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DISCUSSION PAPER 02/24 | 27 JUNE 2024

Unhealthy but not by Choice: Food Environment and Nutrition Inequalities

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Khazanah Research Institute

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Unhealthy but not by Choice: Food Environment and Nutrition Inequalities

Ai Ni Teoh

Summary

- **Food environments are the contexts in which people access food and make decisions about what to eat.** It encompasses five dimensions: food availability, food affordability, food properties, vendor properties, and food messaging. The food environment acts as an interface between the consumers and the bigger food system, making it a key policy entry point to tackle diet-related malnutrition.

- **Findings suggest that the current food environment is unfavourable in promoting the consumption of healthy diets.** There is a growing availability of energy-dense and high-fat, sugar, or salt foods, which are often made more desirable through targeted advertising, especially to children. The increased rate of eating out behaviour and takeaway home delivery also poses additional challenges to eating healthy.

- Processed, unhealthy foods are also increasingly accessible with the growth of modern food retailers which serve as a key channel for sales and marketing. The emergence of online food delivery, which offers high accessibility to fast foods and sugary drinks, can contribute to the round-the-clock availability of unhealthy food choices. This can displace the consumption of otherwise healthier foods.

- **Meanwhile, healthy diets are becoming increasingly unaffordable for people living in poverty or with low income.** Although fruits and vegetables are essential food groups that make up a healthy diet, they account for the most significant proportion of the cost of a healthy diet, implying their relative unaffordability.

- **These characteristics of the food environment can disproportionately impact people with financial and time constraints, children, and adolescents, making them more prone to consume less healthy diets**. The findings point to the need for equitable and more comprehensive food environment policies to induce system-wide improvements in the food environment in Malaysia. The findings also highlight several significant research gaps, necessitating additional in-depth food environment research to enable evidence-based policymaking.

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1. Introduction

Some disparities or inequalities in health outcomes, such as between age groups, gender, race, and ethnicity, can be attributed to biological determinants like genetics[1]. However, to a larger extent, health inequalities are determined by social determinants such as income, occupation, education level, social class, ethnicity, and gender[2]. Inequalities in health outcomes, particularly between socioeconomic groups, have consistently been reported among Malaysians[3]. Lower-income individuals are found to have higher rates of non-communicable diseases (NCDs), such as high blood pressure, high blood cholesterol, diabetes, and mental health problems[4]. Children from low-income households and whose parents had low education levels are more likely to have poorer cognitive performance[5].

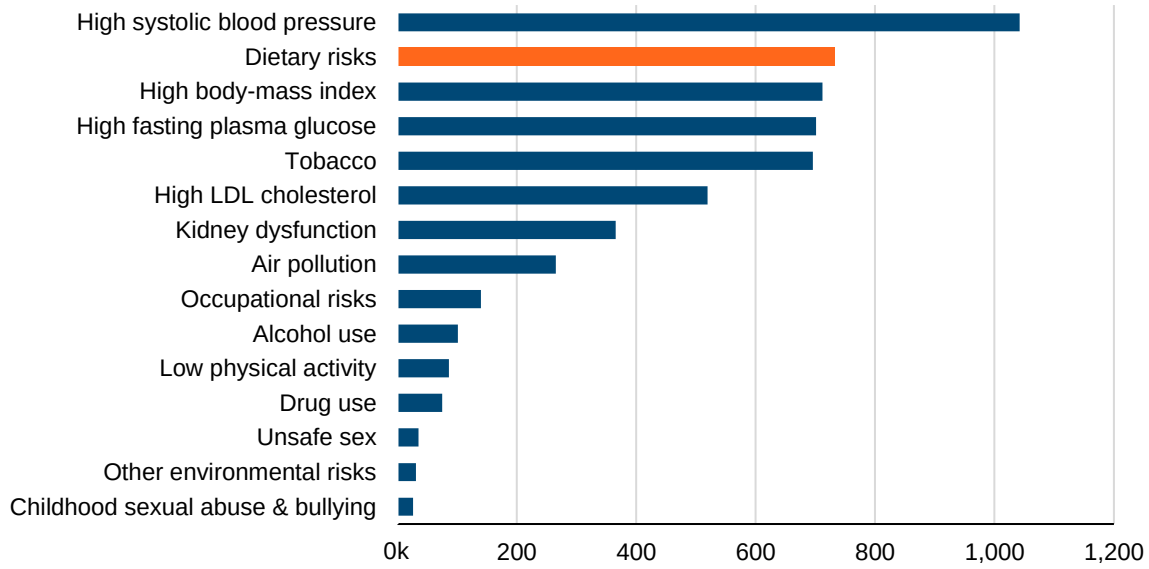
Nutrition inequalities, or the inequalities in the quantity and quality of food consumed, are a significant contributor to health inequalities[6]. Many studies show that low-income individuals in Malaysia are more prone to consuming diets of poorer quality, typically those consisting of energy-dense, nutrient-poor, and low-cost foods[7]. Distinct health and dietary differences between socioeconomic groups suggest that individual food choices are not entirely determined by personal preferences but largely by the environmental and structural factors that drive inequities in food choices[8].

Indeed, individual food choices are significantly driven by the contexts in which people access food and make decisions about what to eat, i.e. the food environment[9]. Depending on its characteristics, the food environment can constrain or prompt positive food choices, making it an important entry point for diet-oriented policy intervention. As such, government policies have great potential in shaping food environments to influence population dietary patterns[10].

[1] Hernandez and Blazer (2006); WHO (n.d.)
[2] KRI (2020a)
[3] Shahar et al. (2019); KRI (2020a); Ismail and Sivadas (2020); Poh et al. (2019)
[4] KRI (2020a); IPH (2020)
[5] Poh et al. (2019)
[6] James et al. (1997)
[7] Eng et al. (2022); Shahar et al. (2019); Azizan et al. (2018); S. P. Chong, Appannah, and Sulaiman (2019); Nohan et al. (2020)
[8] Drewnowski (2009)
[9] HLPE (2017)
[10] Swinburn, Dominich, and Vandevijvere (2014)

Poor dietary choices can have detrimental impacts on health. Unhealthy diets arising from insufficient intakes of nutrient-rich foods, such as fruits and vegetables, or over-consumption of certain foods or nutrients, such as salt, trans-fat, processed meat, and sweetened beverages, are the second leading contributors to NCDs-related morbidity in Malaysia[11]. It accounted for 732,091 or 12.9% of all disability-adjusted life years (DALYs) caused by NCDs in 2019[12], indicating significant years of life lost due to premature death and the year lived with disability[13] (see Figure 1).

Figure 1: DALYs from NCDs attributable to top 15 risk factors, 2019



Source: IHME (2019)
Note: Dietary risks refer to diets low in whole grains, fruit, fibre, legumes, nuts and seeds, omega-3 fatty acids, polyunsaturated fatty acid (PUFA), vegetables, milk, and calcium; and diets high in sodium, trans fats, red or processed meat, and sugar-sweetened beverages. The data shown is for both sexes and all ages in Malaysia. LDL = low-density lipoprotein.

Malaysians, however, do not consume healthy diets adequately. Most Malaysian adults and adolescents do not consume enough fruits and vegetables—an observation that has consistently been reported by national surveys over various years[14]. The local food consumption landscape has undergone a shift from traditional dietary patterns towards more 'Westernised' diets consisting of fast foods, breads, soft drinks, confectionery, and breakfast cereals[15], introducing additional dietary risks. Frequent intake of unhealthy foods such as confectionery, sugar, and sugar-based foods characterised the food consumption patterns of Malaysian adults[16].

[11] IHME (2019)
[12] Ibid.
[13] WHO (n.d.)
[14] IPH (2020); (2014); (2022)
[15] Shyam et al. (2020)
[16] Kasim et al. (2018); MOH (2008); IPH (2014)

As Malaysia continues to grapple with the rising rates of malnutrition and dietary-related NCDs [17], with evidence of the lower income and vulnerable groups being disproportionately impacted, it is crucial to address the aspects of our food environment that can contribute to or further exacerbate health and nutrition inequalities. Tackling these inequalities through food environment interventions can be an effective strategy, as food intake is recognised to be a significant determinant of health[18], and individual food behaviours are highly modifiable[19].

This paper aims to provide an overview of the food environment in Malaysia by examining the respective food environment dimensions and recognising the aspects that can contribute to inequalities in food choices. We also identify the different segments of the population that are more prone to making poor food choices due to factors in the food environment, which include those with financial constraints, time-poor individuals, children, and adolescents.

2. Understanding the Food Environment

2.1. Definition of the Food Environment

According to the United Nations' Food and Agriculture Organization's (FAO) High Level Panel of Experts on Food Security and Nutrition (HPLE), food environments refer to "**the physical, economic, political and socio-cultural surrounding, opportunities and conditions that create everyday prompt, shaping people's dietary preferences and choices**" [20]. In other words, food environments are the contexts in which people access food and make decisions about what to eat.

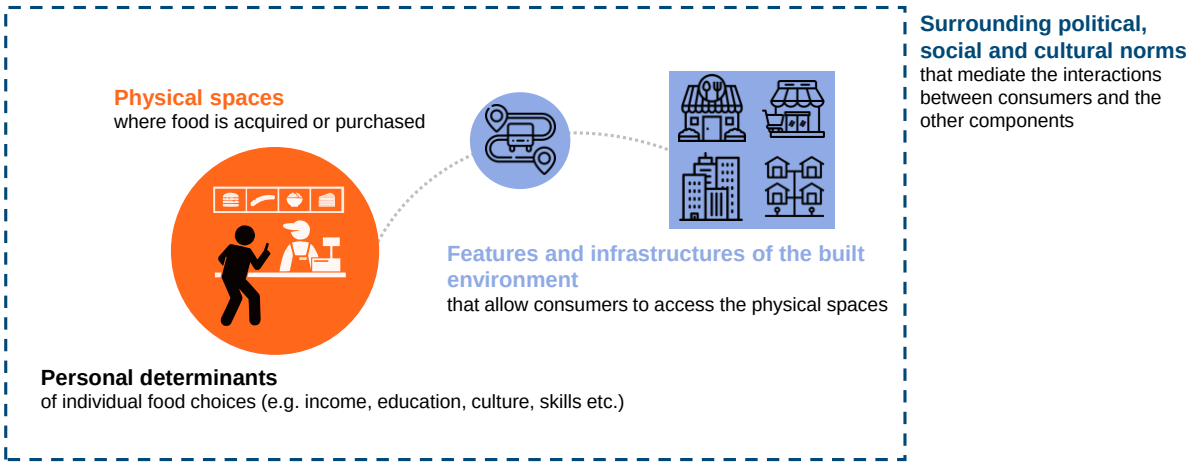
Food environments can be further defined at the micro and macro levels. The local or micro-food environments, where consumers directly interact with food on a daily basis, include schools, workplaces, homes, and retail spheres [21]. At the macro level, food environments consist of broad, higher-level systems comprising food industries, national food supply chains, food advertising, and other infrastructures[22].

[17] IPH (2020); Development Initiatives (2018)
[18] Afshin et al. (2019)
[19] WHO (2022); Arifin et al. (2022)
[20] HLPE (2017)
[21] Ziso, Chun, and Puglisi (2022); Bauer et al. (2022)
[22] Ziso, Chun, and Puglisi (2022); Bauer et al. (2022); Swinburn and Egger (2002)

As illustrated in Figure 2, the food environment comprises four main elements[23]:

- **Personal determinants** of individual food choices, such as income, education, culture and skills;
- **Physical spaces** where food is acquired or purchased;
- Features and infrastructure of the **built environment** that allow consumers to access the physical spaces, including buildings, open spaces, utilities, and transportation; and
- **Surrounding political, social, and cultural norms** that mediate the interactions between consumers and the above components.

Figure 2: Elements of the food environment



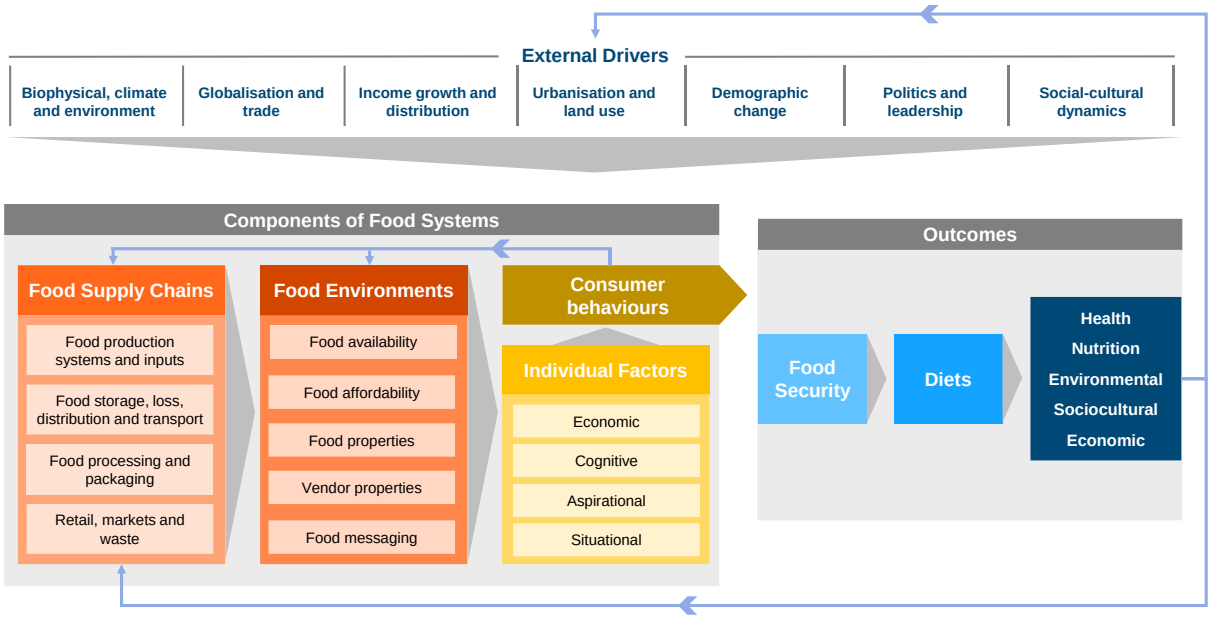
Source: HLPE (2017), Author's illustration

The food environment acts as an interface between the consumers and the bigger food system[24] (Figure 3). The characteristics of the food environment, mediated by individual economic (income and purchasing power), cognitive (information and knowledge), aspiration (desires, values, and preferences), and situational (environment, mobility, location, and resources) factors, significantly shape consumer behaviour [25]. This subsequently influences their food acquisition, consumption patterns, and, ultimately, nutrition and health outcomes.

Our food environment is shaped by the food supply chains, which interact upstream with other food system drivers, such as climate and environment, income growth and distribution, politics, sociocultural dynamics, demographic changes, globalisation, trade, and urbanisation[26]. These drivers and components ultimately shape the health, nutrition, environmental, sociocultural, and economic outcomes at the population level.

[23] HLPE (2017)
[24] Ibid.
[25] Ibid.
[26] Fanzo et al. (2020); HLPE (2017)

Figure 3: The drivers, components, and outcomes of food systems



Source: Fanzo et al. (2020), HLPE (2017)

2.2. Food Environment Dimensions

Our food choices are shaped by a combination of the food environment dimensions that we encounter; the types of food retail and service stores available, the cost, desirability, and characteristics of the food and beverage they provide, the kinds of promotion being offered, and our exposure to food marketing and advertising. According to HLPE (2017), food environments encompass five dimensions:

- *Food availability* – type and diversity of food available;
- *Food affordability* – food prices, alone and relative to other foods, income, or expenditure;
- *Food properties* – safety, quality, appeal, convenience, and sustainability;
- *Vendor properties* – location, type, and characteristics of retail food outlets; and
- *Food messaging* – promotion, advertising, labelling and other information about food.

The various combinations of the five dimensions can result in different food environments in different places. A healthy food environment provides equitable access to a range of healthier foods and prompts healthier food choices[27]. On the contrary, an unhealthy food environment with features that promote unhealthy food options tends to favour unhealthy food choices, and this can affect different groups of people differently, depending on their backgrounds and needs. It can lead to poor diet quality and, in the long run, dietary-related diseases[28]. The next part of this section elaborates further on each food environment dimension, its definition, measurements, and role in determining food choices.

Food Availability

In the simplest terms, food availability refers to the presence or absence of food or food sources within a given setting[29]. The settings are where people normally spend most of their time, such as workplaces, schools, universities and homes. In the food security context, the definition of food availability expands to include a sufficient quantity of food of good quality for consumption supplied through domestic production or imports[30]. In addition to the overarching definition, food availability in the context of health and nutrition emphasises healthier food availability and variety. Healthier food typically includes fresh or minimally processed foods, fruits and vegetables, whole-grain or high-dietary-fibre products, lower-fat milk and meat products, and low-sugar food items.

Food availability is commonly measured in terms of:

- The national supply (quantity and diversity) of food or calories per capita[31];
- The presence and types of food within a certain range around one's home, school, work, or other locations[32]; and
- The types of food within a food retail or service outlet by shelf space and variety[33].

[27] Drewnowski et al. (2020); Downs et al. (2020); HLPE (2017)
[28] Westbury et al. (2021); Hawkes et al. (2020); Drewnowski et al. (2020); HLPE (2017)
[29] Turner et al. (2018)
[30] FAO (2006)
[31] Lytle and Sokol (2017); Nodari et al. (2020)
[32] Turner et al. (2018); Nodari et al. (2020)
[33] Ibid.

Food Properties

Food properties refer to the intrinsic (physical aspects such as taste, smell, form, and composition) and extrinsic (packaging, nutritional claims, and price) attributes of a food or food product. Safety, quality, taste, composition, convenience, level of processing, packaging, shelf life, and sustainability are some of the key food properties consumers value[34]. These properties can shape the desirability of a food item to the consumers, thereby influencing purchase and consumption behaviour[35].

While consumers generally value fundamental properties like safety and quality, some also value other properties like convenience and sustainability. For example, consumers with environmental considerations may prefer foods that are organic or come with eco-friendly packaging. Parents facing time constraints may opt for takeaway or pre-packaged food to save time from cooking. This dimension of the food environment is constantly evolving with the advancements in food processing and technology and the growth in consumers' demands.

Food Affordability

Food affordability reflects the interaction between food prices and an individual or household's income and purchasing power[36]. This dimension of the food environment is highly sensitive to fluctuations in food availability and accessibility. It is important to differentiate between food cost and affordability; food cost refers to the price tag or the monetary value one pays, whereas food affordability is typically defined as the cost of food relative to the household's income[37]. Food affordability is one of the most significant determinants of purchase and consumption, especially in low- and middle-income countries (LMICs), whereby a larger share of income is spent on food than in high-income countries (HICs)[38].

[34] Turner et al. (2018)
[35] Ibid.
[36] Schneider et al. (2023)
[37] A. Lee et al. (2013)
[38] HLPE (2017)

Food affordability is commonly defined based on monetary values, i.e. food prices. Hence, the terms 'affordability' and 'economic access' are often used interchangeably. A less discussed aspect of food affordability is perceived affordability based on the food value relative to its cost. **Food affordability can be perceived differently as food is more than a commodity; It has values beyond its price tag and nutritional content.** Food safety, taste, convenience (time and effort needed for acquisition and preparation), symbolic value (culture, religion, and family and social relationships), package size, satiety, and risk of waste or spoilage are factors affecting a food or food product's perceived affordability [39]. For example, fresh vegetables, albeit cheaper, can be considered less desirable than canned alternatives to people without food storage and preparation facilities or the necessary cooking knowledge. This is because the former is highly perishable and requires proper storage or cooking prior to consumption, whereas the latter is shelf-stable and ready to eat.

Vendor Properties

Vendor properties refer to the type and characteristics of food vendors, such as opening hours and products and services provided [40]. To differentiate from food availability, which looks at the presence of food within a certain range, this dimension of the food environment examines the properties of food sources, specifically the food vendors[41]. Vendor properties and food properties interact with individual factors, such as time allocation and the availability of preparation facilities, to shape the convenience and desirability of food[42]. Food vendors typically tailor their properties to cater to the needs and demands of the target consumer base[43].

In general, food and services vary between formal and informal vendors. Informal or traditional vendors are typically long-established retail structures such as local wet or open-air markets, mobile vendors, opportunistic vendors, and canteens[44]. These vendors are usually the primary source of locally produced fresh and staple foods, especially for certain individuals such as women and low-income groups [45]. On the other hand, consumers tend to obtain packaged and processed foods from formal or modern vendors like supermarkets, independent grocers, convenience stores, cooperatives, and online vendors[46]. Food service vendors include pubs, bars, fast food vendors, and other sit-down restaurants.

