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Written Dissertation

**(Understanding ultra-processed food: examining ways to lead healthier food
choices)**

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1. Engagement with Literature Skills		
	25	
2. Knowledge and Understanding Skills		
	25	
3. Cognitive and Intellectual Skills		
	30	
4. Practical Application Skills		
	10	
5. Transferable Skills for Life and Professional Practice		
	10	

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Understanding ultra-processed food: examining ways to lead healthier food choices

Abstract

Introduction: Ultra-processed food (UPF) consumption is on the rise and has been associated with many non-communicable diseases such as type 2 diabetes and cardiovascular disease (Wright et al., 2017). Efforts are being made to reduce their consumption, however, the population appears to be confused by the term and manufacturers often take advantage of this. This study aimed to explore the current topic in layman's terms by exploring the association between UPFs and health, factors influencing food choice and confusion along with identifying existing gaps that can indicate the best way to promote better food choices.

Method: this study was conducted as a narrative review to allow an in-depth understanding of the topic. Articles included were between the years 2014-2024, peer-reviewed, in English, and have the full article available. When discussing UPF articles must have used the NOVA classification to determine category and data was analyzed using a combination of inductive and deductive coding.

Discussion: All ultra-processed foods are not equal as some can be beneficial to health. However, an unprocessed or minimally processed diet such as the mediterranean diet is preferred and food literacy may be the key to reversing the nutrition transition leading to increased UPF consumption. The challenges being faced by policies to combat UPF consumption all return to customer choice and the aim should be to alter their preferences with a focus on children and adolescents. The findings in this study may be used by policymakers to guide their target focus and identification of areas that may need proper evaluation to determine effectiveness.

Introduction

Non-communicable diseases (NCDs) are a major health concern globally (Lago-Penas et al., 2021). Some of the leading NCDs according to Ramesh and Kosalram (2023) include various cancers, cardiovascular diseases such as strokes and heart attacks, chronic respiratory disease, and diabetes. The increase in incidences has been attributed to various factors over the years including air pollution, increased alcohol consumption, lack of physical activity (Hazazi and Chandramohan, 2017), and high levels of sodium intake (World Health Organization (WHO), 2018). WHO (2018) indicated that NCDs are responsible for killing 41 million people annually, and equates to approximately 4% of deaths worldwide. They also stated that 77% of these deaths occur in low to middle-income countries. However, Islam et al. (2014) have suggested that “socioeconomic growth and fast urbanization” are contributing to the rising trend seen in non-communicable diseases. Peters et al. (2019) support this statement as their systematic overview reflected that the rise in NCDs is not only observed in lower-income countries but in high-income countries as well. Studies in recent years have been suggestive that the uptake in ultra-processed food (UPF) is to be blamed (Hall et al., 2019). Most foods are generally processed, but UPFs normally have 5 or more ingredients with most not being commonly found in cooking such as hydrolyzed protein, interesterified oils, and many other additives such as colorants, emulsifiers, firming, glazing, and anticaking agents (Martinez Steele et al., 2016). The ingredients used are often to disguise undesirable qualities of the final product by improving palatability (Monteiro et al., 2016). They also have a longer shelf life and are generally cheaper and aesthetically appealing.

The term ultra-processed food was developed by Brazilian researchers under the NOVA classification system that categorizes food based on the purpose and extent of food processing. The four categories are (group 1) unprocessed or minimally processed foods, (Group 2) processed culinary ingredients, (group 3) processed foods, and (group 4) ultra-processed foods. Group 1 is food in their natural state that or those that have received minimal processing such as fresh fruits and vegetables, whole grains, seeds,

nuts, and legumes. Group 2 is derived from group 1 foods including fats, oil, salt, sugar, and other substances used in cooking, seasoning, and preparing food. They have been processed but not eaten on their own but used in the preparation stages. Group 3 is food that has deliberately been processed to enhance food flavor, texture, and shelf life such as some bread, cheese, cured meat, and some canned vegetables. Group 4 are those foods generally industrially formulated and contain ingredients not often found in home cooking.

