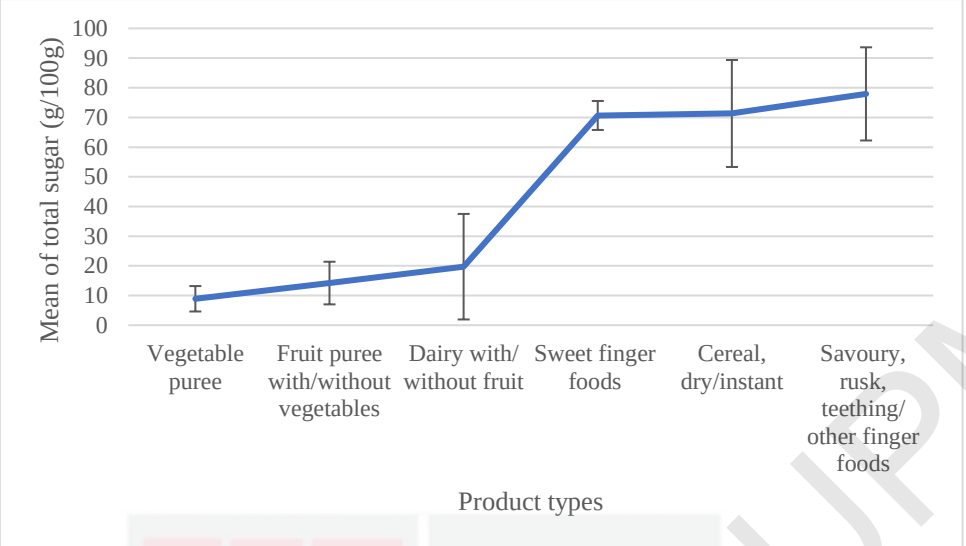

Figure 18. Mean of total sugars (g/100g) by product types

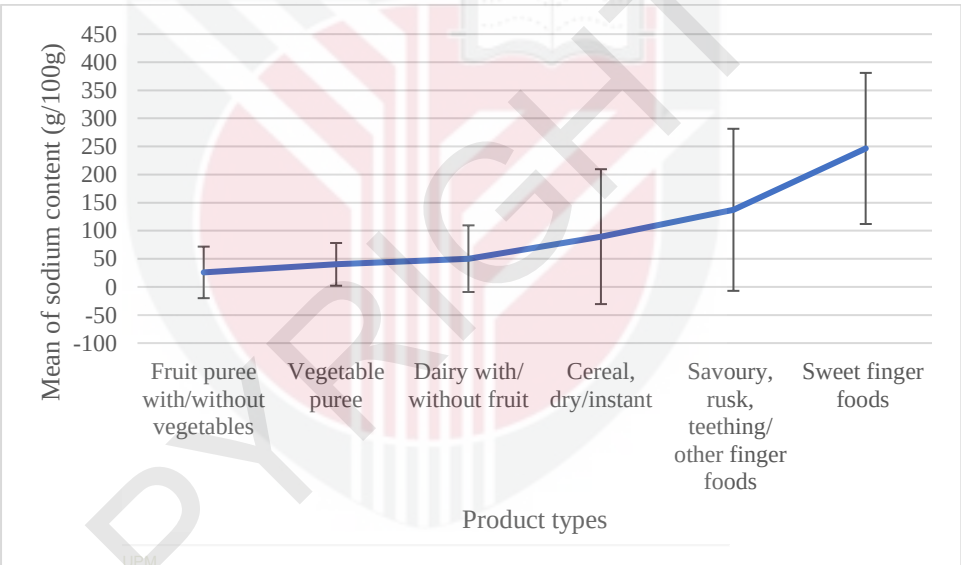

Figure 19. Mean of sodium content (g/100g) by product types

192271

ORIGINALITY REPORT

23%	21%	11%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.euro.who.int Internet Source	6%
2	dspace.nwu.ac.za Internet Source	2%
3	www.ncbi.nlm.nih.gov Internet Source	1%
4	Submitted to University of Glasgow Student Paper	<1%
5	journals.plos.org Internet Source	<1%
6	apps.who.int Internet Source	<1%
7	Submitted to Universiti Teknologi MARA Student Paper	<1%
8	onlinelibrary.wiley.com Internet Source	<1%
9	epubs.surrey.ac.uk Internet Source	<1%