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[39] Daniel (2020); Bell et al. (2021); Fielding-Singh (2017); Poulain et al. (2023)
[40] Turner et al. (2018)
[41] Nodari et al. (2020)
[42] Turner et al. (2018)
[43] Gaupholm et al. (2023)
[44] Gaupholm et al. (2023); Bogard et al. (2021)
[45] Wertheim-Heck and Raneri (2019); M. Kelly et al. (2015)
[46] Gaupholm et al. (2023); Bogard et al. (2021)

The interplay between the location (proximity and density) and the types of food vendors in a given area or neighbourhood also determines the types of food available[47]. International research in this area has led to the identification of food deserts and food swamps; food deserts are defined as areas with low availability of grocery stores selling nutritious foods, limiting access to healthier food[48]. On the other hand, food swamps refer to areas with a high density of convenience stores and fast-food restaurants that make unhealthy food options prevail over healthier ones[49]. Studies from other countries show that people who live in food swamps are more likely to purchase and consume unhealthy foods.

Food Messaging

Food messaging, which refers to the communication of food properties or information, is another important driver of individual food purchasing decisions and consumption patterns[50]. It is a potent tool for food communication. **Food messaging can shape the acceptability and desirability of food vendors and products by interacting with one's personal preferences, desires, acceptability, health status, income, identity, culture, knowledge, and skills, both negatively and positively**[51].

Food messaging can be done through various means, including:

- **Food promotion** via selling foods at a reduced price (e.g. buy one, free one), premiums, sampling, coupons, contests, sweepstakes, and event marketing[52];
- **Food marketing and advertising** through television advertising, digital marketing, packaging, in-school marketing, product placements, toys and products with brand logos, and children- and youth-targeted promotions[53];
- **Food labelling** to provide information to consumers, facilitate informed decision-making and shift industry practices by promoting product reformulations[54]; and
- **National food-based dietary guidelines** to influence food choices and inform both actors in the food supply chain and policymakers[55].

[47] Mathieu, Robitaille, and Paquette (2022); Stark et al. (2013); Ambikapathi et al. (2021)
[48] CDC (2013)
[49] Honório et al. (2021); CDC (2013)
[50] Friel, Hattersley, and Ford (2015)
[51] Turner et al. (2018); P.-J. Chen and Antonelli (2020)
[52] HLPE (2017)
[53] Story and French (2004)
[54] A. Jones et al. (2019)
[55] HLPE (2017)

2.3. Food environment policies

Policies can shape the food environment, both positively and negatively, and ultimately, the population's dietary intake and nutritional status. A widely used index to monitor food environment policy implementation is the Food Environment Policy Index (Food-EPI) developed by the International Network for Food and Obesity/NCDs Research, Monitoring and Action Support (INFORMAS)[56].

The Food-EPI covers seven policy domains of the food environment: 1) food composition, 2) food labelling, 3) food promotion, 4) food provision, 5) food retail, 6) food prices, and 7) food trade and investment. These domains present multifaceted policy entry points for governments to shape a food environment where healthy food is readily accessible, available, and affordable[57]. Table 1 provides the descriptions and examples of each food environment policy domain.

The Food-EPI tool has previously been used to examine the degree of implementation of food environment policies in Malaysia. The study conducted between 2016 to 2017 revealed that the implementation for nearly two-thirds of the Food-EPI indicators was considerably low (mean percentage of implementation = 26-50%) in Malaysia, with the rest of the policy indicators being rated as 'medium' (mean percentage of implementation = 51-75%)[58].

When benchmarked against international best practices, Malaysia's performance in food environment policy implementation was average (neither commendable nor poor) [59]. Food promotion indicators, including the restriction of unhealthy food promotion in children's settings and through broadcast media such as television and food composition targets or standards for out-of-home meals, were the lowest-rated indicators[60].

The findings suggested a strong need to close the gaps in the implementation of food environment policies, prioritising areas such as food promotion and food labelling. To the best of the author's knowledge, no recent research has been conducted on the implementation of food environment policies in Malaysia since the last study.

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[56] Swinburn et al. (2013); INFORMAS is a global network of public-interest organisations and researchers that aim to monitor, benchmark, and support public and private sector actions to create healthy food environments and reduce obesity, NCDs, and their related inequalities. INFORMAS carries this out by regularly monitoring key domains of food environments between countries.

[57] Ibid.

[58] Ng et al. (2018)

[59] Ibid.

[60] Ibid.

Table 1: Descriptions and examples of the Food-EPI policy domains

Policy domain	Descriptions	Policy examples
Food composition	Policies or standards that aim to improve the nutritional quality of foods and non-alcoholic beverages, especially processed foods and out-of-home meals.	• Food composition targets or standards (reduction of salt, saturated fat and added sugar, and elimination of trans-fat)
Food labelling	Policies on food labelling to enable consumers to make healthier, informed choices and prevent misleading claims	• Ingredient or nutrient declarations • Health and nutrition claims • Front-of-pack labelling (FOPL) • Menu labelling
Food promotion	Policies or regulations that restrict unhealthy food and beverage promotion, marketing and advertising to children and adolescents across relevant media and contexts	• Regulations restricting unhealthy food and beverage advertisements through broadcast (television and radio) and non-broadcast media (Internet, packaging, sponsorship, and outdoor advertising) across all settings (e.g. schools)
Food prices	Economic tools that incentivise healthy food purchases and disincentivise unhealthy food purchases, making healthy choices the easier, cheaper choices.	• Food taxes (e.g. excise, sales, value-added, tariffs) on unhealthy foods • Subsidies for foods that are recommended in dietary guidelines • Food-related income support programmes that favour healthy food purchase
Food provision	Policies promoting healthy food intake aligned with dietary guidelines in settings where people gather to work, learn, and recreate, such as schools, hospitals and workplaces	• Nutrition standards for school meals • Promotion of healthy food choices in public sector settings • Government-developed guidelines and support systems for healthy food provision for employees in private companies
Food retail	Policies that improve access to healthy food and limit access to unhealthy foods in communities	• Zoning laws supporting healthy food outlets or restricting unhealthy ones • Guidelines promoting in-store healthier food options or limiting in-store availability of unhealthy food in food outlets and restaurants
Food trade and investment	Measures that assess and consider the impacts of trade agreements on public health and nutrition and protect governmental regulatory capacity in relation to investments that may impact public health and food sovereignty	• Health or nutrition-related trade impact assessments of trade and investment agreements • Measures to protect a country's public health regulatory capacity in protecting and promoting public health and nutrition

Source: Løvhaug et al. (2022), Friel, Hattersley and Laura (2015), and Swinburn et al. (2013)

3. Examining Malaysia's Food Environment

The global food system has seen substantial shifts and is still in a state of rapid flux. These changes are largely driven by economic growth, industrialisation, urbanisation, globalisation, and trade liberalisation[61]. As a result, rates of infectious disease, poor sanitation, periodic famine, and undernourishment have significantly reduced over the decades[62]. **These food system shifts also shape the food environment, given its connectedness to the food supply chains and external drivers[63].** But with great transformation come trade-offs and new challenges.

The current global food environment is described as one that is permeated with inequities, spanning from poor availability and unaffordability of healthy foods to an excess of low-nutritional-quality options and limited access to nutritious foods[64]. This gives rise to many forms of inequity in the way people obtain and make decisions about their food and, consequently, inequities in nutritional outcomes[65].

The food environment, therefore, is a research area deserving attention. In light of the proliferation of dietary-related diseases and the evident socioeconomic disparities in health outcomes, there are both policy and research imperatives to gain a comprehensive understanding of Malaysia's food environment.

The following sections first examine Malaysia's food environment and then elucidate its linkages to nutrition inequalities among Malaysians. The primary focus is on the data available in the context of Malaysia. Where local data is lacking, findings from other countries are extrapolated. This section will start with the respective food environment dimensions: food availability, properties, affordability, vendor properties, and food messaging. The focus of this section is on breadth rather than depth. This allows a comprehensive understanding of the multifaceted and unequal impact of the food environment on food choices. The use of an overview approach in this paper also allows the identification of gaps that necessitate policy attention and further research.

[61] Remans (2020); Development Initiatives (2020)
[62] Barry M. Popkin (2006)
[63] Development Initiatives (2020)
[64] Ibid.
[65] Ibid.

3.1. Food Availability

In general, what is available is what is consumed. Food availability is a key dimension of the food environment and the precursor of the other dimensions of the food environment. One of the basic measures of food availability or supply is the amount of energy or calories available at the national level[66]. In order to examine Malaysia's food availability, data on the quantities of foods available for human consumption, from both domestic production and imports, were extracted from the supply and utilization accounts (SUA) and food balance sheets (FBS) compiled by FAO.

The SUA and FBS provide the quantities of food items and commodities potentially available through production and import for human consumption, taking into account exports and food losses through storage, transport and processing[67]. These datasets differentiate between food supplies for human consumption, livestock feeding, seeds, and non-dietary purposes[68]. The per capita supply of each food item or group (g/capita/day or kcal/capita/day), which serves as an element in projecting the food supply, is calculated by dividing the quantity of food available for human consumption by the population size estimate[69].

Over the decades, Malaysia's food supply in caloric terms has increased tremendously, which is consistent with the trend in other continents (Figure 4)[70]. In Malaysia, the daily supply of calories per person has long surpassed the average daily requirements of 2,190 kilocalories (kcal) and 1,900kcal for adult men and women[71], respectively. This means that the daily caloric supply of 2,965kcal per person is now in excess of 50% for women and 30% for men. In general, the daily supply of calories per person has been on a stable upward trend, with an 18% increment from 1961 to 2020.

This upward trend is correlated with a country's income status; as a country moves towards a higher income status, the food availability in terms of national caloric supply also increases alongside the significant decline in hunger and undernourishment. However, it is important to note that the number of calories available is not equivalent to the amount of calories actually consumed. In reality, the amount of calories consumed is normally lower than the amount available due to food loss and wastage.

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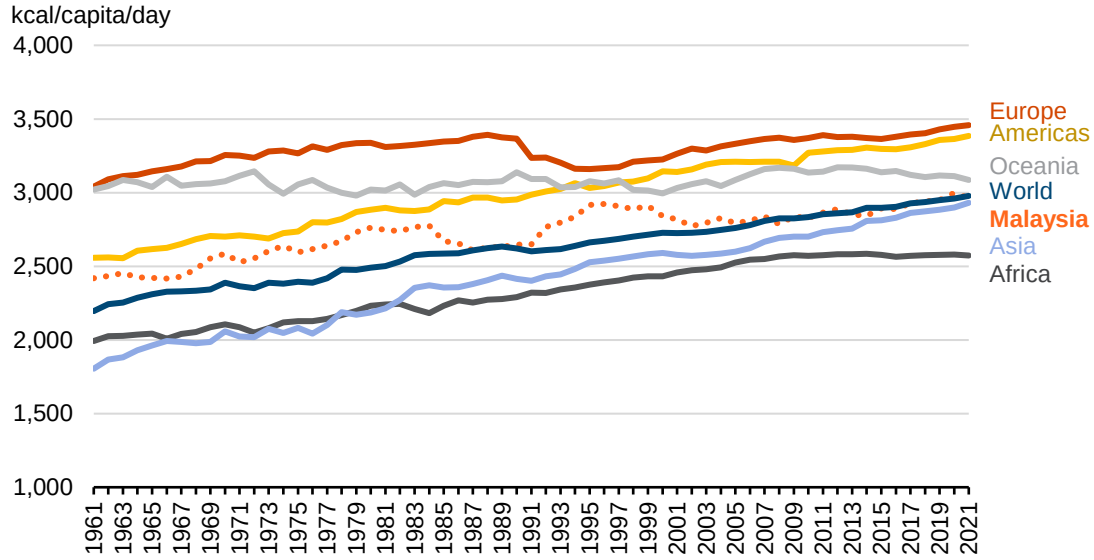
[66] Goh et al. (2020); Al Hasan et al. (2022)
[67] FAO (n.d.)
[68] Ibid.
[69] Ibid.
[70] FAO (2020)
[71] MOH (2017); The minimum energy requirements of 1,900kcal and 2,190kcal are for adult females and males aged 30 to 59 with a moderately active physical activity level (PAL) of 1.6, respectively.

Figure 4: Daily supply of calories per person, 1961 – 2021

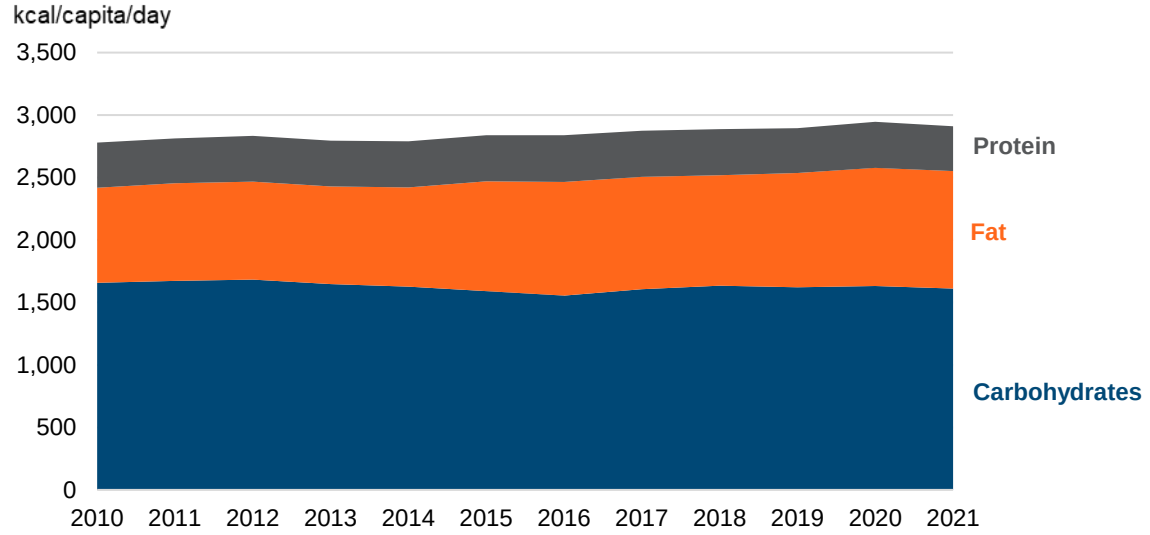


Note: The data is obtained from FBS on the FAOSTAT portal.
Source: FAO (2022)

Energy supply in itself does not give a comprehensive view of food availability as it does not provide any indication of nutrition fulfilment. Hence, it is crucial to examine food availability based on the types of macronutrients, namely carbohydrates, proteins, and fats. **Over the past decades, the structure of our food supply has gradually shifted towards a more energy-dense diet with more fat supply.** As depicted in Figure 5, the rise in the total caloric supply from 2010 to 2021 was mainly attributed to the increase in the caloric share of fat (27.4% to 32.3%). Nonetheless, carbohydrates remain the primary source of calories in our diets[72].

[72] FAO (2020)

Figure 5: Total daily per capita caloric supply and caloric shares of macronutrients, 2010 – 2021



Source: FAO (2024)
Note: The data is obtained from the Availability subdomain of Food and Diet Domain in the FAOSTAT portal, which is based on supply utilization accounts. The SUA provides a more comprehensive picture of nutrient availability at the national level than the FBS, as it contains more detailed lists of food and agricultural items. In comparison, the FBS estimates of nutrient availability are based on the conversion of SUA food items into food groups or commodities, which does not give an accurate representation of nutrient availability that tends to vary between food items (e.g., different kinds of fruits).

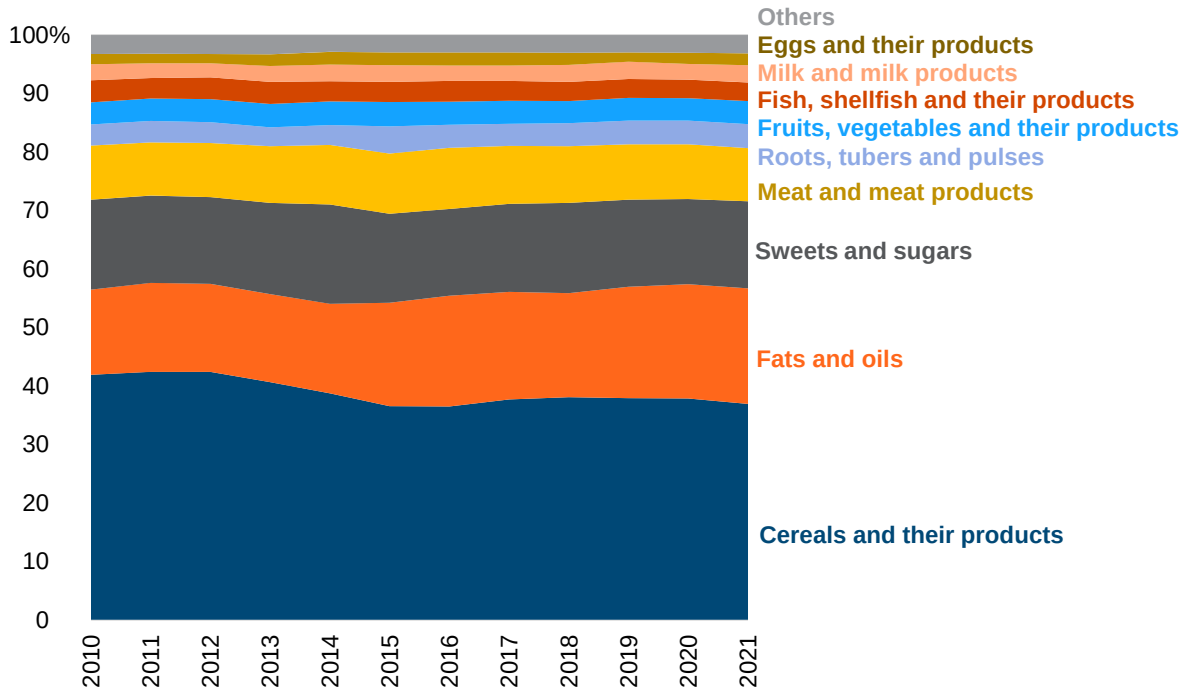
The changes in the caloric supply of macronutrients are an outcome of the nutrition transition, where countries move from high rates of infectious disease, poor sanitation, periodic famine, and malnutrition to a prevailing state of chronic disease and overconsumption [73] . Alongside this transition is the shift of dietary patterns, characterised by an overabundance of energy supply, diversification of the types of food consumed, and changes in eating behaviours[74].

Carbohydrate-rich staples derived from cereals, roots, and tubers are important and cheap energy sources but are generally low in micronutrients and high-quality protein[75]. As income rises, the share of carbohydrates mainly from starchy staples in dietary energy supply is increasingly displaced by more expensive and nutrient-dense food, as Bennett's law explains[76]. Generally, with a 1% increase in a country's GDP, there is a corresponding 0.07% decline in the intake of cereals, roots, and tubers and a 0.24% or 3.3-fold increase in the consumption of animal products[77]. A rising level of education, urbanisation, trade liberalisation, and related socioeconomic shifts also contribute to these dietary shifts[78].

[73] B. M. Popkin and Gordon-Larsen (2004); Goh et al. (2020)
[74] Goh et al. (2020)
[75] Headey and Alderman (2019)
[76] Bennett (1941)
[77] Bogmans, Pescatori, and Prifti (2021)
[78] Barry M. Popkin (1998); Goh et al. (2020)

When examining the caloric supply by food groups, the data also points to the growing share of fats and oils in Malaysia's food supply. Over the recent decades, Malaysia's food supply in caloric terms from fats and oils has risen more significantly than other food groups, as shown in Figure 6. This explains the rising share of fat in the total caloric supply in the previous figure. Interestingly, sweets and sugars are the third largest food group contributing to the total energy supply, after cereals and their products and fats and oils. The caloric share of other food groups, on the other hand, has remained relatively constant.