These foods often contain additives, preservatives, and other non-nutritive substances and include fast food, confectionary, packaged snacks, soft drinks, and ready-to-eat products. A cohort study by Sellem et al. (2023) shows a statistical significance in the association of trisodium phosphate (E339) often used as a thickening agent with coronary heart disease. Many other studies have associated UPFs with cancer (Fiolet et al., 2018), hypertension (Mendonca et al., 2017), irritable bowel syndrome (Schnabel et al., 2018), and more. Hall et al. (2019) also found a strong relationship between the intake of UPF with obesity and diabetes. They proposed that the increased access to these UPFs as the years progressed is a contributor to the upward trend of NCD incidence and prevalence. Because of this, governing bodies have been trying to reduce the consumption of these products; however, they do not understand well what they should be reducing. This is reflected in the British Nutrition Foundation (BNF) report that indicated that despite people knowing ultra-processed foods are bad for them more than 50% of them do not understand the term or know how to identify these items.

De Araujo et al. (2021) stated that a lot of research has been conducted on UPF and different health outcomes on an individual level and have suggested further research to be conducted on UPF and the possible association with NCD incidence, prevalence, and mortality when it comes to cancer, cardiovascular disease, and diabetes. Vineis et al. (2021) have shared the same outlook. They explained that as important as individual interventions are such as advice by general practitioners it is insufficient due to inequality factors. This research was focused on exploring why the term has been

deemed to be confusing whilst evaluating strategies that have been used to reduce consumption and identify any possible gap that needs to be addressed in order to improve the effectiveness of these strategies.

The information from this study would be beneficial to the general public to obtain a better understanding of how food choices affect their health and to be able to make more informed decisions. According to Sarmiento-Santos et al. (2022) and Saulias, Corcuff and Boonefaes (2023) there is still a gap in knowledge and understanding of ultra-processed food among consumers. This research can also be used by policymakers. By assessing interventions currently in place that work or do not they may be able to make more effective choices and produce more precise cost-benefit analysis. In the absence of hindsight, they may also be able to assess whether previous interventions can be redesigned and focused differently to achieve better results.

Aims and Objectives

This narrative review aims to provide a summary of the current state of affairs on ultra-processed foods; this includes whether people understand what they are and how they impact the health system. The paper also critically explored the policies and strategies used to reduce its consumption and determine what may be the most effective in promoting better food choices amongst the general population. This was carried out by describing the association of UPFs with NCDs, assessing and critically evaluating factors of influencing UPF consumption, strategies presently in use and gaps that needs to be addressed to promote and maintain better food choices.

Methodology

This research was conducted using a narrative review. A narrative review was chosen as it allows for a more in-depth understanding of any given topic (Greenhalgh et al., 2018). Apart from the opportunity to present data more holistically, this type of review of literature can be easily understood by a layman's audience (Sarkar and Bhatia, 2021).

Search strategy

ProQuest Central, PubMed, Google Scholar, and the LWW Health Library were used to search for articles using the following keywords and combination thereof:

“Ultra-processed food” OR “Preservatives OR Additives” AND “Sugar tax”, “Food Literacy”, “Food labelling”, “(NCD OR Diabetes OR Cardiovascular disease OR Hypertension)”. Other references were sorted if relevant from the bibliography of the selected articles.

Eligibility criteria

Studies were eligible for inclusion once they were; (1) in English; (2) had full text available to allow proper data critique; (3) investigated ultra-processed food association with NCDs (4) were peer-reviewed. Studies were excluded if they were: (1) abstracts only, (2) not peer-reviewed. Approximately 98% of the researches included in this paper are between the years 2014-2024, however, a strict date limit was not placed on the inclusion criteria to allow a historical discussion on the development of the subject.

Study selection and data extraction

The titles and abstracts of research that meet the eligibility criteria will be screened for relevance to the aim of this review. Ultra-processed food referred to in the articles much also be classified based on the NOVA classification. The selected articles were then broken down into the following for analysis and discussion: the region the study was conducted in, the design used, the method of data collection, what was investigated, results, limitations, and strengths identified, and recommendations made.

Data Analysis

To provide an overview of the present information and opinions around ultra-processed foods a combination of inductive and deductive coding was used along with a comparative analysis. Walls et al. (2017) stated that comparative analysis helps to identify themes in health issues that may assist policy-making. The articles were broken down by year, research design, the issue being investigated, the data collection method used, their study strength and limitations along with any suggested recommendations or suggestions for future research. The main deductive codes were (ultra-processed foods are bad for you and ultra-processed foods are not all bad), (tax, marketing/advertising policies, and other), (effective or ineffective). Other themes that developed and are not listed were noted separately

Ethical consideration

There are no ethical concerns for this research. However, the researcher was objective when evaluating and presenting the information on the topic to avoid bias.

Discussion

Are ultra-processed foods really bad for you?