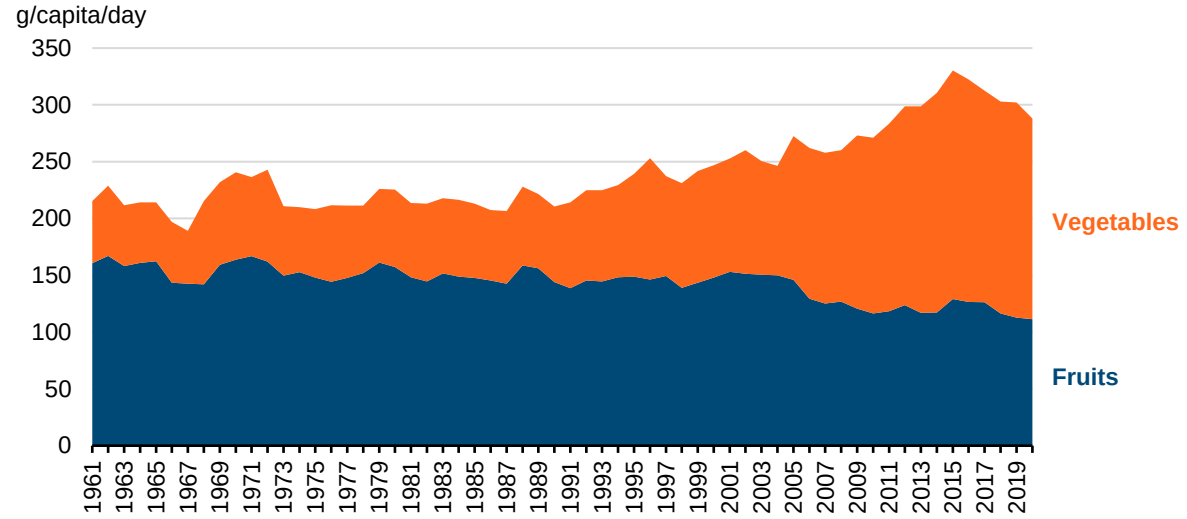
Figure 6: Composition of daily caloric supply per capita by food groups, Malaysia, 2010-2021



Note: The data is obtained from the Availability subdomain of Food and Diet Domain in the FAOSTAT portal, which is based on supply utilization accounts. The datasets differentiate food groups by FAO/WHO Global Individual Food Consumption Data Tool (GIFT) food groups that differ from those used for the FBS. Others include spices and condiments, beverages, and foods for particular nutritional uses.
Source: FAO (2024)

Against the backdrop of a growing supply of calories and fat, the supply of fruits and vegetables, a food group essential for vitamin intake, has seen relatively more minor changes in the past decades. As depicted in Figure 7, the cumulative supply of fruits and vegetables has increased modestly since 1961. Throughout the same period, the supply of fruits appeared to be on a downward trend, the opposite of the growing supply of vegetables. However, the overall supply of fruits and vegetables seems to have declined from 2015 onwards. In 2020, the supply of fruits and vegetables was 111.4 g/capita/day and 176.6g/capita/day, respectively.

Figure 7: Total supply of fruits and vegetables in Malaysia, 1961 – 2020



Source: FAO (2020)

When examined against the dietary guidelines, the current supply of fruits and vegetables appears to fall short of the recommended daily intake level. The Malaysian Dietary Guidelines (MDG) 2020 recommends consuming at least two servings of fruits and three servings of vegetables[79], along with a moderate and balanced intake of other food groups to maintain good health. The WHO's guidance is to eat at least 400g or five portions of fruits and vegetables daily to reduce the risk of NCDs and ensure sufficient dietary fibre intake[80].

Hence, while studies have consistently highlighted the inadequate consumption of fruits and vegetables among Malaysians, the food supply data suggests that the national supply itself is insufficient to meet population needs according to the dietary recommendations. Such an observation was also reported in many other countries[81], indicating that the inadequate supply of fruits and vegetables is not an issue unique to Malaysia. Globally, the supply of fruits and vegetables is 22% short of the total population's needs, according to nutritional recommendations[82].

[79] NCCFN (2021). For children aged 6 years old and below, the recommended daily serving size for fruits and vegetables is two respectively.
[80] WHO (2018)
[81] Mason-D'Croz et al. (2019); Siegel et al. (2014)
[82] Siegel et al. (2014)

However, several limitations must be considered when interpreting the data from FBS and SUA. Although the FBS and SUA take into account the food waste and losses on the farm and during the distribution and processing, it does not factor in the edible food wasted or lost at the household level, such as during preparation, cooking, storage, plate waste, or discarded[83]. It also does not take into account food produced from subsistence farming, home production and non-retail markets[84]. Hence, the amount of calories and macronutrients actually available may not be equivalent to the amount of food available based on the FBS methodology.

Additionally, the national level estimates per capita provided by FBS do not provide any indications of the differences in intakes by key demographics such as age, sex, and geographical areas[85]. Nonetheless, the datasets have been widely used to provide estimates of temporal food availability at the national level, considering that its methodology is well-standardised and recognised across countries[86]. Hence, the food availability data from FBS and SUA should be interpreted in conjunction with other indicators to provide a more comprehensive picture.

Food supply does not only come from domestic production, but a significant part of it is also obtained through trade to meet the increasing consumption needs due to population and income growth[87]. In their study, Remans et al. (2014) assessed the nutritional diversity of food production and supply in countries including Malaysia using Shannon Entropy[88] and Modified Functional Attribute Diversity (MFAD)[89]. The Shannon Entropy measures the types of food items available in a country and the evenness of their distribution, whereas the MFAD measures this in terms of nutrients.

[83] FAO (n.d.)
[84] Ibid.
[85] Ibid.
[86] Al Hasan et al. (2022); Siegel et al. (2014); Sheehy and Sharma (2011); Garcia-Closas, Berenguer, and González (2006)
[87] Sundaram and Tan (2019)
[88] Shannon (1948)
[89] Schmera, Erős, and Podani (2009);

Their results show that during the period when Malaysia transitioned from a low-income to an upper-middle-income country (UMICs), our production diversity and supply diversity also decoupled over time[90]. As the diversity of food produced declined sharply between 1960 and 2010, Malaysia's diversity of food supply that was available for human consumption continued to rise[91]. **Malaysia's ability to maintain supply diversity despite declining production diversity indicates that our nutritional diversity is compensated through food imports**[92].

As this transition coincided with a period of increased export and import values, such a change was likely driven by the shifts in macroeconomic policies. Indeed, past studies that examined Malaysia's food import reported an upward trend in the import quantity of most food items[93]. The latest statistics in 2022 show that Malaysia's food import bill remains high, at RM75.6 billion[94].

Alongside the rise in food imports, however, is the increased import of ultra-processed, energy-dense and high fat, sugar or salt (HFSS) foods that are recognised to be associated with NCDs such as obesity, high cholesterol, high blood pressure, and heart and blood vessel diseases. In order to examine the temporal trends of healthy and unhealthy food imports, food commodities based on the HS codes were extracted from the United Nations Comtrade Database and then categorised as healthy and unhealthy foods based on the classifications used in published studies[95].

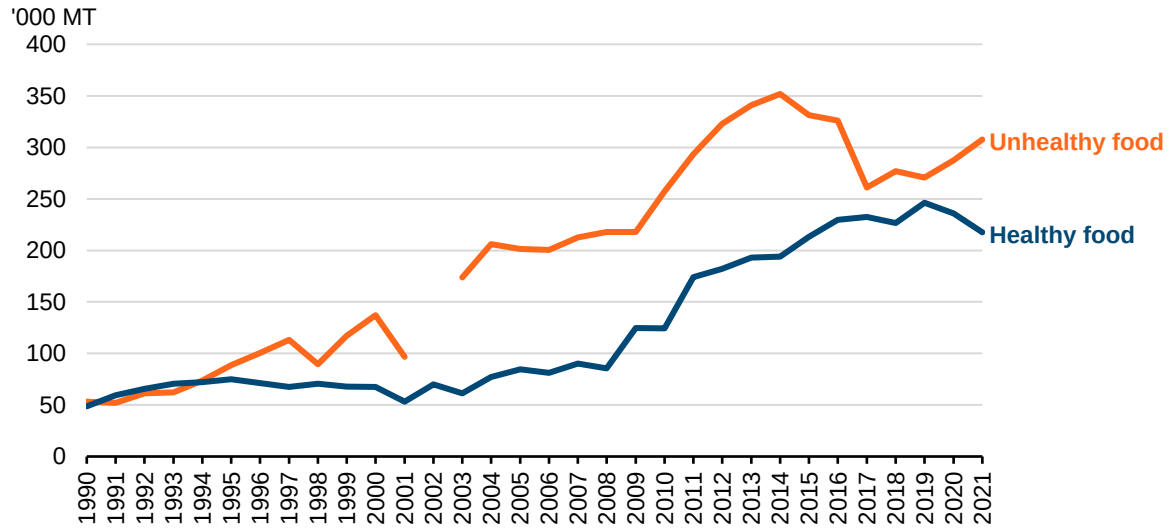
Healthy foods include fresh fruit and vegetables, pulses, nuts and seeds, and staple whole-grain cereals[96]. The relatively unhealthy foods comprise ultra-processed, energy-dense, and high-fat foods that are associated with elevated obesity and NCD risks[97]. They include fatty meat products, high-fat, processed dairy products, energy-dense or sweetened beverages, savoury ready-to-eat snacks and meals, sweet snacks, and sweet, packaged breakfast cereals[98]. All commodities included in the healthy and unhealthy food groups are listed in Appendix I.

[90] Remans et al. (2014)
[91] Ibid.
[92] Ibid.
[93] Che Omar (2022); Sundaram and Tan (2019)
[94] DOS (2024)
[95] Brewer et al. (2023); Friel et al. (2013)
[96] Friel et al. (2013); Brewer et al. (2023)
[97] Lim et al. (2012); Barry M. Popkin (1998); WHO (2003)
[98] Friel et al. (2013); Brewer et al. (2023)

As depicted in Figure 8, the weight of imported ultra-processed, energy-dense, and high-fat foods has been increasing at a compounded annual growth rate (CAGR) of 5.82% since 1990. The import of healthy food also showed an upward trend during the same period, albeit at a smaller absolute quantity and CAGR of 4.94% than that of unhealthy food. Notably, in the early 90s, the quantity of healthy food imported was comparable to that of unhealthy food and started to diverge from the mid-90s.

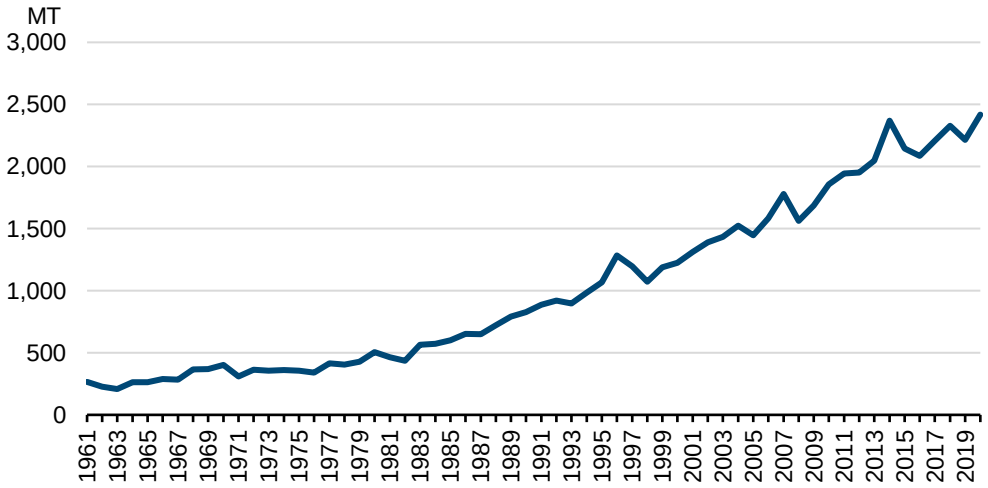
The import quantity of sugar and sweeteners has been on the rise as well (see Figure 9); the availability and consumption of which have been consistently shown to increase the risk of diabetes and obesity. This finding, when interpreted in conjunction with the significant caloric share of sugars and sweets in our food supply (see Figure 6), suggests that a considerable supply of this food group is imported.

Figure 8: Weight of healthy food and unhealthy food imported, 1990 – 2021



Source: Author's calculations based on Friel et al. (2013), United Nations (2020), and Brewer et al. (2023)
Note: The quantity of unhealthy food imported in 2002 was excluded from the chart due to an abnormally high number. MT = metric tonne

Figure 9: Weight of sugar and sweeteners imported, 1961 – 2021



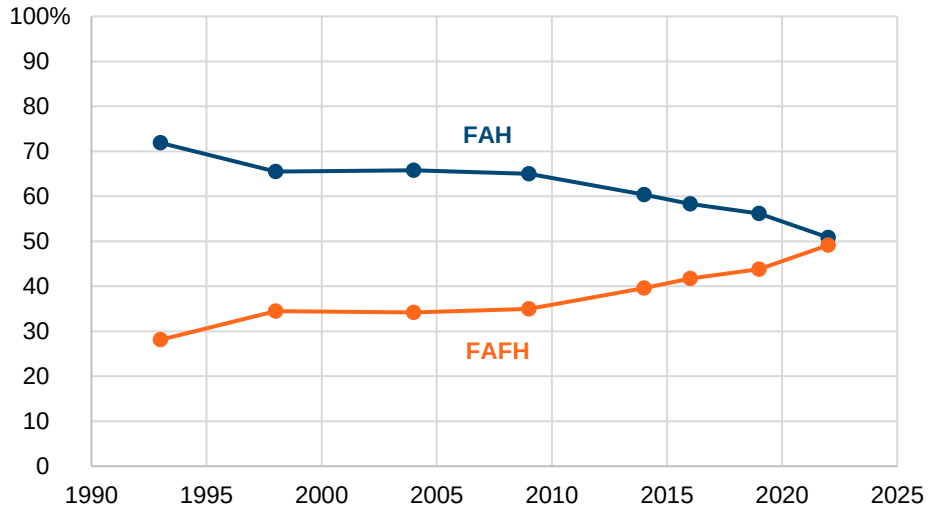
Source: United Nations (2020), Author's Illustration

Although the food supply data presented here is not a comprehensive indication of actual food consumption, it is important to note that what is available is what is consumed. **When food availability, particularly healthier food, is constrained, and unhealthier food is abundant, people may be 'sludged' to make unhealthy choices, leading to poor health.** The implication of the abovementioned findings can, therefore, be significant.

As the national food supply shifts towards a more energy-dense, high-fat and high-sugar diet, Malaysian households also experience a transition in consumption expenditure patterns. During the period from 1993 to 2009, food at home (FAH) were the primary source of food for Malaysian households[99] (Figure 10). The rest were supplemented by food obtained away from home (FAFH), such as from street vendors, restaurants, cafés, fast food restaurants, hotels, canteens, cafeterias of educational institutions, as well as takeaways from these places[100].

The role of FAH as the primary source of food for Malaysian households has since been gradually substituted by the increased consumption of FAFH. In 2022, Malaysian households spent an almost equal proportion of FAH and FAFH[101]. If the current trend were to continue on the same trajectory, it is possible that FAFH may overtake FAH as the primary source of food for Malaysian households. Such a change in household food consumption expenditure can have significant dietary and nutrition implications, considering that FAFH tends to be high in energy, fat, and salt (see Subsection 3.2).

Figure 10: Proportion of household FAH and FAFH consumption expenditure, 1993 – 2022



Source: DOS (2022), Author's Illustrations

[99] DOS (2023a)
[100] Ibid.
[101] Ibid.

The diversification of diets has contributed to the increasing supply of calories and fat, of which excessive consumption has well been recognised to contribute to obesity and NCDs[102]. This is in part due to the growing import of ultra-processed, energy-dense, high-fat, and sugary foods. Meanwhile, with an insufficient national supply of fruits and vegetables hindering adequate consumption of fruits and vegetables, achieving healthy diets may not be a viable goal for people in Malaysia. The growing prevalence of eating out behaviours and food delivery among Malaysian households also poses additional challenges to healthy eating. Collectively, these trends may reflect a food environment where unhealthy foods are readily available.

3.2. Food Properties

The properties of food have greatly evolved with the advancements in food processing technology and consumer demands. Emerging health needs and environmental concerns of consumers also help drive innovations in food processing and packaging. Food acquisition patterns used to be and are still primarily driven by food safety concerns[103]. However, with rapid urbanisation, modern food retail boom, and time scarcity due to work and commute[104], easy access and convenience of food, on top of low prices, can be more important or even outweigh consumers' concerns regarding food safety[105]. Indeed, packaged and processed foods, in which convenience is a crucial feature, now comprise a significant share of diets worldwide[106].

Rapid urbanisation has brought about profound changes in lifestyle and food habits among Malaysians[107]. As discussed in the previous subsection, food away from home or FAFH, which used to be an aspirational or discretionary expenditure item, is fast becoming a necessity among Malaysian households. The FAFH is gaining popularity among Malaysian households for various reasons. Urbanisation improves the availability and choices of food, particularly through modern food vendors and food service establishments such as fast food restaurants[108].

[102] L. Wang et al. (2020); WHO (2021)
[103] Liguori et al. (2022)
[104] FAO (2023)
[105] Liguori et al. (2022)
[106] Development Initiatives (2020)
[107] Poulain et al. (2020)
[108] MOH (2008); H. S. H. Lee and Tan (2007)

Meanwhile, income growth enables people to have higher purchasing power and greater demands for a diverse range of foods[109]. As the share of the population engaged in the labour force increases, the issue of time poverty also becomes prevalent, limiting the time people, especially women, have to prepare and consume food at home[110]. This issue is particularly common among urban households who tend to spend longer time travelling between work and home due to traffic congestion[111].

The FAFH is favoured for several reasons: convenience, opportunities for socialisation, palatability, and aspiration[112]. For busy families and individuals, purchasing ready-cooked food from street food vendors or consuming food at food service establishments provides a quick and convenient alternative to cooking at home. They also present the opportunity to eat out not only during typical mealtimes but also at any time in a variety of contexts, such as for work meetings, social gatherings, and celebrations[113].

FAFH are also highly desirable for their taste and diversity. The emergence of culinary cosmopolitanism[114] in the major cities of Malaysia provides urban consumers a vast opportunity to get a taste of food from foreign cultures, such as European cultures (e.g. French, Spanish, and Italian), other Asian cultures (e.g. Japanese, Korean, and Vietnamese), and transnational fast food cultures (e.g. McDonald's, Subway, Jollibee, and Kentucky Fried Chicken)[115]. Even when they are more expensive than home-cooked meals, FAFH, particularly those purchased from food service establishments, can be seen as aspirational.

[109] A. K. G. Tan (2010)
[110] Prochaska and Schrimper (1973)
[111] H. S. H. Lee and Tan (2007)
[112] N. N. Abdullah et al. (2015)
[113] Poulain et al. (2020)
[114] Culinary cosmopolitanism is defined by the disposition and the openness to embrace foreign cuisines and participate in transnational foodways. Source: Cappeliez and Johnston (2013)
[115] Poulain et al. (2020)

Despite the benefits, FAFH intake is generally associated with higher energy intake and poorer diet quality[116]. Their portion sizes tend to be bigger than food prepared at home, increasing the likelihood of overconsuming calories. Those who eat out more frequently are also found to be more likely to consume more fat[117], sodium[118], and sugar-sweetened beverage (SSB)[119]. In other words, FAFH consumption may increase one's intake of HFSS foods. A significant source of FAFH is fast food restaurants, which are popular among adolescents and young adults[120]. Adolescents who eat out frequently tend to opt for fast food, which is associated with the overconsumption of cereals, meat, poultry, or eggs and the inadequate intake of vegetables[121].

However, there is little evidence to establish the connection between the consumption of FAFH and poor nutritional status in Malaysia[122]. The lack of evidence may suggest that the relationship between eating out and overweight or obesity may be more complex. Factors such as the type of restaurants, the kind of food they served, and the sociocultural aspects of food away from home in the Malaysian multi-cultural contexts may come into play with health and dietary implications[123]. The growing significance of FAFH in shaping our diets and health is a crucial research area that requires in-depth examination.

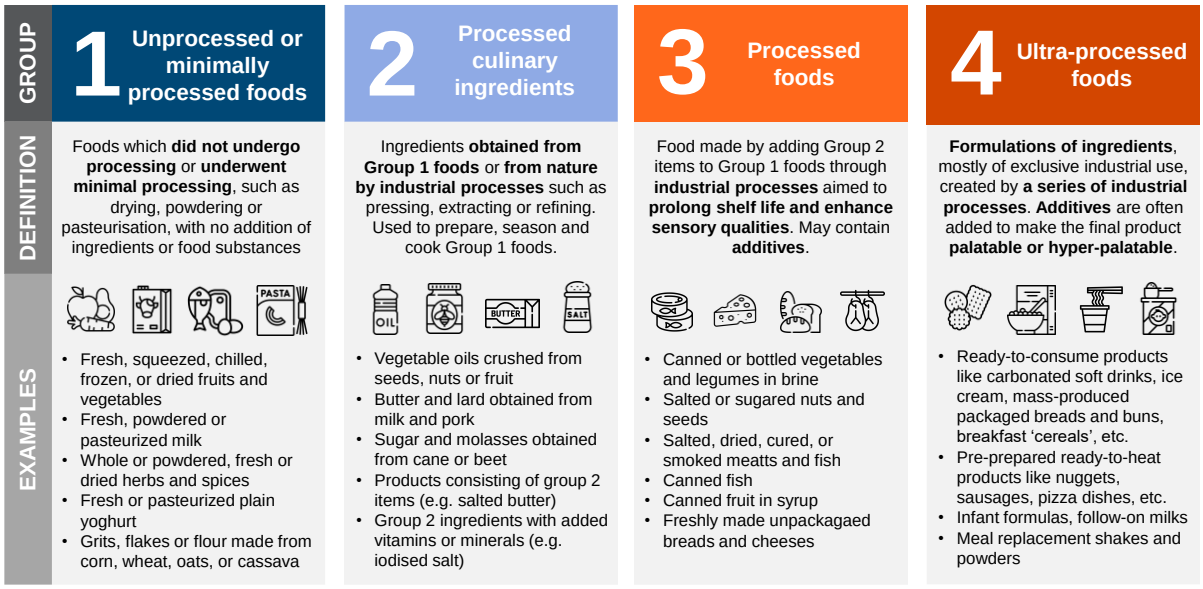
Since prehistoric times, various processing techniques have been explored and used to make food safer, more shelf-stable, and palatable. **However, in recent decades, the increasing use of industrial techniques has initiated a paradigm shift from conventional food processing to more advanced and novel processing**[124]**, leading to a growing share of ultra-processed foods (UPFs) in the current market**[125]**.**

[116] Landais et al. (2023); N.-F. Abdullah, Teo, and Foo (2016); Man et al. (2020); Cynthia, Zalilah, and Lim (2013); Karupaiah et al. (2013)
[117] Cynthia, Zalilah, and Lim (2013)
[118] Ashari et al. (2022)
[119] Balasubramanian et al. (2020)
[120] N. N. Abdullah et al. (2015); Man et al. (2021)
[121] Man et al. (2021)
[122] Pell et al. (2016); Fournier et al. (2016)
[123] Ibid.
[124] Capozzi et al. (2021)
[125] Baker et al. (2020)

The term "UPFs" was introduced in NOVA, a processing-oriented classification system that is recognised by FAO[126]. Distinct from the conventional food classifications that group food and food items by their botanical origin or animal species and nutrient contents, the NOVA classification system is based on the nature, extent, and purpose of food processing[127].

According to the NOVA classification system, processed foods exist along a spectrum from unprocessed or minimally processed foods, processed culinary ingredients and processed foods to UPFs that can only be created by a multitude of sequences of industrial processes[128]. UPFs encompass a wide range of foodstuffs that are mostly or entirely formulated from substances derived from foods and additives. They include HFSS foods like soft drinks, confectionery, pre-prepared ready-to-heat products, reconstituted meat products such as nuggets and sausages, and ready-to-eat food and beverage. The definition and examples of each classification are listed in Figure 11.

Figure 11: The NOVA food classification



Source: Monteiro et al. (2019), Author's Illustration

[126] Monteiro, Cannon, et al. (2018); Monteiro et al. (2019)
[127] Monteiro, Cannon, et al. (2018)
[128] Monteiro et al. (2019)

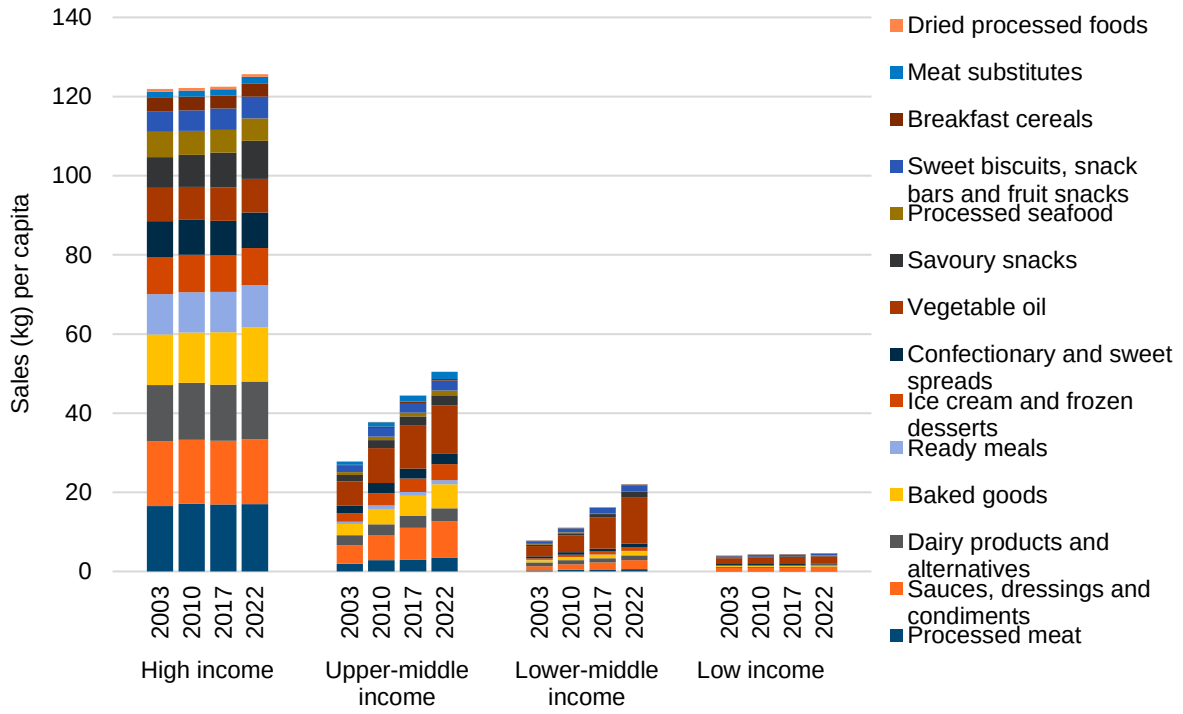
Studies that examined national dietary patterns classified based on NOVA consistently reported the pervasive growth of UPF sales and consumption, which was shown to displace the intake of unprocessed or minimally processed foods and freshly prepared dishes and meals. For example, the share of UPFs in total caloric intake had been growing exponentially from much lower levels to over half in Canada[129], the United Kingdom (UK)[130] and the United States (US)[131], over 40% in Australia and Sweden[132], nearly one-third in Chile[133] and Mexico[134], and over one-quarter in Brazil[135] for the past few decades. Some of these studies also reported a significant share of UPF consumption among children and adolescents[136].

In Malaysia, findings regarding UPF consumption remain limited and primarily come from cross-sectional studies, which limit generalisation to the population level. Findings from past studies suggest that UPFs consumption among adolescents and adults ranges from 24 to 31% of the total food intake[137]. In terms of the frequency of consumption, one study reported 33% among adults, with packaged breads and buns, cookies, biscuits, ready-to-cook noodles, and cocoa drinks being the most consumed[138]. The evidence, albeit limited in number and generalisability, suggests that UPFs are consumed in considerable proportion of the diets among certain groups of Malaysians.

A more recent study that analysed trends and patterns of UPF and beverage (UPB) consumption in 80 countries, including Malaysia, demonstrated that the rapid growth of UPFs is a worldwide phenomenon[139]. Between 2006 and 2019, UPF and UPB sales were on an upward trend across all country income groups and regions (Figure 12 and Figure 13). The results also showed that as a country's income rises, the sales of UPF and UPB tend to follow; sales growth of UPF and UPB measured in compounded annual growth rate (CAGR) was particularly strong in upper-middle-income countries (UMICs) and LMICs, with signs of stagnation in HICs, possibly due to market saturation[140].

[129] Monteiro et al. (2013); A. P. B. Martins et al. (2013); Moubarac et al. (2014)
[130] Monteiro, Moubarac, et al. (2018)
[131] Steele et al. (2016)
[132] Mertens, Colizzi, and Peñalvo (2022); Machado et al. (2019)
[133] Cediel et al. (2018)
[134] Marrón-Ponce et al. (2018)
[135] Monteiro et al. (2013); A. P. B. Martins et al. (2013); Moubarac et al. (2014)
[136] Sparrenberger et al. (2015); Marrón-Ponce et al. (2018); Polsky, Moubarac, and Garriguet (2020)
[137] Ganesrau et al. (2023); Asma et al. (2019)
[138] Amani Mohammad, Ramli, and Sharif (2023)
[139] Baker et al. (2020)
[140] Ibid.

Figure 12: Ultra-processed foods sales (kg) per capita by country income level, 2006 – 2019, with projections to 2022

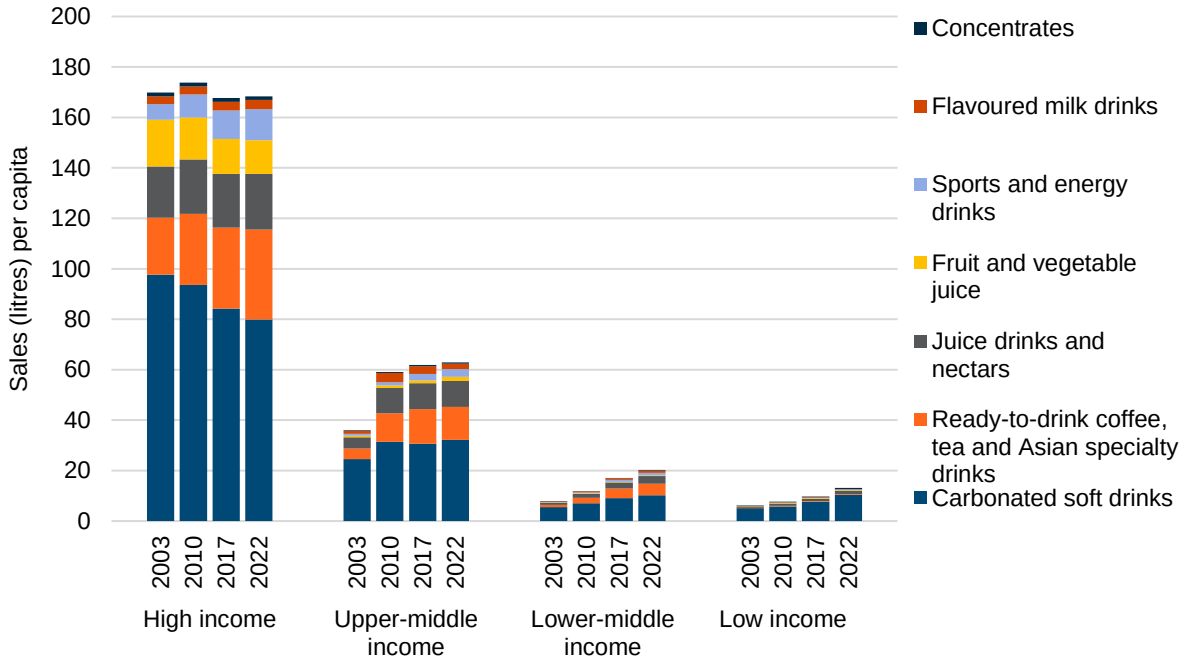


Source: Adapted from Development Initiative (2020)

As a UMIC, Malaysia is also undergoing a similar dietary transition. Malaysia's combined UPF and UPB sales in 2019 were comparatively lower than most UMICs. However, it displayed a moderately high sales growth (4%), similar to China and Iran but higher than many UMICs, such as Thailand, Kazakhstan, Mexico, Brazil, Costa Rica, Serbia, and Argentina. The main factor contributing to the rising combined sales was the stronger sales growth of UPB, which mainly consists of SSBs such as carbonated soft drinks, juice drinks and nectars, ready-to-drink coffee and tea, and Asian speciality drinks[141]. This suggests a concern with SSB consumption among Malaysians, a risk factor for diabetes and obesity.

[141] Baker et al. (2020)

Figure 13: Ultra-processed beverages sales (kg) per capita by country income level, 2006-2019, with projections to 2022



Source: Adapted from Development Initiative (2020)

The convenience (long shelf life and ready-to-consume), high palatability, affordability (low-cost ingredients) and high profitability of UPFs, coupled with attractive packaging and marketing that especially appeal to children[142], are the mechanisms responsible for these shifts in dietary consumption. However, there are some disagreements and criticisms regarding the validity of NOVA classification and the UPF concept by the agro-food industry and some researchers. Some argue that the UPF definition is ambiguous and the causality between UPF consumption and poor health is not well-established[143]. Some opine that the NOVA classification is confusing for consumers and does not help inform dietary guidelines compared to the existing nutrient-based profiling system[144].

[142] Pulker, Scott, and Pollard (2018); Vignola, Nazmi, and Freudenberg (2021)
[143] Gibney et al. (2017); Astrup, Monteiro, and Ludwig (2022)
[144] Astrup, Monteiro, and Ludwig (2022); Petrus et al. (2021); J. M. Jones (2019)

Despite the criticisms of the NOVA classification and UPF concept, multiple countries have adopted the NOVA classification in their dietary guidelines (see Box 1). Furthermore, the existing body of global research evidence consistently shows the association between UPF consumption and many diet-related poor health outcomes. Studies have shown that UPFs contribute significantly to the higher consumption of calories, added sugar [145], salt, poor quality fat and protein, high glycaemic index carbohydrate, and lower micronutrient and fibre contents. Most, if not all, of these factors are well-recognised to be linked to adverse health outcomes.

Indeed, there is a growing body of evidence that demonstrates the association between UPF consumption and higher risks of obesity [146], diabetes [147], hypertension [148], cardiovascular diseases [149], depression [150], as well as all-cause [151] and cardiovascular mortality. The dietary and health implications are not limited to adults but also to children and adolescents[152], indicating the potential of a widespread population health risk and the urgent need for public health responses[153]. Although studies investigating the health implications of UPFs in the Malaysian population remain scarce, the available findings similarly found higher health risks, such as obesity and inflammatory bowel disease, associated with UPF consumption[154].

[145] Cediel et al. (2018); Steele et al. (2016)
[146] Monteiro, Moubarac, et al. (2018); Mendonça et al. (2016)
[147] Srour et al. (2020); Z. Chen et al. (2023)
[148] M. Wang et al. (2022)
[149] Yuan et al. (2023); Pagliai et al. (2021)
[150] Pagliai et al. (2021); Gómez-Donoso et al. (2020)
[151] Yuan et al. (2023); Pagliai et al. (2021); Suksatan et al. (2021)
[152] Rauber et al. (2015); Cascaes et al. (2023); Zhang et al. (2022); Mesas et al. (2022); G. M. S. Martins et al. (2022); Y.-C. Chen et al. (2018)
[153] Touvier et al. (2023)
[154] Ganesrau et al. (2023); Narula et al. (2021)

Box 1: National dietary guidelines that have incorporated the NOVA classification or advice on UPF consumption

In light of the growing body of evidence that supports the negative health consequences of UPF consumption, several countries have adopted the NOVA classification as the basis of their national dietary guidelines or incorporated UPFs in their dietary recommendations. The Brazilian Dietary Guidelines[155] published in 2014 were recognised by FAO as the first food-based dietary guidelines that take social, cultural, economic, and other aspects of sustainability into account[156]. In the document, each NOVA classification is explained with food examples provided. The dietary recommendations about the consumption of each NOVA food group are provided with biological, cultural, social, and environmental reasons to aid consumers' understanding[157].

The document also provides specific guidelines for the Brazilian population on the various combinations of local healthy foods in the form of meals (breakfast, lunch, dinner, and small meals) to assist in meal preparation and the benefits of different eating modes or contexts. One of the chapters also addresses the common obstacles to following dietary recommendations and provides advice on overcoming them.

Based on the NOVA classification, the Brazilian Dietary Guidelines listed one golden rule—always prefer natural or minimally processed foods and freshly made dishes and meals to UPF—and four main recommendations, as follows:

- Make **natural or minimally processed foods**, in great variety, mainly of plant origin, and preferably produced with agroecological[158] methods, the basis of your diet.
- Use **oils, fats, salt, and sugar** in small amounts for seasoning and cooking foods and to create culinary preparations.
- Limit the use of **processed foods**, consuming them in small amounts as ingredients in culinary preparations or as part of meals based on natural or minimally processed foods.
- Avoid **ultra-processed products**.

[155] Brazilian Ministry of Health (2015)
[156] Fischer and Garnett (2016)
[157] Brazilian Ministry of Health (2015)
[158] Agroecology refers to holistic and integrated farming approach that integrates ecological and social concepts and principles to the design and management of food production. Source: FAO (n.d.)

The 2016 edition of the Uruguayan Dietary Guidelines similarly acknowledged the NOVA classification and the importance of lifestyle and food environment on food choices[159]. The key component of the Uruguayan Dietary Guidelines is the food guide, visualised as a disk displaying five food groups to be consumed in appropriate amounts and regularly as part of a healthy diet[160]. Additional messages complement the food guide, including promoting physical activity, enjoying and sharing food, avoiding meal-skipping, using traditional foods, and restricting UPF consumption[161].

Although the whole NOVA classification is not used in defining the dietary guidelines, Malaysia, Ecuador, Belgium, Maldives, Peru, and France have explicitly mentioned UPF and its negative health impacts and advised on the reduction or avoidance of UPF[162]. For example, France's National Nutrition and Health Program's dietary guidelines set a target to reduce population consumption of UPF by 20% from 2018 to 2021[163].

The Malaysian Dietary Guidelines 2020 highlights foods that should be consumed in limited quantities, specifically fats, oils, sugar, and salt, at the top of the Malaysia Food Pyramid 2020[164]. The note accompanying the illustration for this category includes UPFs, indicating that UPFs that contain artificial additives should be limited in the diet[165]. According to Key Recommendation 3 of the dietary guidelines, Malaysians are advised to limit intake of UPFs that are nutritionally unbalanced, favour natural ingredients for cooking, reduce the eating frequency at fast food restaurants, and refrain from consuming ready-to-eat frozen foods sold in convenience stores[166]. It is noteworthy that Malaysia is the first Southeast Asian country to provide advice on UPF consumption in its national dietary guidelines.

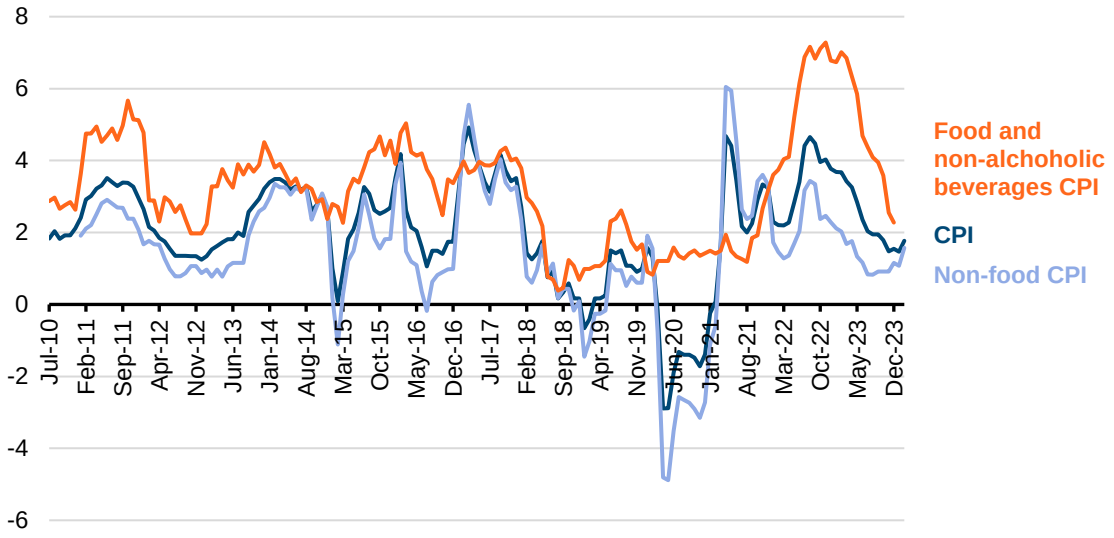
[159] Ministerio de Salud Pública (2016)
[160] Ibid.
[161] FAO (n.d.)
[162] NCCFN (2021); Superior Health Council (2019); Ministerio de Salud Pública del Ecuador and FAO (2020); Health Protection Agency (2019); Luis, Serrano, and Domínguez Curi (2019); Ministère de la Santé et de la Prévention (2018), 2019–23
[163] Ministère de la Santé et de la Prévention (2018), 2019–23
[164] NCCFN (2021)
[165] Ibid.
[166] Ibid.

3.3. Food Affordability

Worldwide, food prices have been on the rise due to geopolitical conflicts, global supply chain disruptions, rising input prices, labour shortages hitting especially the agriculture industry and more frequent extreme weather that affects food production[167]. Rising food prices in Malaysia have increasingly been at the centre of discussion, particularly during the pandemic. Over the past decades, food inflation, measured as the year-on-year (YoY) change in food and non-alcoholic beverages consumer price index (CPI), has risen at a faster rate than overall inflation or CPI, with a notable surge in 2022 (See Figure 14)[168]. The surge was due to Russia's invasion of Ukraine, both of which are major grain producers and exporters in the world[169].

More recently, inflation has been on a downward trend, but the CPI figure for food and non-alcoholic beverages remains elevated compared to the pre-conflict levels. **The continual escalation of food prices has inevitably pushed up the cost of a healthy diet. This is of particular concern, especially in light of the rising share of the population who is living with food insecurity and malnutrition**[170].

Figure 14: Consumer price indices year-on-year inflation, 2010 – 2023



Source: CEIC (2024)

[167] World Bank (2023b)
[168] CEIC (n.d.); DOS (2023b)
[169] Lin et al. (2023)
[170] FAO (2023)

The cost of a healthy diet, as defined by FAO, is the cost of the most affordable locally available foods needed to meet energy and food-based dietary requirements[171]. The healthy diet consists of six food groups in a standard basket called the Healthy Diet Basket for a representative person with an energy intake of 2,330 kcal/day[172]. The reported cost of a healthy diet was the median cost of meeting ten national food-based dietary guidelines, representing a comprehensive range of dietary recommendations at the regional level[173]. A healthy diet is considered unaffordable when its cost exceeds 52%[174] of the household income in a country[175].

As depicted in Figure 15, there has been little progress in reducing the number of people who cannot afford a healthy diet in Malaysia since 2017. In 2021, an estimated 800,000 people or 3% of the Malaysian population were unable to afford a healthy diet. The figure has declined marginally from 2017. However, part of the progress was reversed due to the economic impact of the pandemic, which further exacerbated food insecurity[176]. As a result, the number of people unable to afford a healthy diet rose in 2019, nearly offsetting the improvement achieved over the previous two years.

Concomitantly, food inflation prevailed. **In 2017, before the pandemic happened, a healthy diet would cost 3.22 purchasing power parity dollars (PPP $) or 5.34 Ringgit Malaysia (RM) per capita per day in Malaysia, more than triple the cost of an energy-sufficient diet**[177]. **Over four years, the cost has climbed by 9.2%, recording RM5.83 in 2021**. Rising costs of food, coupled with wage stagnation, have inevitably made food, particularly healthy food, less affordable. **The rising cost of a healthy diet will pose a major obstacle to achieving healthy eating and optimal nutritional status**.

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[171] FAO (2023)

[172] FAO (2023); Herforth et al. (2022);

[173] Ibid.

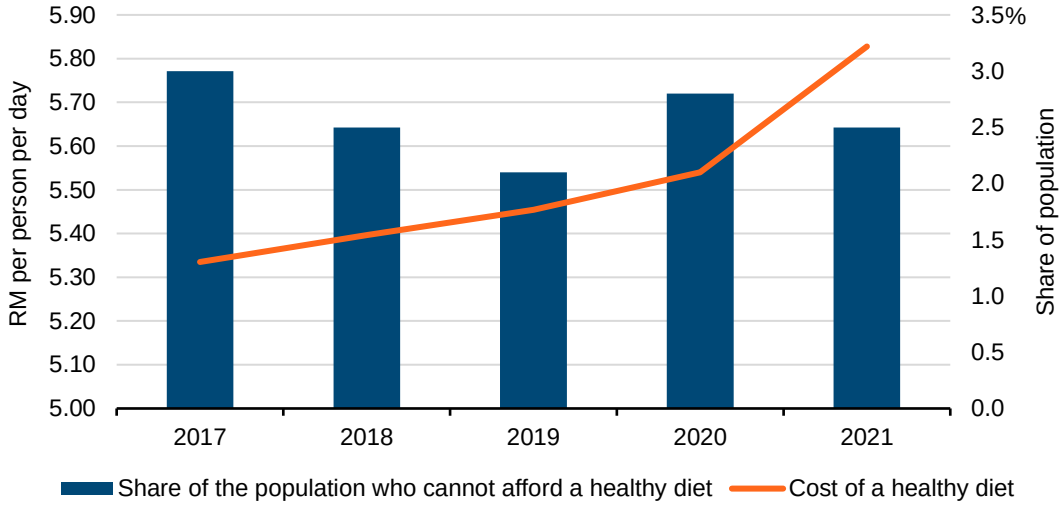
[174] World Bank (2017). The 52% refers to the portion of income that can be credibly reserved for food expenditure. The figure is derived from the observations that the population in low-income countries spend an average of 52% of their household income on food, based on the 2017 national accounts household expenditure data of the World Bank's International Comparison Programme.

[175] FAO (2023)

[176] FAO et al. (2022)

[177] FAO (2023); An energy-sufficient diet refers to meals made up of the most affordable locally available starchy staple food for daily subsistence, without meeting nutrient adequacy or other dietary requirements. The cost of an energy sufficient diet is calculated based on the least-cost starchy staple available in each country. The purchasing-power-parity (PPP) is the rate at which the currency of one country needs to be converted into that of a second country to ensure that a given amount of the first country's currency will purchase the same volume of goods and services in the second country as it does in the first.

Figure 15: Cost of a healthy diet and the number of people who cannot afford a healthy diet in Malaysia, 2017 – 2021



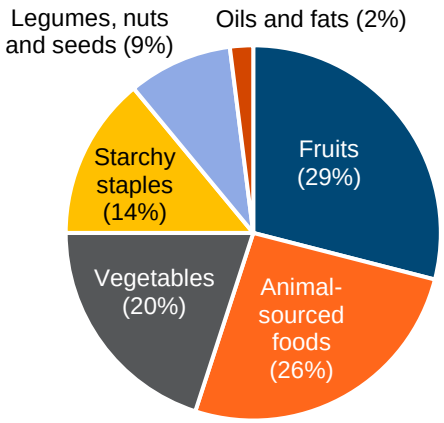
Source: FAO, IFAD, UNICEF, WFP, and WHO (2023)
Note: The costs of a healthy diet were originally expressed in purchasing power parity (PPP) dollars per person per day, which were then converted into Ringgit Malaysia (RM) using the PPP conversion factor obtained from data.un.org.

Micronutrient-rich non-staples contribute to most of the cost. When examined by food groups, fruits alone account for nearly one-third of the cost of a healthy diet, followed by animal-sourced foods and vegetables [178] (see Figure 16). Together, starchy staples, legumes, nuts and seeds, and oils and fats contribute to one-quarter of the cost. Figure 17 illustrates the breakdown of the absolute cost of a healthy diet.

While fruits, vegetables, and animal-sourced foods are nutritious, they are also more expensive. Fruits are approximately two times costlier than starchy staples, a highly affordable and accessible source of calories, followed by animal-sourced foods at 1.8 times and vegetables at 1.4 times [179]. This trend is consistent with the findings reported from a Malaysian study; Pondor et al. (2017) found that as the diet quality improved, the cost of such diets also increased, with a more significant contribution from the costs of cereal products, fruits, and vegetables[180]. This means to acquire a healthy diet, one must first be able to afford it.

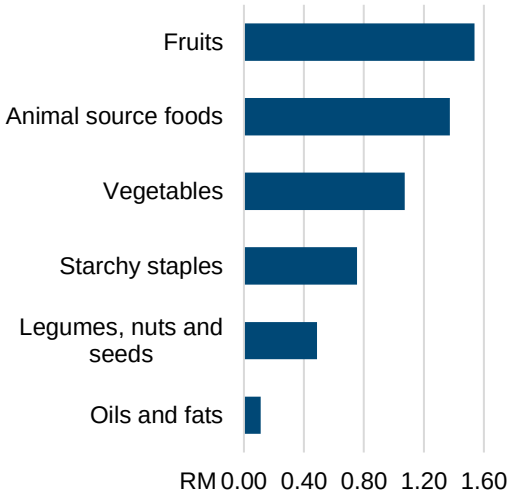
[178] World Bank (2023a)
[179] Ibid.
[180] Pondor, Gan, and Appannah (2017)

Figure 16: Cost shares of food groups in a healthy diet in Malaysia, 2017



Source: World Bank (2023a)

Figure 17: Cost of a healthy diet by food group in Malaysia, 2017



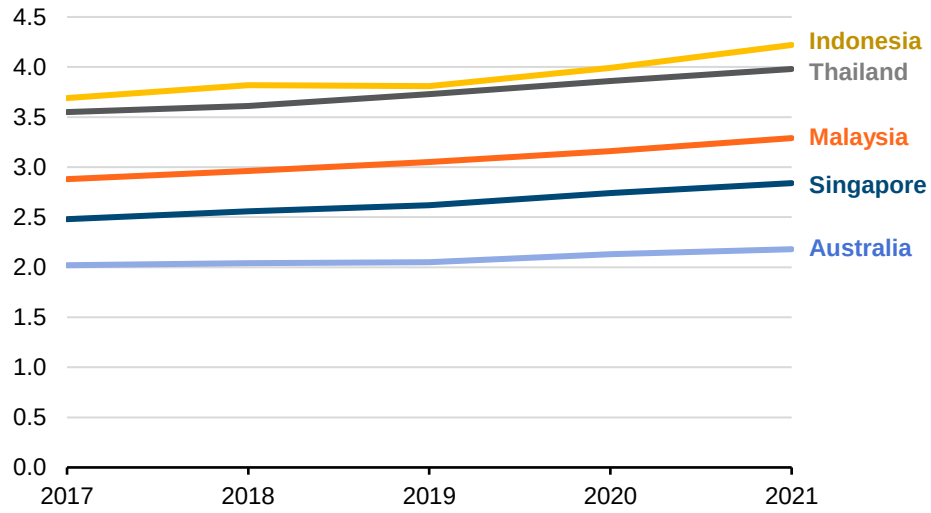
Source: World Bank (2023a)

Ironically, fruits and vegetables are the food groups that Malaysians, on average, do not consume adequately. The MDG 2020 recommends that adults consume at least three servings of vegetables and two servings of fruits daily[181]. According to the National Health and Morbidity Survey (NHMS) 2019 and 2023, almost all Malaysian adults (94.9% and 95.1%) do not consume adequate fruit and vegetable intake[182]. **The prevalence appears to differ across the income groups.** Adults in the top income quintile are more likely to consume adequate fruit and vegetables[183]. Lower-income adults, on the other hand, are less likely to consume sufficient amounts of fruits and vegetables[184].

When compared to the international food poverty line of $1.12 per day, a healthy diet in Malaysia is 3.3-fold more costly[185]. Measuring the cost of a healthy diet against the international food poverty line allows global comparison and provides an understanding of food affordability by taking into account the income earned. A healthy diet in Malaysia is relatively more affordable than neighbouring UMICs like Thailand and Indonesia but less so than HICs like Australia and Singapore (see Figure 18). **This implies that healthy diets are unaffordable for those living in poverty and just above it.**

[181] NCCFN (2021)
[182] IPH (2020); (2024)
[183] Abd Aziz et al. (2019)
[184] Eng et al. (2022); IPH (2020)
[185] World Bank (2023a); The $1.12 food poverty line is set at 52% of the current international poverty line of $2.15 per day. The 52% is set based on the average share of income spent on food in households in low-income countries.

Figure 18: Ratio of the cost of a healthy diet to the $1.12/day international food poverty line in 2017 PPP $, 2017 – 2021



Source: World Bank (2023a)

Local context-specific studies similarly find healthy eating as generally unaffordable (see Table 2 for the summary of the studies). In their 2016 study, Saleem et al. estimated the cost of consuming healthy diets in Penang based on the menu options provided in the MDG 2010. Healthy diets that meet 1,500kcal of energy requirements were estimated to cost RM27.22 to RM29.37 per person per day[186], or RM845.50 (US$191.50) per person per month in Penang. The costs to meet 2,000kcal and 2,500kcal were even higher, approximately RM1062.30 (US$240.75) and RM1437.60 (US$325.80) per person monthly, respectively.

Another 2014 study estimated that a minimum of RM320.33 per week or RM1,281.32 per month was needed for lower-income, rural households of five in Malaysia to consume the least-cost meals that meet energy and most nutrient recommendations[187]. On the other hand, KRI previously estimated that the minimum daily cost to acquire nutritionally adequate meals for a household of five is between RM25.21 in the least expensive city (Kota Bharu) and RM38.45 in the most expensive city (Kuching) in 2016[188]. This translates to RM766.89 and RM1,169.65 per month for the household. However, these studies may not be directly comparable due to variations in the studied population and methodology in defining nutritious or healthy diets and calculating dietary costs.

[186] Saleem et al. (2016); Caloric requirement varies by gender, physical activity and weight status. The recommended calorie intake of 1,500kcal is for sedentary women and older adults, 2,000kcal for most children, teenage girls, moderately active women and sedentary men, and 2,500kcal or more for teenage boys, active men, very active women as well as underweight men and women. The currency conversion used was 1 RM = 0.23 US$ as reported in the study.

[187] Azahari, Zainal Badari, and Arcot (2014)

[188] KRI (2016)

Table 2: The estimated cost of a healthy or nutritious diet in Malaysia

Source	Definition	Methodology	Settings	Target population	Estimated cost
Azahari (2014)	Malaysia Healthy Food Plan Basket, a weekly home-cooked food basket developed for lower-income families that meets the Malaysian Recommended Nutrient Intake (RNI) and MDG	Mean of the total costs of food included in the basket	Wet markets and supermarkets nearest to the villages sampled in the study	Low-income households in Peninsular Malaysia comprising five members	**RM1,281.32** per household per month[1]
KRI (2016)	Nutritionally adequate diets consisting of home-cooked food items based on the MDG-recommended daily servings for all food groups	Price estimations based on the 1Pengguna website, with the lowest prices for each food item selected	Seven cities in Malaysia: Kota Bharu, Alor Setar, Johor Bharu, Kuala Lumpur, Kuala Terengganu, Kota Kinabalu, and Kuching	Urban households of five	**RM766.89 to RM1,169.65** per household[2] per month or **RM153.32 to RM233.93** per person per month
Saleem et al. (2016)	Examples of home-cooked meals in a one-day menu provided in the MDG for 1,500, 2,000, and 2,500 kcal of caloric requirements	Single time-point walk-in survey	Hypermarkets situated in the centre of the Penang City	General population	**1,500kcal menu: RM845.50** per person per month **2,000kcal menu: RM1,062.30** per person per month **2,500kcal menu: RM1,437.60** per person per month
FAO et al. (2023)	The most affordable locally available foods needed to meet energy and food-based dietary requirements for a representative person with an energy intake of 2,330 kcal/day	Median cost of meeting ten national food-based dietary guidelines	National level	General population	**RM532** per person per month

Note: [1]The reference household consists of a 50 years old adult male, 46 years old adult female, 17 years old adolescent male, 14 years old adolescent male and 8 years old female child. [2]The household includes an adult male (30 – 50 years old), an adult female (30 – 50 years old), a male child (7 – 9 years old), a female child (4 – 6 years old), and another child (1 – 3 years old).

However, it is to be noted that the findings should be interpreted and compared with considerations of the differences in methodology and definition used for the studies. There are two definitions of diet commonly used: a nutritionally adequate diet and a healthy diet. **A nutrient-adequate diet fulfils all key nutrient requirements, including macronutrients and essential micronutrients needed to prevent nutrient deficiencies or toxicity** [189] **. On the other hand, a healthy diet meets dietary requirements, with adequate diversity and quantity within and between food groups that can protect against diet-related diseases**[190]**.**

However, it is argued that a nutrient-adequate diet is less realistic to be practised as it does not meet food group requirements specified in national dietary guidelines and can only be identified using linear programming[191]. In actual practice, people select foods based on food groups, not the specific nutrients present in the food. Additionally, the local studies were based on MDG 2010 and may not reflect the current prices and the latest dietary recommendations in MDG 2020. Today, the cost of a healthy diet will likely be higher due to the effects of inflation.

On top of the actual price tags, several factors can also add to the food cost. These include the time and energy costs (such as electricity, gas, and other fuels) required for transporting, purchasing, storing, preparing, and cooking a household meal[192]. Additional costs are associated with the facilities and equipment required for preparation, storage, and cooking[193]. These costs are seldom taken into account when estimating food costs, but they can have an impact on perceived affordability.

With the growing share of women in the labour force and dual-earner households, the time costs of acquiring and preparing food become higher. They can have a disproportionate impact, especially when the household work, including food preparation, is not distributed equitably between men and women[194]. This subsequently leads to the preference for semi-prepared food, ready-to-eat food, and eating out[195]. This issue, however, is understudied and require investigation to fully understand the prevalence of time poverty in our current society and its impact on food choices.

[189] World Bank (2023a); Herforth et al. (2022); FAO (2023);
[190] Ibid.
[191] Herforth et al. (2022);
[192] A. Lee et al. (2013); Davis and You (2011)
[193] Torzillo et al. (2008)
[194] Baker et al. (2020); Ashari et al. (2022); Ali and Abdullah (2012)
[195] Ashari et al. (2022); Ali and Abdullah (2012)

Discussion around food prices or affordability typically revolves around certain staple food groups or healthy food in general. **In light of the growing availability and consumption of unhealthy food, examining the affordability of unhealthy food is necessary to provide insights into how unhealthy food displaces healthy food consumption.** This is especially relevant considering the growing availability of unhealthy food in the country (see Subsection 3.1). Experience from other countries shows that most, but not all, studies have reported rising disparities between the price of healthy and unhealthy food (see Box 2). In Malaysia, price monitoring of healthy and unhealthy foods is currently lacking. There is a strong need to fill this data gap.

Box 2: Findings from international studies on the affordability of unhealthy food

A systematic review examining 27 studies conducted in the early 2000s across multiple countries found that unhealthy diets (e.g. diets packed with processed foods, meats, and refined grains) were on average ~$1.50 cheaper per day than healthy diets (e.g. Mediterranean-type diets rich in fruits, vegetables, fish and nuts)[196]. Other studies published in more recent years reported a similar trend; food became less affordable and more expensive as its healthfulness or nutrient density increased[197]. However, the generalisation of the findings remains limited due to methodological challenges in aggregating healthy and unhealthy foods[198]. The definition and selection of healthy and unhealthy foods can vary across studies based on the national dietary guidelines and the methodologies used, and most appear to be subjective[199].

With the increasing recognition and adoption, several studies have used the NOVA food classification to identify cost differences between healthy food (unprocessed or minimally processed foods and processed culinary ingredients) and unhealthy food (UPFs). Compared to unprocessed or minimally processed foods, UPFs were found to be cheaper in countries like the US, UK, and Belgium[200]. While food prices generally showed an upward trend, the price increment for UPFs was slower than unprocessed or minimally processed food[201].

[196] Rao et al. (2013)
[197] Colchero et al. (2019); Kern et al. (2017)
[198] A. Lee et al. (2013)
[199] Ibid.
[200] Aceves-Martins et al. (2022); Gupta et al. (2019); Vandevijvere et al. (2020)
[201] Gupta et al. (2019)

Using national data and estimates, Maia et al. (2017) analysed the temporal trends in the prices of food categorised by NOVA food classification in Brazil. They showed that the prices per kg of UPFs were higher than other food groups in 1995, but they started undergoing successive reductions in the early 2000s[202]. Meanwhile, the prices of unprocessed or minimally processed foods and processed culinary ingredients, as well as processed foods, have been increasing continuously. This has led to the narrowing of price gaps between UPFs and other food groups.

Based on the forecast prices up to 2030, the prices of UPFs are estimated to eventually become lower than that of unprocessed or minimally processed foods and processed culinary ingredients[203]. **The findings imply that unhealthy food (UPFs) may become cheaper than healthy food (unprocessed or minimally processed foods and processed culinary ingredients) in the near future for the Brazilian population**.

Maia and colleagues attributed this trend to three contributing factors. Firstly, UPF manufacturers greatly benefit from and are incentivised by the economic growth that brought about technological improvements in the food industry. Secondly, national agricultural policies tend to favour the production of food commodities such as corn, soya, and sugarcane. While these items and their by-products (soybean oil, animal feed, sugar, and ethanol) have economic and commercial significance, they are also the ingredients essential for UPF production. Thirdly, the UPF business is highly profitable. UPF manufacturers often employ promotions and volume discounts to attract consumers at lower prices, further intensifying the consumption and price trends observed in the study.

The observations reported by Maia et al. (2017) are not unique to Brazil but rather signs of a global transition towards a more highly processed diet[204]. The industrialisation of agriculture has facilitated the mass production of cheap food commodities, which are also commonly used as ingredients and inputs for global food production. Concurrently, new markets of aspirational consumers emerge in middle-income countries as rapid urbanisation and income growth take place concurrently.

[202] Maia et al. (2020)
[203] Ibid.
[204] Baker et al. (2020)

Urbanisation prompts greater accessibility to a more diverse range of food, including UPFs and beverages, and shifts to time-scarce lifestyles less conducive to home food preparation[205]. These, alongside the rapid expansion and globalisation of the global UPF manufacturing industry, give rise to the imbalances in the global food system characterised by the growing dominance of UPFs[206].

3.4. Vendor Properties

The availability and the types of food are often conditioned to the types of food retailers available, given that most food consumed is sourced from a food retailer of some sort. A food retailer's decision concerning the type and range of food available in store and their prices and desirability can, therefore, influence consumer's decisions about food purchases[207]. According to Dawson (1995), food retailers are both reactive and proactive to consumer choices[208]; their decisions can drive consumers' food choices and are also shaped by consumers' demands and preferences.

Over the years, the food retail scene in Malaysia has undergone a "supermarket revolution" with the emergence and rapid expansion of more modern and formalised retail at the expense of traditional retail[209]. Traditional food retailers such as wet markets, sundry shops, street vendors and mobile vendors are dwindling. Simultaneously, modern food retailers, including supermarkets, hypermarkets, convenience stores, food e-commerce, and online retailing, are increasingly dominating, especially in urban areas[210] (see Table 3 for the differentiation of various food vendors).

The share of processed food distributed through modern retail channels (convenience stores, supermarkets, and hypermarkets) and their market concentration (indicating high market power and weak competition) has grown rapidly from 1999 to 2013, albeit at a lower rate than other UMICs like China and Thailand[211]. This is a common phenomenon among developing countries fuelled by economic development, urbanisation, and the globalisation of food distribution[212].

[205] Baker et al. (2020)
[206] Development Initiatives (2020)
[207] Hawkes (2008)
[208] Dawson (1995)
[209] MGCC (2016); Reardon, Timmer, and Minten (2012)
[210] Shamsudin and Selamat (2005); MGCC (2016)
[211] Baker and Friel (2016)
[212] Reardon, Timmer, and Minten (2012)

Despite the shift in food retailing, traditional food retails remain the primary source of fresh produce, such as meat, fruits, and vegetables, for Malaysian consumers[213]. While some modern food retailers also offer a wide range of fresh produce, they are generally dominated by processed, dry, and packaged foods[214]. Modern food retail, especially large, multinational food retail chains, is also a common setting where food promotion and marketing are in heavy presence with the purpose of driving processed and, often, less healthy food sales (see Subsection 3.5). Owing to their comparative advantage of selling a large volume of products, they also have greater flexibility in adapting prices to national and local conditions to remain competitive, influencing consumer's food choices with their competitive pricing[215].

While the shift in food retailing has generally resulted in some benefits, such as increased convenience, higher food safety levels, and greater availability of a wider range of food and products, these changes may also have implications for food and lifestyle choices[216]. Consumers' dietary choices are now more influenced by the food sold in food retail, especially modern ones. This is due to their omnipresence, the prices they charge, the promotion and marketing strategies they use, and the services they provide[217].

There is a growing body of evidence that suggests that the dominance of modern food retailers is contributing to a bias towards marketing of less healthy, processed foods and resulting in less healthy population diets[218]. Purchases from these food sources have been shown to gravitate towards highly processed foods at the expense of staple and relatively healthier food compared to traditional retail[219], with adverse health implications such as obesity[220]. Previous studies in the US and Guatemala show that people who live near fast food restaurants and convenience stores or in food deserts are found to be more likely to have obesity and diabetes than those who live near grocery stores, supermarkets, and fresh food vendors[221]. For neighbourhoods that are both lower in income and with a higher availability of fast food restaurants and convenience stores, the prevalence of obesity and diabetes is even higher[222].

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[213] MGCC (2016); Chamhuri and Batt (2009)
[214] Chamhuri and Batt (2009); Serafim et al. (2022)
[215] Hawkes (2008)
[216] Deakin University, VicHealth, and UNICEF (2021); Baker and Friel (2016)
[217] Hawkes (2008)
[218] Deakin University, VicHealth, and UNICEF (2021); Riesenberg et al. (2019); Charlton et al. (2015); Thornton et al. (2013)
[219] Asfaw (2008)
[220] Ibid.
[221] California Center for Public Health Advocacy (2007); Babey et al. (2008)
[222] Babey et al. (2008)

Table 3: Descriptions of various traditional and modern food retail vendors

Types of food retailer	Structure	Customer base	Offered products	Location	Key properties	Examples
Traditional						
Sundry shops	Small, independent, open-fronted stores	Local households Older customers	• Limited range of groceries and local and traditional products, with some popular imported products • The preferred source of daily products and staples, typically bought in small quantities	More commonly found in residential areas as well as rural or small towns	• Convenience • Social bonding	Local, family-own sundry shops
Wet market	Open air market, generally divided into a "wet" section and "dry" section	Traditional, open wet markets mainly cater to local low to middle-income groups. Modernised indoor wet markets are also frequented by higher-income groups	A wide range of local fresh produce, including meat, fish, seafood, live animals, fruits, vegetables, rice, dried seafood, herbs, and spices	Local neighbourhood	• Microcosm of the multi-cultural society • Traditional • Social bonding	*Pasar basah, pasar pagi* and *pasar tani*
Modern						
Convenience stores and mini supermarkets	Small retail business shop	Convenience-seeking consumers due to proximity to their house or workplace	• A small variety of essential, everyday items • Some offer frozen food and instant or ready-to-eat foods • Fresh fruits and vegetables are limited and often not available • Smaller range of products than at supermarkets and hypermarkets	• Urban and suburban areas • Location and concentration correspond to population density	• Convenience • 24-hour operation	Convenience stores like 7-eleven, Family Mart, MyNews and mini-supermarkets like 99 Speedmart, KK mart

Types of food retailer	Structure	Customer base	Offered products	Location	Key properties	Examples
Supermarket	• Self-service store with departmentalised food and household merchandise • Normally located in shopping malls or complexes	Popular across all customer segments, especially low to middle-income groups	• A wide range of fresh and processed food and household products, both locally produced and imported • Larger and broader product selection than sundry shops but smaller in size and product range than hypermarkets	High-density populated areas, especially in urban and suburban areas	• Competitive prices • Regular promotion • Loyalty rewards	Jaya Grocer, Village Grocer, and local supermarkets
Hypermarket/ Superstore	• Self-service distribution store with a sales floor area ≥3,000 m^2 • Standalone buildings with parking lot	Popular across all customer segments, especially families/multiperson households	A wide range of fresh and processed food, household appliances and toiletries, both locally produced and imported	Near populated area*	• Competitive prices • Promotion • Loyalty rewards • Bulk purchase	AEON, Giant, Lotus's, Mydin, and Econsave
Premium stores	Similar to supermarkets	• Middle and high-income segments • Expatriates • Customers with lifestyle trends, e.g. gluten-free, healthier, and sustainable foods	• A wide selection of imported products, including high-end and gourmet food products and local premium products • Wider healthy product range, e.g. organic products and free-range poultry	Urban areas, particularly in affluent neighbourhoods	• Premium • Imported • Specialty	Ben's Independent Grocer, Qra
E-commerce and online retailers	Online vendors that sell and deliver groceries and prepared food to homes	• Digitally literate consumers • Middle to high-income groups • Individuals with time and mobility constraints	Similar or smaller range of products as in the physical stores	Urban and semi-urban areas	• Convenience	Grab Mart, Shopee Supermarket, Pandamart, Tesco Online, MyAEON2go

Source: MGCC (2016)
Note: *There is a general regulation that hypermarkets are not permitted to operate within a 3.5km radius of a residential area or town centre and built-in locations with less than 250,000 residents. Additionally, it is required to provide at least 50 parking lots per 1,000 m^2 of business floor. One hypermarket is allowed for every 250,000 residents.

Studies from other Asian Pacific countries that have undergone the shift in food retailing also reported similar observations. In Thailand, individuals who shopped at supermarkets and convenience stores tended to consume more energy-dense and highly processed foods such as SSBs, processed meats, instant foods, deep-fried foods, and snacks, irrespective of age, sex, income, retail availability, and rurality[223]. Conversely, those who predominantly shopped at fresh markets are more likely to consume sufficient fruits and vegetables[224].

In South Asia, proximity to fast food restaurants is associated with a higher risk of diabetes[225]. In Vietnam, where the food retail transition took place later, food obtained from modern retail outlets constituted a tiny share of dietary intake and did not contribute significantly to the quality of the diet[226]. However, modern food retail, like supermarkets and hypermarkets, was found to be the primary source of UPFs, contributing to 84% of the UPFs consumed[227].

The retail transition may also further drive nutrition inequalities. Retail preferences tend to demonstrate a socioeconomic gradient, whereby lower-income individuals or households rely more on traditional retailers over modern retailers for fresh and nutritious foods[228]. With the decline of traditional food retail, they may have to shift to modern food retailers that offer greater proximity and convenience[229]. This may increase their exposure and accessibility to energy-dense and highly processed foods in these modern retail environments. Not to mention that traditional retailing also serves as a source of livelihood for many low-income individuals[230].

However, our understanding of the impact of this shift in food retailing on dietary quality among Malaysians remains limited because of insufficient local studies and data. The available research evidence on the role of food retail vendors in shaping the Malaysian population's dietary intake is scarce. An ongoing research investigating the retail food environment in Malaysia will hopefully provide critical insights into a to-date understudied issue in Malaysia[231]. The data gaps signal a strong need for more research in this area to facilitate evidence-based policymaking.

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[223] M. Kelly et al. (2014)
[224] Ibid.
[225] Kusuma et al. (2022)
[226] Wertheim-Heck and Raneri (2019)
[227] Ibid.
[228] Wertheim-Heck and Raneri (2019); M. Kelly et al. (2015)
[229] Ibid.
[230] M. Kelly et al. (2015)
[231] Phulkerd et al. (2022)

While learning from other countries' experiences may provide relatable insights, the actual impact is likely context-specific. It depends on geographical, economic, social, cultural, and demographic factors that vary across countries, societies, neighbourhoods, and households[232]. For instance, modern food retailers tend to sell more energy-dense processed foods but also offer a wider range of fresh and healthy foods than some traditional food retailers[233]. This means that different households may experience this transition of food retailing differently, where some communities, such as the low-income group, may face more constraints in making healthy food choices, while others may not[234]. Hence, research investigating the dietary implications of food retail vendors should also take into account the retail food environment, which varies across types and contexts.

Another unfolding trend reshaping the landscape of food retailing in Malaysia is the surge of online food delivery services that was accelerated during the COVID-19 pandemic when restrictions and closures drove people to online food purchases[235]. The trend extends beyond the pandemic phase, as Grab, Malaysia's leading food delivery app[236], estimates that the order volume of food deliveries grew by 24% from 2021 to 2022[237]. This reflects the increased reliance on digital platforms and a fundamental shift in consumer purchasing behaviour. Food retailers, by virtue of the Internet and e-commerce, are now accessible virtually everywhere, including in people's homes.

Such a game-changing trend has a double-edged sword effect. On the one hand, it improves food accessibility and availability by increasing the geographical reach of food sources. The urban population more significantly experiences the benefits than those in rural areas where the geographical reach of food delivery services and the availability of takeaway foods are typically lower. On the other hand, the growing market share of online food delivery services may increase the accessibility of unhealthy food and promote excessive consumption[238].

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[232] Hawkes (2008)
[233] Ibid.
[234] Ibid.
[235] Reardon, Timmer, and Minten (2012)
[236] Oppotus (2023)
[237] Grab (2022). Grab's annual food trends reports are generated based on their primary research data, experts and stakeholder interviews, media trends analysis, and insights from Grab platform.
[238] Jia et al. (2022); Duthie et al. (2023)

Evidence from countries such as Australia, the United States, the Netherlands, and China has shown the dominance of fast food franchises and unhealthy foods on online food delivery platforms[239]. The most popular food items tend to be fast food, energy-dense, nutrient-poor food or SSBs[240]. The use of marketing and promotion tactics, such as vouchers that offer discounts and free delivery, may encourage overconsumption. The heavy presence of marketing and promotion of fast food and unhealthy foods that are energy-dense, nutrient-poor, or ultra-processed on online food delivery platforms has also been reported[241]. **With that, online food delivery may further reinforce and worsen an already obesogenic food environment**[242].

In Malaysia, relatively unhealthy food and beverages also seem to dominate online food delivery app. **Fast food, such as fried chicken and burgers, and sugary drinks, like bubble tea, milk tea and *teh tarik*, are consistently reported as among the top food categories searched or most popular food ordered on GrabFood, a leading food delivery platform in Malaysia, from 2021 to 2023**[243]. Sweetened or carbonated drinks are frequently ordered as teatime and supper snacks[244]. This raises public health concerns as these foods are typically energy-dense and high in sugar, which are significant contributors to obesity, diabetes and other NCDs[245].

The strategy of offering combo sets or add-ons, typically drinks and desserts, to help customers achieve the minimum spend to qualify for free delivery or other promotions may seem like a cost-saving benefit, but it may encourage overconsumption of energy[246]. Furthermore, the convenience of ordering food online and having it delivered to the doorstep may also promote a sedentary lifestyle.

As such, the round-the-clock availability of unhealthy food choices as a result of online food delivery services may have undesirable implications on food intake. Nonetheless, evidence in this area remains scarce, and more research and data in this area are imperative to ascertain the impacts online food delivery services have on the Malaysian population's dietary intake.

[239] Partridge et al. (2020); Poelman, Thornton, and Zenk (2020); Maimaiti et al. (2020)
[240] Partridge et al. (2020); Osaili et al. (2023)
[241] Jia et al. (2022); (2021); Horta, Matos, and Mendes (2021); Horta et al. (2021)
[242] Maimaiti et al. (2020)
[243] Grab (2021); (2022); (2023)
[244] Grab (2021); (2022)
[245] IHME (2019)
[246] Grab (2022); (2023)

3.5. Food Messaging

To date, research pertaining to food messaging in Malaysia remains limited, with food marketing and advertising being more frequently examined. Despite that, **the existing body of evidence consistently points to the targeting of unhealthy food marketing and advertising on traditional broadcast media (primarily television) and, more recently, new non-broadcast media avenues (primarily the Internet) to children**.

Based on television transmission data from 2011 to 2012, a study found that **non-core or unhealthy food was predominantly advertised compared to core or healthy food**. **In addition, the advertising rate was remarkably higher on school holidays compared to normal days** (3.53 and 1.93 food ads/hr/ channel, respectively)[247].

The study defined core or healthy food as low-energy but nutrient-dense food, such as low-sugar, high-fibre breakfast cereals, fruits and vegetable products without added fats, sugar, or salts, and plain milk and yoghurts. Non-core or unhealthy food refers to HFSS foods like SSBs, fast food, processed meat, savoury snacks, and sweets. SSB was the most frequently advertised unhealthy food, similar to the findings from several Asia Pacific countries[248], followed by pastries, cake, and fast food[249]. The higher advertising rate on school holidays was attributed to the more than doubled advertising rate of SSBs[250].

An earlier study conducted in Malaysia in 2006 reported a different observation. Karupaiah and her colleagues found that snacks, ice cream, and biscuits were frequently displayed during children's peak viewing time (PVT)[251]. It varied from the types of food advertised during adults' prime time, which included dairy products, snacks and beverages[252].

Additionally, Ng et al. (2014) reported that **the rate of unhealthy food advertising was the highest during children's PVT, especially during school holidays**[253]. This means during children's PVT, there were three unhealthy foods shown during normal days and ten during school holidays for every one healthy food advertisement shown. Promotional characters like cartoons or celebrities were more commonly used in the advertisement of unhealthy food as a persuasive marketing technique, strengthening the influence of the advertisements[254].

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[247] Ng et al. (2014)
[248] B. Kelly et al. (2016)
[249] Ng et al. (2014)
[250] Ibid.
[251] Karupaiah et al. (2008)
[252] Ibid.
[253] Ng et al. (2014)
[254] Ibid.

Similar to TV, the types of food and beverages advertised on social media and online platforms were primarily unhealthy. In their study, Tan et al. (2018) recorded and interpreted the advertisements encountered while watching the most viewed child-centric videos on YouTube, with a focus on food and beverage advertisements. It was found that over half of the food and beverage advertisements encountered while viewing the selected videos were on unhealthy food, especially fast food, confectionery, and cakes and pastries, at a frequency of 1.3 advertisements per hour[255].

The strategy in which unhealthy food was advertised on YouTube also differed from that of healthy food. Unhealthy food tended to be advertised via video ads, which were more prominent, engaging and contained more persuasive marketing techniques[256]. On the other hand, healthy food was frequently shown as overlay advertisements. A variety of persuasive marketing techniques were also used in unhealthy food advertisements, ranging from taste appeal, positioning the product as new or unique, animation, fun appeal, promotional characters, and price advantages, with the focus on health and nutrition benefits being the least used strategy[257].

Although the rate of unhealthy food advertising on the sampled YouTube videos (0.73 advertisement/h) was lower than that of TV (2.73 advertisements/h), the authors argued that YouTube is a more potent marketing platform. Reasons include the lack of regulations and parental control, rapid adoption of social media and online platforms, and personalised marketing driven by browser cookies[258]. Indeed, advertisements on social media or the Internet have been shown to have a greater influence over consumer purchasing behaviour than advertisements shown in print (e.g. books, magazines, and newspapers) and broadcast media (e.g. TV and radio) in Malaysia[259].

[255] L. Tan et al. (2018)

[256] Ibid. In-video advertisements refer to advertisements that are imbedded as video and are either skippable or non-skippable

[257] Ibid.

[258] Ibid.

[259] Woon and Hee (2018)

These findings consistently highlight the significant exposure of children to food marketing and advertising via traditional and online media. This raises a great cause of concern, given the considerable amount children spend with media.

Based on a subsample of urban Malaysian children, the total time children spent watching TV during the weekend was about 4.77h daily on average, more significant than on weekdays (2.35h) and greater than the time spent doing physical activity (1.15h) [260]. On top of that, these children also spent an average of 1.65h daily surfing the internet, increasing their chances of being exposed to food marketing and advertising[261]. Overall, nearly half (47.5%) of the children reportedly spent more than three hours watching TV daily. The significant amount of exposure indicates the potential impact of TV advertisements.

Moreover, the nearly doubled rate of unhealthy food advertising on school holidays compared to normal days suggests that children's exposure to these advertisements during school holidays similarly increased. This is considering the greater time children spend on leisure activities such as watching TV and browsing social media on their non-school days. When compared to other countries in the Asia Pacific, the ratio of unhealthy to healthy food advertising frequency in Malaysia stands out[262]. The advertising of unhealthy food towards children can influence children's food preferences, purchase requests, and food consumption, subsequently leading to malnutrition issues, such as overweight and obesity[263].

The abovementioned Malaysian studies are dated and may not fully represent Malaysia's current food marketing and advertising landscape, which has evolved due to the global rise of digital media. Nonetheless, TV remains a relatively important source of food marketing exposure to children, especially those from low-income households, compared to digital media, given the presence of digital inequalities.

[260] Ng et al. (2015)
[261] Ibid.
[262] Bridget Kelly et al. (2019)
[263] Cairns et al. (2009); Boyland et al. (2016)

Digital marketing is becoming an increasingly employed strategy to market food to consumers through digital mediums such as the Internet, websites, social media, online videos, and advergames (advertising embedded within online games). The use of data analytics and creative techniques, many of which are unique to the digital format, allow digital marketing to be personalised and tailored to individuals[264]. An example of a digital marketing technique is the use of social media influencers in propagating brand-specific food marketing messages and initiating widespread engagement. **Digital food marketing has proven more persuasive than generic and conventional marketing[265] and more significant in influencing food choices**.

The rapid spread of digital marketing mirrors the increase in digital media consumption. In Malaysia, 96.8% of the population has internet access, and over three-quarters are active social media users as of January 2023[266]. On average, Malaysians spend around 8 hours and 6 minutes on the internet and 2 hours and 47 minutes on social media daily[267]. The time spent watching TV (broadcast and streaming) has declined but remains significant at 3 hours and 9 minutes daily[268]. This means **our exposure to food marketing and advertising, including that of unhealthy food, may also increase in tandem with the ubiquitous presence and usage of digital media**.

Existing research on food marketing and advertising in Malaysia mainly focused on children. However, other age groups, including adolescents and adults, are also vulnerable to the influences of pervasive food marketing and advertising. Many different sources of food messaging, such as food promotion in food retail, can further amplify the influences of food marketing and advertising.

[264] Tatlow-Golden et al. (2016)
[265] Matz et al. (2017)
[266] Kemp (2023)
[267] Ibid.
[268] Ibid.

In a study, unhealthy food promotion has been found to dominate online supermarket circulars in Malaysia, with a ratio of two unhealthy foods to every healthy food promoted [269] . The most frequently promoted unhealthy foods in supermarket circulars were desserts or ice cream (11.2%), followed by ready-to-eat meals (8.1%), snacks (5.8%), and SSBs (4.8%)[270]. In comparison, unprocessed, healthy foods like fruits, vegetables and grains were promoted at a lower rate (3.2% and 9.7%, respectively). Compared to 11 other countries in the study, Malaysia has a relatively higher proportion of unhealthy food promoted in supermarket circulars, indicating the potential significance of such an issue in perpetuating an unhealthy food environment at the population level[271].

However, the findings were derived based on the data collected from a single supermarket (Giant) over eight weeks. The data collected did not take into account factors such as the seasonality of food supply, festive promotions, and the targeted demographics of the supermarket. At the time of the study (2014), Giant had a relatively small market share (15%), meaning the findings may not be generalisable to represent the diverse food retail landscape.

Nonetheless, the evidence provides a glimpse into the food promotional landscape at the retail level, suggesting a differential promotion rate of healthy and unhealthy food. **The existing data gaps concerning the prevalence of targeted unhealthy food messaging and its impacts on the wider Malaysian population also signal for future research**.

Another key finding from the abovementioned studies is the consistently higher rate of advertising and promotion of unhealthy and processed foods than healthy foods. This is owing to two main push factors. Firstly, food promotion, marketing, and advertising are often from transnational food companies, who are the major producers of processed and ultra-processed food. They are most able to afford to pay for such strategies, with a strong tendency toward the marketing of less healthy, prepackaged foods most likely to be purchased on impulse in modern food retails[272]. Secondly, food retailers are similarly motivated to offer and promote highly processed food, such as confectionery, due to their high profitability[273].

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[269] Charlton et al. (2015); Supermarket circular is a form of marketing to promote the items being sold and on promotion to the consumers.

[270] Ibid.

[271] Ibid.

[272] Deakin University, VicHealth, and UNICEF (2021); Riesenberg et al. (2019); Charlton et al. (2015); Thornton et al. (2013)

[273] Piacentini, MacFadyen, and Eadie (2000)

Compared to staple food items, marketing strategies are particularly important in determining the sales of impulse items[274]. This is because almost two-thirds of in-store food purchasing decisions are unplanned; hence, within-store placement and promotion are strong determinants of unhealthy food purchases[275]. When done strategically, the promotion of unhealthy food can outweigh the desirability of healthier options within the same space, such as in retail stores; it can thus prompt unhealthy food purchase decisions[276].

4. Linkages Between Food Environment and Nutrition Inequality

Malaysia currently faces the double burden of malnutrition—the coexistence of undernutrition (underweight, stunting, and wasting) alongside overnutrition (overweight and obesity)[277]. One of the significant risk factors for this public health crisis lies in the consumption of poor diets[278]. Yet, the findings in this paper suggest that the current food environment is unfavourable in promoting the consumption of healthy diets.

Energy-dense and HFSS foods, which are often made more desirable through targeted advertising and promotion, are readily available. These foods are also increasingly accessible with the growth of FAFH consumption and modern food retailers that serve as a key channel for the sales and marketing of ultraprocessed, HFSS foods. The growing availability of unhealthy food can displace the consumption of otherwise healthier foods, given their relative abundance, convenience, and affordability.

Meanwhile, healthy diets are becoming increasingly unaffordable for people living in poverty or with low income. Although fruits and vegetables are essential food groups that define a healthy diet, they account for the most sizable proportion of the cost of a healthy diet, implying their relative unaffordability. The national supply of fruits and vegetables also seems to fall short of the population's needs in order to achieve the recommended dietary intake.

[274] Kalla and Arora (2011); Piacentini, MacFadyen, and Eadie (2000); Hawkes (2008)
[275] Thornton et al. (2013); (2012)
[276] Deakin University, VicHealth, and UNICEF (2021)
[277] IPH (2020)
[278] IHME (2019)

An unhealthy food environment tends to make unhealthy food choices more favourable than healthier options. While the effects of an unhealthy food environment can be population-wide, they are usually inequitable[279]. This can give rise to nutrition inequities and further contribute to the disparities in health outcomes.

Nutrition inequalities are determined by factors beyond the individual level. At the basic level, socioeconomic and political contexts shape people's social position, human capital and potential, driving the stratification of society into different groups based on income, occupation, and resources[280]. These structural determinants then determine people's everyday circumstances and exposure to food, healthcare, and living environments[281]. This means that social, political, and commercial determinants collectively determine a person's likelihood of being malnourished.

Tackling nutrition inequalities by addressing obstacles in the food environment to healthy eating, while insufficient to tackle the broader causes of the issue, is a crucial first step that lays the groundwork for higher-level interventions. Based on the findings discussed in the previous section, three groups at risk of nutrition inequalities were identified based on three mechanisms: income, time, and vulnerability to food marketing and advertising. The following discussion seeks to answer the question: why are these groups of individuals more prone to making poor food choices?

4.1. Income

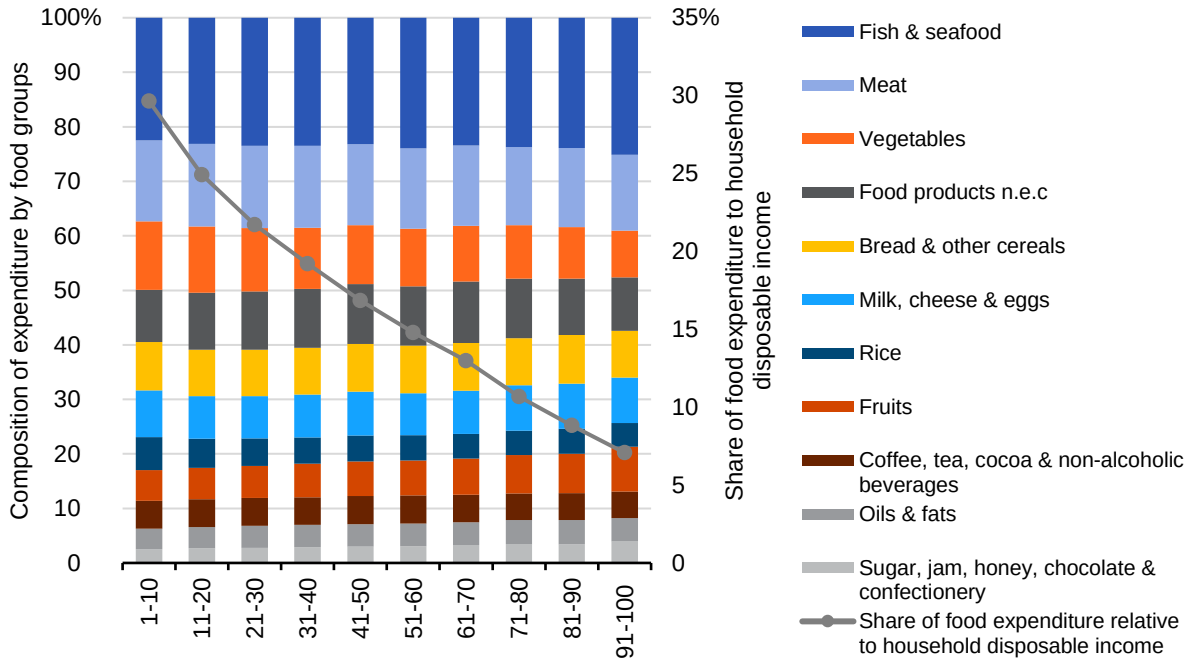
An unhealthy food environment can result in disparities in food choices between income groups due to three main factors: the lower affordability of healthy foods, limited access to healthier options, and the desirability of less healthy food[282]. The food choices of those living in poverty or with low incomes are more likely to be hindered by food prices even when such foods are available at a similar cost to all[283]. Given the same accessibility to food through both traditional and modern food vendors, social determinants like income and ethnicity still affect diet quality significantly[284].

[279] Schneider et al. (2023)
[280] Development Initiatives (2020)
[281] Ibid.
[282] Lewis et al. (2021); Schneider et al. (2023)
[283] Schneider et al. (2023)
[284] Karupaiah et al. (2013)

As lower-income households usually commit a larger share of their income to food than those with higher incomes[285] (Figure 19), their spending behaviours are highly sensitive to food price fluctuations. In 2022, households from the bottom 20% income group (B20) spent RM879 or 39.3% of their median disposable income on food and beverages (both at home and away from home) monthly in 2022. In comparison, those from the top 20% quintile (T20) spent RM2,636 or 19.9% of their median disposable income.

Therefore, the food purchasing decisions of lower-income households tend to be determined by prices and, to a lesser extent, availability and taste[286]. Food choices are often made in the context of competing demands for scarce resources for these individuals or households[287].

Figure 19: Composition of monthly household food consumption expenditure and share of food at home expenditure relative to household disposable income, by decile income group and food groups, 2022



Source: DOS (2023a)
Note: The data does not include household expenditure on food away from home which is made up of subcategories of expenditure items that are different from food at home.

[285] KRI (2020b); DOS (2023a)
[286] Eng et al. (2022)
[287] Kirkpatrick and Tarasuk (2011)

When food prices and the overall cost of living rise without a consummate increase in wages, low-income individuals or households often compromise by reducing food expenditure in quantity or quality to accommodate other fixed and essential spending, such as housing and utilities[288]. Even within the food budget, they tend to prioritise energy-abundant food, such as cereal and cereal products (e.g. rice, noodles, and flour) and protein (e.g. egg, chicken, and meat), over micronutrient-rich food like fruits[289].

Indeed, an income gradient in food expenditure can be observed among Malaysian households. When examined by the share of expenditure relative to the total food expenditure, households from the lower income deciles gravitate towards spending proportionally less on fruits, fish and seafood, sugar, jam, honey, chocolate, and confectionery[290], as well as oils and fats, as compared to those from higher-income households (see Figure 20). Conversely, they tend to spend a larger share of their food expenditure on rice and vegetables[291].

The lower-income deciles' share of spending on meat also appears to be marginally higher than those from the higher-income deciles. While the expenditure on milk, cheese, and eggs does not display a distinct income gradient, households from the lowest income decile (1-10) notably spend more on this food category (8.5%) compared to the rest of the income deciles. This is possibly due to eggs being a relatively cheaper source of protein than meat and fish.

Economically disadvantaged individuals often face trade-offs between the price of food and its nutritional quality. When less healthy food is relatively more affordable and accessible and, with the effect of promotion and marketing, also more desirable than healthy food, individuals living in poverty and low income are therefore more inclined to purchase and consume the former[292].

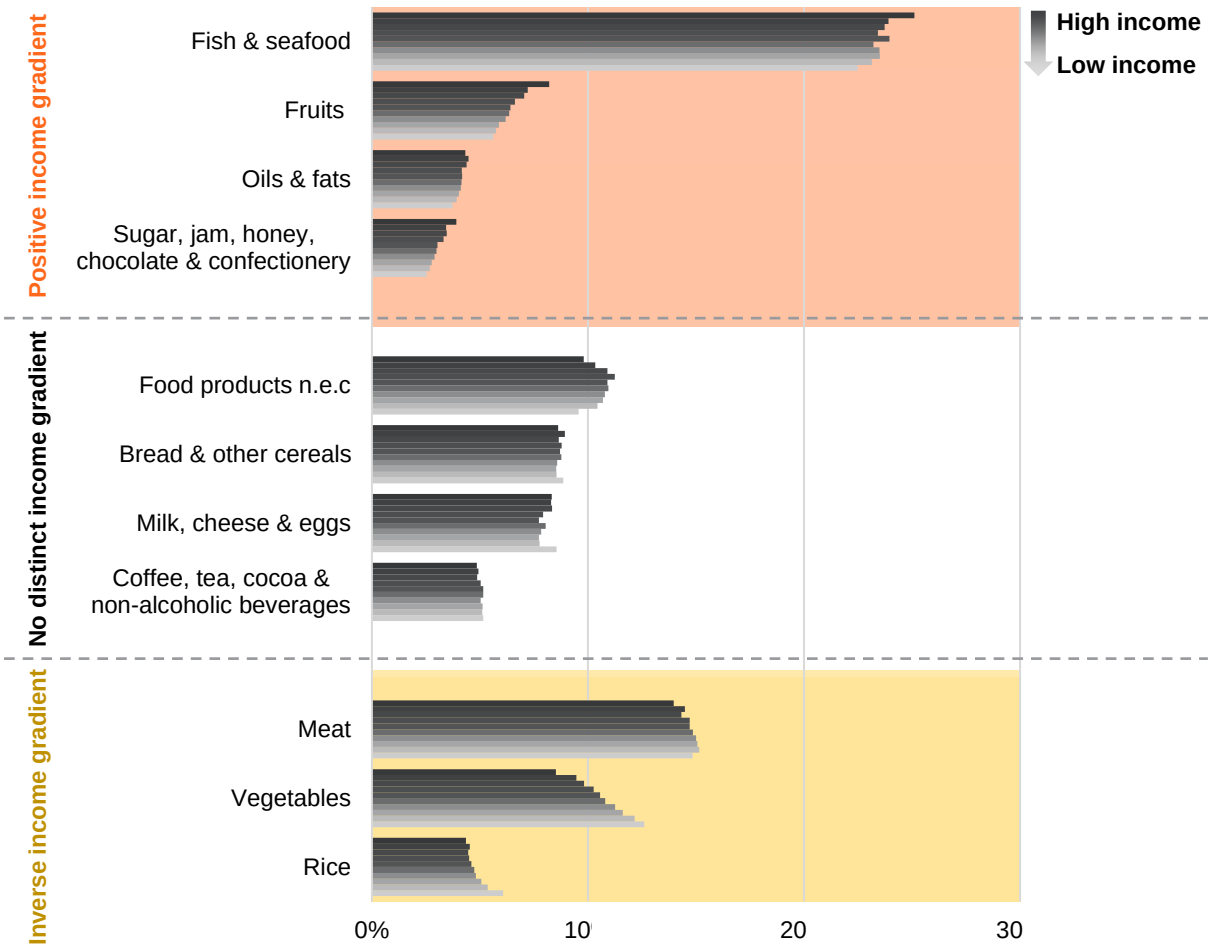
[288] Darmon and Drewnowski (2015); KRI (2018)
[289] Maguire and Monsivais (2015)
[290] DOS (2023a)
[291] Ibid.
[292] Schneider et al. (2023)

Overconsumption is also a form of malnutrition[293]. Excessive consumption of calories, fat, salt, and sugar can contribute to overweight, obesity, and other chronic diseases[294]. In fact, higher income does not necessarily contribute to healthier consumption patterns and high-quality diets. In some cases, middle- and high-income individuals and households are also prone to malnutrition due to overconsumption[295]. For example, income is positively associated with the consumption of FAFH, which includes HFSS foods and fast food[296]. This is because higher-income households generally have higher purchasing power and opportunity cost of time[297].

While Figure 20 shows an inverse income gradient in the share of expenditure on meat, vegetables, and rice, it also illustrates a positive income gradient in the share of spending on oils, fats, sugar, jam, honey, chocolate, and confectionery, in which households from higher income deciles spend proportionally more on. This consumption trend among the higher-income group is consistent with some of the studies reported in the past. Adults with higher incomes were reported to consume more confectionery as compared to those with lower incomes[298]. Children and adolescents from middle- or high-income groups have been found to be more likely to consume fast food[299].

[293] Johnstone and Lonnie (2023)
[294] IHME (2019)
[295] Kee et al. (2019); Salleh et al. (2021); Cheah et al. (2020)
[296] A. K. G. Tan (2010); Latimaha, Bahari, and Ismail (2018)
[297] H. S. H. Lee and Tan (2007)
[298] Cheah et al. (2020)
[299] K. H. Chong et al. (2016); Kee et al. (2019)

Figure 20: The share of monthly household food and beverage consumption expenditure by income decile, Malaysia, 2022



Source: Author's calculations based on DOS (2023a)

Note: Positive income gradient indicates that the share of expenditure increases as household income increases. Inverse income gradient indicates that as the household income decreases, the share of expenditure increases. The data focuses on food at home expenditure and does not include the spending on food away from home. The findings should be interpreted as the percentage of expenditure of each food group over the total household expenditure on food at home. It reflects the distribution/proportion of the expenditure on each food group within the total food expenditure of the households. Hence, it does not provide an indication of the consumption quantity. It should be noted that higher income groups spend more in expenditure value on food than lower income groups, although the proportion relative to total food expenditure may be the same.

4.2. Time

Time poverty, defined as the lack of discretionary time (the time available after engaging in essential activities like sleeping and committed activities of paid and unpaid work)[300]**, can lead to poor food choices and a sedentary lifestyle**[301]. This is because time is an essential resource to obtain, prepare, and consume food, particularly whole, fresh, and unprocessed foods that require preparation and cooking[302]. For example, one needs to allocate more time to wash, cut, and prepare fresh vegetables before eating as opposed to reheating a can of preserved vegetables.

The time spent purchasing and preparing food carries the opportunity costs of not engaging in other activities, such as income-generating activities, household maintenance, care work, or even resting[303]. **As with financial constraints, individuals with time poverty also face trade-offs in food choices due to their restrictions in allocating time, attention, and effort**[304].

While all individuals technically have 24 hours per day, people tend to face varying time constraints depending on their life circumstances, such as employment, income, and roles that affect their autonomy over time allocation[305]. Time poverty is a common challenge among certain groups of individuals in society, namely the working class, especially dual-income and single-headed households living with one or more children[306]. In these households, working women who shoulder the household responsibilities of managing and preparing food as well as other unpaid care work are most likely to face the brunt of time poverty[307].

Even when fresh foods such as vegetables are cheap, they can appear less favourable than the ready-to-eat or processed alternatives when the time opportunity cost is considered. As a result, individuals with time scarcity are more prone to choose more pre-prepared or highly processed foods that tend to be energy-dense and nutrient-poor over fresh and healthy foods[308].

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[300] Kalenkoski and Hamrick (2014)
[301] Venn and Strazdins (2017)
[302] Schneider et al. (2023)
[303] Williams, Masuda, and Tallis (2016)
[304] Carpio et al. (2020); Venn and Strazdins (2017)
[305] Kalenkoski and Hamrick (2013)
[306] Harvey and Mukhopadhyay (2007); Whillans and West (2022); Jabs and Devine (2006)
[307] KRI (2019)
[308] Venn and Strazdins (2017); Venn et al. (2018)

With time constraints, people with sufficient purchasing power are also increasingly turning to FAFH (dine-in and takeaway foods) and food delivery, as these foods are relatively quicker and convenient to obtain and can be inexpensive[309]. According to the Grab annual report, the lack of time to prepare meals is the primary reason driving the demand for food delivery, followed by food cravings and the desire for convenience over cooking[310]. Indeed, the leading consumer base of Grab food delivery services comprises demographic groups commonly facing time scarcity: married couples, typically white-collared workers aged between 25 and 44 years old, with children and a household income above RM5,000[311].

While improving food access and the convenience of acquiring food, online food delivery services also increase access to unhealthier food choices and exposure to food marketing and advertising on such platforms[312]. Additionally, food prepared at home is commonly found to be relatively healthier, whereas FAFH is typically associated with a lower diet quality[313]. The growing use of on-demand food delivery services may, therefore, bring about dietary risks for individuals and households whose food choices are affected by time scarcity.

Low-income households tend to face the double burdens of income and time poverty. On the one hand, they cannot afford to hire help for household and care work due to financial constraints[314]. On the other hand, they often cannot afford to eat out, and online food delivery services are typically more expensive. This dilemma drives them towards ready-to-eat, highly processed food, further exacerbating nutrition inequalities between income groups.

[309] Venn et al. (2018)
[310] Grab (2021)
[311] Ibid.
[312] Duthie et al. (2023)
[313] Carpio et al. (2020); Nagao-Sato and Reicks (2022)
[314] Jabs and Devine (2006)

4.3. Vulnerability to Food Marketing and Advertising

Children, especially young children, are particularly susceptible to the influences of food marketing and advertising due to their developmental vulnerabilities[315]. They are least adept at recognising and comprehending the selling and persuasive intent of marketing communications[316]. This makes children more likely to perceive marketing and advertisements as factual[317].

Food marketing and advertising target children both as consumers and as influencers who can sway the food choices of other consumers, particularly their parents and peers[318]. For instance, Malaysian parents have cited their children's demands as the primary reason for purchasing certain products[319]. Exposure to food marketing and advertising may also have a long-term impact on children's consumption patterns, as food preferences formed during childhood tend to persist into adulthood[320].

Children's exposure to food marketing and advertising through media has considerable implications on their food consumption and, subsequently, their nutritional status. In Malaysia, unhealthy food advertisements have been shown to more significantly influence children's perception and behaviour compared to that of healthy food among children.

Children were more likely to find unhealthy food advertisements attractive, recognise the advertisements, make purchase requests for the products advertised, and prefer these products[321]. The longer the TV viewing time, the greater the influence of unhealthy food advertising on the children's food preferences and, possibly, their consumption patterns. The influence of unhealthy food advertising also appeared consistent across income groups, meaning such advertisements may similarly impact children irrespective of their household income[322]. The degree of exposure, however, may differ due to inequalities in the access to devices.

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[315] Rozendaal, Buijzen, and Valkenburg (2010)
[316] Ibid.
[317] Ludvigsen and Scott (2009)
[318] Cairns et al. (2013)
[319] Escalante de Cruz et al. (2004)
[320] Scaglioni et al. (2018); Małachowska and Jeżewska-Zychowicz (2021)
[321] Ng et al. (2015)
[322] Ibid.

Furthermore, children are more likely to be attracted to advertisements of unhealthy food that is perceived as tasty, particularly SSBs, fast food, ice cream, high-sugar and low-fibre breakfast cereals, and savoury snacks[323]. **The use of promotional characters associated with the brand and the offer of free gifts often help to reinforce the influence on food preferences.** The impact of unhealthy food advertising on food choices has also been documented in an experimental study, where Malaysian children exposed to fast food advertisements were more likely to favour fast foods than those who were not[324]. At a greater concern, such impacts on food choices are more significant among younger children (7 to 10 years old) and boys than older children (11 to 12 years old) and girls[325], suggesting the inequitable impact of unhealthy food advertising and marketing.

Additionally, the dominance of unhealthier food marketing on digital platforms, which tend to target adolescents, also raises public health concerns[326]. This can be a potential issue in Malaysia, considering that over a quarter of social media users in Malaysia are adolescents and young adults aged below 25[327]. Unhealthy eating patterns, such as fast food and SSB consumption, are commonly reported among adolescents[328]. Even before the emergence of online food delivery platforms, more than three-quarters, or 82.8%, of Malaysian adolescents consumed fast food at least once in a typical week, with a greater prevalence among those who were younger[329].

However, the scale of the problem caused by unhealthy food marketing on digital platforms is uncertain in Malaysia due to the lack of empirical research and data. Nonetheless, the findings suggest that unhealthy food marketing, especially for children, is prevalent and poses public health concerns. This is despite the implementation of industry self-regulatory food marketing initiatives, namely the Guideline on the Advertising and Nutrition Information Labelling of Fast Foods, and Responsible Advertising to Children' Initiative (the Malaysian Pledge)[330]. The former aims to restrict fast food marketing during children's programmes, while the latter encourages signatories to market their food responsibly to children under 12 years old on broadcast media[331].

[323] Ng et al. (2015)
[324] Totu, Igau, and Halik (2013)
[325] Ibid.
[326] Coates et al. (2019); Potvin Kent et al. (2019)
[327] Kemp (2023)
[328] Man et al. (2021); IPH (2022)
[329] Kemp (2023)
[330] Ng et al. (2021)
[331] Ng et al. (2021); IFBA (2024)

With the lack of comprehensive regulation coupled with the pervasive nature of food marketing and advertising, particularly on digital platforms, the impact of unhealthy food marketing and advertising in Malaysia is likely to have grown more widespread than previously reported. This may further contribute to the nutrition inequalities among children and adolescents from different income backgrounds.

5. Concluding Remarks

Despite strenuous efforts to reduce the rates of malnutrition, such as NCDs, obesity, and child stunting in Malaysia, the progress in the past decade not only stagnated but even showed signs of increment [332]. Such a public health crisis consistently exhibits a socioeconomic gradient, underscoring the existence of inequalities in food choices.

The reason behind the disparities in food choices is complex yet obvious. They stem from factors in the food environment that are further reinforced by many other structural issues in society—wage stagnation, income inequality, long working hours, and care demands. The impacts of nutrition inequalities are often long-term, cumulative, and, in some cases, intergenerational[333]. This makes the case for policies addressing nutrition inequality even more compelling, on top of the basis of justice and equity.

It is beyond the scope of this paper to prescribe specific policy recommendations. Nonetheless, the findings suggest that the current food environment is unfavourable in promoting the consumption of healthy diets, necessitating a re-examination of the current food environment policies.

Although nutrition-specific interventions and consumer education can be effective within their respective scopes, their impacts tend to be limited to individual and subgroup level. **Complementing such approaches with food environment interventions can more effectively address multiple forms of malnutrition at the population level**[334]. This can ensure a conducive food environment that facilitates informed consumers to practice and sustain healthy eating behaviours.

[332] Development Initiatives (2018); IPH (2020); (2023)
[333] Development Initiatives (2020)
[334] Farrell et al. (2021)

There is a need for system-wide improvements in the food environment via equitable policy tools. The multidimensionality of the food environment presents various entry points to shape the food environments in Malaysia into healthier ones. Existing food environment policies in Malaysia, such as the SSB tax, Healthier Choice Logo, Guidelines on the Prohibition of Sales of Foods Outside School Perimeters, and Fast Food Advertising Guidelines, are progressive in nature but require strengthening to more adequately respond to the underlying inequalities in food choices. It is necessary to acknowledge and address the social determinants (e.g. income, age, ethnicity, occupation, and household roles) that influence food choices within these policies.

A more comprehensive package of food environment policies is also needed to more adequately respond to rapid shifts in the food environment and consumption patterns. Pervasive digital food marketing, shifts in the food retail landscape with the increased presence of food retailers offering relatively unhealthy foods, and increased rate of food away from home are among the major concerns posed by current shifts in the food environment. The challenges and opportunities presented by the stakeholders involved in shaping the food environment, such as the food producers, manufacturers, retailers, and online food delivery platforms, should be considered when designing and implementing food environment policies.

Developing effective policies requires a comprehensive understanding of food environments and their trends and gaps. Additional in-depth research at both the national and local levels into food environments is required to produce more granular and context-specific data that inform policymaking and support the Government in addressing the environmental causes of malnutrition[335]. The research and data gaps identified in this paper include healthy and unhealthy food costs and affordability at the national and disaggregated levels, the role of food retailers including online food delivery platforms on food purchase and consumption patterns, and the rate and impact of unhealthy food marketing on digital media.

Food choices are not simply personal choices. Policies and efforts that promote heathy food intake or discourage people from consuming unhealthy food and beverages will not suffice. Making sure that healthier choices are similarly, if not more, available, affordable, accessible, and desirable for everyone, particularly for those constrained or disadvantaged, is equally imperative.

[335] Farrell et al. (2021)

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Appendix I

Table A: List of UPFs and UPBs and the subcategories included in Figure 6 and 7

HS Code	Commodity descriptions
	UPFs
Baked goods	Dessert mixes, frozen bakes goods, packaged cakes and pastries, packaged flat bread and leavened bread
Breakfast cereals	Ready-to-eat cereals (e.g. cornflakes, puffed rice)
Confectionery and sweet spreads	Chocolate spreads, confectionery, jams and preserves, nut and seed-based spreads (e.g. peanut butter, almond butter)
Dairy products and alternatives	Chilled and shelf stable desserts, chilled snacks, non-dairy creamer, flavoured condensed milk, flavoured fromage fries (French cheese) and quark (dairy product made from milk, a traditional German cuisine), flavoured yoghurt, margarine and spreads, processed cheese
Dried processed foods	Instant soup mixes, instant noodles, meal replacement shakes and powders
Ice cream and frozen desserts	Frozen desserts, frozen yoghurt, impulse ice cream, take-home ice cream
Meat substitutes	Meat substitutes e.g. industrially processed plant-based meat
Processed meat and seafood	Shelf stable meat and seafood
Ready meals	Chilled lunch kits, chilled pizza, dried or chilled ready meals, frozen pizza, frozen ready meals, shelf stable ready meals
Sauces, dressings and condiments	Ketchup, barbeque sauce, mayonnaise, salad dressing, mustard, soy sauce
Savoury snacks	Other savoury snacks, popcorn, pretzels, salty snacks
Sweet biscuits, snack bars and fruit snacks	Processed fruit snacks, snack bars and sweet biscuits
Vegetable oil	Corn oil, olive oil, palm oil, rapeseed oil, soybean oil, sunflower oil, and other edible oil
	UPBs
Carbonated soft drinks	Carbonates
Concentrates	Fruit concentrates
Dairy products and alternatives	Drinking yoghurt, flavoured milk drinks, milk alternatives
Juice drinks and nectars	Coconut and other plant waters, juice drinks (up to 24% juice), nectars, reconstituted 100% juice
Ready-to-drink tea, coffee and Asian speciality drinks	Commercially available packaged chrysanthemum tea, winter melon tea, lychee drinks, ready-to-drink coffee and tea
Sports and energy drinks	Energy drinks, sport drinks

Appendix II

Table B: List of less healthy food included in Figure 12

HS Code	Commodity descriptions
160100	Meat preparations; sausages and similar products, of meat, meat offal or blood, and food preparations based on these products
160210	Meat preparations; homogenised preparations of meat, meat offal or blood
160231	Meat preparations; of turkeys, prepared or preserved meat or meat offal (excluding livers and homogenised preparations)
160239	Meat preparations; of poultry (excluding turkeys), prepared or preserved meat or meat offal (excluding livers and homogenised preparations)
160241	Meat preparations; of swine, hams and cuts thereof, prepared or preserved (excluding homogenised preparations)
160242	Meat preparations; of swine, shoulders and cuts thereof, prepared or preserved (excluding homogenised preparations)
160249	Meat preparations; of swine, meat or meat offal (including mixtures), prepared or preserved, n.e.c. in heading no. 1602
160250	Meat preparations; of bovine animals, meat or meat offal, prepared or preserved (excluding livers and homogenised preparations)
160290	Meat preparations; of meat, meat offal or the blood of any animal, n.e.s. in heading no. 1602
170410	Sugar confectionery; chewing gum, whether or not sugar-coated, not containing cocoa
170490	Sugar confectionery; (excluding chewing gum, including white chocolate), not containing cocoa
180610	Cocoa; powder, containing added sugar or other sweetening matter
180620	Chocolate & other food preparations containing cocoa; in blocks, slabs or bars weighing more than 2kg or in liquid, paste, powder, granular or other bulk form in containers or immediate packings, content exceeding 2kg
180631	Chocolate and other food preparations containing cocoa; in blocks, slabs or bars, filled, weighing 2kg or less
180632	Chocolate and other food preparations containing cocoa; in blocks, slabs or bars, (not filled), weighing 2kg or less
180690	Chocolate and other food preparations containing cocoa; n.e.s. in chapter 18
190120	Food preparations; mixes and doughs for the preparation of bread, pastry, cakes, biscuits and other bakers' wares
190190	Food preparations; of flour, meal, starch, malt extract or milk products, for uses n.e.s. in heading no. 1901
190230	Food preparations; pasta (excluding stuffed), cooked or otherwise prepared
190410	Food preparations; obtained by the swelling or roasting of cereals or cereal products
190490	Food preparations; cereal or cereal products (excluding maize), in grain form, pre-cooked or otherwise prepared
190510	Food preparations; crispbread, whether or not containing cocoa
190520	Food preparations; gingerbread and the like, whether or not containing cocoa
190530	Food preparations; sweet biscuits, waffles and wafers, whether or not containing cocoa
200520	Vegetable preparations; potatoes, prepared or preserved otherwise than by vinegar or acetic acid, not frozen

200911	Juice; orange, frozen, unfermented, (not containing added spirit), whether or not containing added sugar or other sweetening matter
200919	Juice; orange, not frozen, unfermented, (not containing added spirit), whether or not containing added sugar or other sweetening matter
200920	Juice; grapefruit, unfermented, (not containing added spirit), whether or not containing added sugar or other sweetening matter
200930	Juice; of single citrus fruit (excluding orange or grapefruit), unfermented, (not containing added spirit), whether or not containing added sugar or other sweetening matter
200940	Juice; pineapple, unfermented, (not containing added spirit), whether or not containing added sugar or other sweetening matter
200950	Juice; tomato, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter
200960	Juice; grape (including grape must), unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter
200970	Juice; apple, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter
200980	Juice; of any single fruit or vegetable n.e.s. in heading no. 2009, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter
200990	Juices; mixtures, unfermented, not containing added spirit, whether or not containing added sugar or other sweetening matter
210500	Ice cream and other edible ice; whether or not containing cocoa
220210	Waters; including mineral and aerated, containing added sugar or other sweetening matter or flavoured
220290	Non-alcoholic beverages; n.e.s. in item no. 2202.10, not including fruit or vegetable juices of heading no. 2009

Table C: List of healthier food included in Figure 12

HS Code	Commodity descriptions
70190	Vegetables; potatoes (other than seed), fresh or chilled
70200	Vegetables; tomatoes, fresh or chilled
70310	Vegetables, alliaceous; onions and shallots, fresh or chilled
70320	Vegetables, alliaceous; garlic, fresh or chilled
70390	Vegetables, alliaceous; leeks and other kinds n.e.s. in heading no. 0703, fresh or chilled
70410	Vegetables, brassica; cauliflowers and headed broccoli, fresh or chilled
70420	Vegetables, brassica; brussel sprouts, fresh or chilled
70490	Vegetables, brassica; edible, n.e.s. in heading no. 0704, fresh or chilled
70511	Vegetables; cabbage (head) lettuce (lactuca sativa), fresh or chilled
70519	Vegetables; lettuce (lactuca sativa), (other than cabbage lettuce), fresh or chilled
70521	Vegetables; witloff chicory (cichorium intybus var. foliosum), fresh or chilled
70529	Vegetables; chicory (cichorium spp.), (other than witloof chicory), fresh or chilled
70610	Vegetables, root; carrots and turnips, fresh or chilled
70690	Vegetables, root; salad beetroot, salsify, celeric, radishes and similar edible roots, fresh or chilled
70700	Vegetables; cucumbers and gherkins, fresh or chilled
70810	Vegetables, leguminous; peas (pisum sativum), shelled or unshelled, fresh or chilled
70820	Vegetables, leguminous; beans (vigna spp., phaseolus spp.), shelled or unshelled, fresh or chilled
70890	Vegetables, leguminous; (other than peas and beans), shelled or unshelled, fresh or chilled
70910	Vegetables; globe artichokes, fresh or chilled
70920	Vegetables; asparagus, fresh or chilled
70930	Vegetables; aubergines, (egg plants), fresh or chilled
70940	Vegetables; celery (other than celeriac), fresh or chilled
70960	Vegetables; fruits of the genus capsicum or of the genus pimenta
70970	Vegetables; spinach, New Zealand spinach and orache spinach (garden spinach), fresh or chilled
70990	Vegetables; edible, n.e.s. in chapter 7, fresh or chilled
71029	Vegetables, leguminous; (other than peas or beans), shelled or unshelled, uncooked or cooked by steaming or boiling in water, frozen
71320	Vegetables, leguminous; chickpeas (garbanzos), shelled, whether or not skinned or split, dried
71331	Vegetables, leguminous; beans of the species vigna mungo (l.) hepper or vigna radiata (l.) wilczek, dried, shelled, whether or not skinned or split
71332	Vegetables, leguminous; small red (adzuki) beans (phaseolus or vigna angularis), shelled, dried, whether or not skinned or split
71333	Vegetables, leguminous; kidney beans, including white pea beans (phaseolus vulgaris), dried, shelled, whether or not skinned or split

71339	Vegetables, leguminous; n.e.s. in item no. 0713.30, dried, shelled, whether or not skinned or split
71340	Vegetables, leguminous; lentils, shelled, whether or not skinned or split, dried
71350	Vegetables, leguminous; broad beans (vicia faba var. major) and horse beans (vicia faba var. equina and vicia faba var. minor), dried, shelled, whether or not skinned or split
71390	Vegetables, leguminous; n.e.s. in heading no. 0713, shelled, whether or not skinned or split, dried
71410	Vegetable roots and tubers; manioc (cassava), with high starch or inulin content, whether or not sliced or in the form of pellets, fresh or dried
71420	Vegetable roots and tubers; sweet potatoes, with high starch or inulin content, whether or not sliced or in the form of pellets, fresh or dried
71490	Vegetable roots and tubers; arrowroot, salep, Jerusalem artichokes and similar roots and tubers, high starch or inulin content, whether or not sliced or in the form of pellets, fresh or dried; sago pith
80110	Nuts, edible; coconuts, fresh or dried, whether or not shelled or peeled
80120	Nuts, edible; Brazil nuts, fresh or dried, whether or not shelled or peeled
80130	Nuts, edible; cashew nuts, fresh or dried, whether or not shelled or peeled
80211	Nuts, edible; almonds, fresh or dried, in shell
80221	Nuts, edible; hazelnuts or filberts (corylus spp.), fresh or dried, in shell
80222	Nuts, edible; hazelnuts or filberts (corylus spp.), fresh or dried, shelled
80231	Nuts, edible; walnuts, fresh or dried, in shell
80232	Nuts, edible; walnuts, fresh or dried, shelled
80240	Nuts, edible; chestnuts (castanea spp.), fresh or dried, whether or not shelled or peeled
80250	Nuts, edible; pistachios, fresh or dried, whether or not shelled or peeled
80290	Nuts, edible; n.e.s. in heading no. 0801 and 0802, fresh or dried, whether or not shelled or peeled
80300	Fruit, edible; bananas, (including plantains), fresh or dried
80410	Fruit, edible; dates, fresh or dried
80420	Fruit, edible; figs, fresh or dried
80440	Fruit, edible; avocados, fresh or dried
80450	Fruit, edible; guavas, mangoes and mangosteens, fresh or dried
80510	Fruit, edible; oranges, fresh or dried
80520	Fruit, edible; mandarins (including tangerines and satsumas), clementines, wilkings and similar citrus hybrids, fresh or dried
80530	Fruit, edible; lemons (citrus limon, citrus limonum), limes (citrus aurantifolia)
80540	Fruit, edible; grapefruit, fresh or dried
80590	Fruit, edible; citrus fruit n.e.s. in heading no. 0805, fresh or dried
80610	Fruit, edible; grapes, fresh
80710	Fruit, edible; melons (including watermelons), fresh
80720	Fruit, edible; papaws (papayas), fresh

80810	Fruit, edible; apples, fresh
80820	Fruit, edible; pears and quinces, fresh
80910	Fruit, edible; apricots, fresh
80920	Fruit, edible; cherries, fresh
80930	Fruit, edible; peaches including nectarines, fresh
80940	Fruit, edible; plums and sloes, fresh
81010	Fruit, edible; strawberries, fresh
81020	Fruit, edible; raspberries, blackberries, mulberries and loganberries, fresh
81040	Fruit, edible; cranberries, bilberries and other fruits of the genus vaccinium, fresh
81090	Fruit, edible; fruits n.e.s. in heading no. 0801 to 0810, fresh
91010	Spices; ginger
91030	Spices; turmeric (curcuma)
110411	Cereal grains; rolled or flaked, of barley
110412	Cereal grains; rolled or flaked, of oats
110419	Cereal grains; rolled or flaked, of cereals excluding barley and oats
110421	Cereal grains; worked (eg hulled, pearled, sliced or kibbled) of barley
110422	Cereal grains; worked (eg hulled, pearled, sliced or kibbled) of oats
110423	Cereal grains; worked (eg hulled, pearled, sliced or kibbled) of maize (corn)
110429	Cereal grains; worked (eg hulled, pearled, sliced or kibbled) of cereals n.e.s. in item no. 1104.2, except rice of heading no. 1006
110430	Cereal; germ of cereals, whole, rolled, flaked or ground
100620	Cereals; husked (brown) rice
71410	Vegetable roots and tubers; manioc (cassava), with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets
71420	Vegetable roots and tubers; sweet potatoes, with high starch or inulin content, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets
71490	Vegetable roots and tubers; arrowroot, salep, Jerusalem artichokes and similar roots and tubers (not manioc or sweet potatoes), high starch or inulin content, fresh chilled, frozen or dried, whether or not sliced or in the form of pellets; sago pith
110419	Cereal grains; rolled or flaked, other than oats
110429	Cereal grains; worked, other than rolled or flaked (eg. Hulled, pearled, sliced or kibbled) of cereals, excluding oats and maize, and rice of heading no.1006
70390	Vegetables, alliaceous; leeks and other kinds n.e.c. in heading no. 0703, fresh or chilled
70490	Vegetables, brassica; edible, n.e.c. in heading no. 0704, fresh or chilled
70990	Vegetables; edible, n.e.c. in chapter 7, fresh or chilled
71339	Vegetables, leguminous; n.e.c. in item no. 0713.30, dried, shelled, whether or not skinned or split
71390	Vegetables, leguminous; n.e.c. in heading no. 0713, shelled, whether or not skinned or split, dried

80290	Nuts, edible; n.e.c. in heading no. 0801 and 0802, fresh or dried, whether or not shelled or peeled
80540	Fruit, edible; grapefruit (including pomelos), fresh or dried
80590	Fruit, edible; citrus fruit n.e.c. in heading no. 0805, fresh or dried
81090	Fruit, edible; fruits n.e.c. in heading no. 0801 to 0810, fresh
110422	Cereal grains; worked (egg hulled, pearled, sliced or kibbled) of oats
110423	Cereal grains; worked (egg hulled, pearled, sliced or kibbled) of maize (corn)
110429	Cereal grains; worked, other than rolled or flaked (egg. Hulled, pearled, sliced or kibbled) of cereals, excluding oats and maize, and rice of heading no.1006
70930	Vegetables; aubergines, (e.g. plants), fresh or chilled
70960	Vegetables; fruits of the genus capsicum or of the genus pimenta, fresh or chilled
71331	Vegetables, leguminous; beans of the species vigna mungo (l.) hepper or vigna radiata (l.) wilczek, shelled, whether or not skinned or split, dried
71332	Vegetables, leguminous; small red (adzuki) beans (phaseolus or vigna angularis), shelled, whether or not skinned or split, dried
71333	Vegetables, leguminous; kidney beans, including white pea beans (phaseolus vulgaris), shelled, whether or not skinned or split, dried
71339	Vegetables, leguminous; n.e.c. in item no. 0713.3, shelled, whether or not skinned or split, dried
71350	Vegetables, leguminous; broad beans (vicia faba var. major) and horse beans (vicia faba var. equina and vicia faba var. minor), shelled, whether or not skinned or split, dried
71490	Vegetable roots and tubers; arrowroot, salep, Jerusalem artichokes and similar roots and tubers (not manioc, sweet potatoes, yams, taro or yautia), high starch or inulin content, fresh, chilled, frozen, dried, sliced or not, or in pellet form; sago pith
80540	Fruit, edible; grapefruit, including pomelos, fresh or dried
80930	Fruit, edible; peaches, including nectarines, fresh
81020	Fruit, edible; raspberries, blackberries, mulberries, and loganberries, fresh
110422	Cereal grains; worked (e.g. hulled, pearled, sliced or kibbled) of oats
110423	Cereal grains; worked (e.g. hulled, pearled, sliced or kibbled) of maize (corn)
110429	Cereal grains; worked, other than rolled or flaked (e.g. Hulled, pearled, sliced or kibbled) of cereals, excluding oats and maize, and rice of heading no.1006