There is a lot of debate and studies that have shown an adverse relationship between diets containing UPF and chronic diseases and mortality (Lane et al., 2024). However, studies such as Moubarac et al. (2017) suggest that the occasional consumption of these foods with a balanced meal may not have these negative impacts on health. For example, traditional wines following the NOVA classification will be classified as processed while other alcoholic drinks such as whisky and gin, rum, and whisky are classed as UPF (Derbyshire, 2019). Alcohol and drinking are known to be detrimental to one's health and a major contributor to chronic diseases of the liver, heart and digestive system (O'keefe et al., 2014). Even so, alcohol consumption is not completely bad for you as it is sometimes recommended for good health. Moderate intake of red wine is suggested for improved gut and heart health due to its high antioxidant content (Snopek et al., 2018). Alcohol begins to have an adverse impact on health when more than the recommended guidelines are consumed. Similarly, there are ultra-processed foods that can be beneficial to health and a level of consumption that correlates to adverse health has not been established (Messina et al., 2022).

To the knowledge of the researcher of this paper, no published research gives a definite quantity of how much ultra-processed food it takes to have adverse effects on health. The studies all state that a diet with "high" or plainly "UPF consumption" causes or contributes to many ailments as previously mentioned. A randomized control study by Hall et al. (2019) noted a positive relationship between ultra-processed food intake and weight gain when compared to the controlled group who consumed unprocessed food. Despite being cited often to reflect the impacts of UPFs on health, this study should be interpreted with caution as despite there being a standard three meals for the 28-day period; no restrictions were placed on the quantity each participant consumed in each of these settings. A prospective cohort study by Srour et al. (2019) had a larger sample size (104 707) compared to the study by Hall and company in 2019 (n=20), however, similarly, the method of data collection used was associated with frequency and not

quantity. The study used a 24-hour recall questionnaire to obtain dietary intake. The details gathered were beneficial in identifying patterns of higher consumption of UPF among younger adults, different inadequate or overconsumption of certain foods but not analysing how much it takes to have an adverse effect. The investigation also indicated that the risk of UPF consumption and type-2 diabetes risk was not merely the type of food chosen but their overall diet and energy intake. Another multinational cohort study was conducted by Cordova et al. (2023) identified a positive relationship between UPF diets with some cancers and type 2 diabetes. The study aimed to examine the relationship between UPF consumption and the incidence of multimorbidity of cancer and cardiometabolic disease. A 260g increment of UPF consumption was used for the analysis of the data received from the participants on a long-term follow up basis. Nevertheless, despite the study establishing that the higher the total UPF consumption the increased the risk, it did not indicate whether the lowest intake or below this measure predicts no or lower risk of the multimorbidity being investigated. Confounding factors such as a family history of premature cancers or cardiometabolic diseases were also not taken into account and were noted as a limitation of this study. As per the study by O'Keefe et al. (2014) "The dose makes the poison... or the remedy".

Not all UPFs as classified by the NOVA classification are bad for you. Mozaffarian et al. (2019) suggest that maybe fortified foods should not be classified as ultra-processed as their main role is to improve the nutritional quality of foods by adding specific nutrients rather than fundamentally altering their composition or structure. Fortified foods can often be categorized as ultra-processed but are recommended for some individuals such as older adults and pregnant women who may often be at a nutrient deficiency risk (Department of Health, 1991). In many nutritional guidelines including the UK, Vitamin D fortified breakfast items such as cereal and supplements are advised for older adults. This is because the natural aging process sometimes prevents or limits the amount of vitamin D that can be absorbed from the sun and may also interfere with the kidney's ability to assist in the conversion of active vitamin D (Meehana and Penckofer, 2014). Persons with special requirements and diets may also benefit from fortified foods. For example, vegans who are at risk for vitamin B deficiencies can greatly benefit from food

fortified with vitamin b12 which would not be obtained in plant-based foods (Petti et al., 2017). Messina et al. (2022) also argued that despite labelled as ultra-processed some plant-based meat and dairy alternatives are nutritionally equal to their unprocessed or minimally processed counterparts. Similarly, plant-based foods just like non plant based foods have their risk in the ingredients included in processing that can cause different health concerns (Satija et al., 2017). Nonetheless, nutritionally-dense plant foods once supplemented to make a balance meal and avoid deficiency is known to lower saturated fat intake that is a major risk factor for cardio diseases along with the higher intake of dietary fibre that is known to aid in type 2 diabetes prevention, weight gain and lowering of blood pressure (Key, Papier and Tong, 2021). This is one of the reasons Neufingerl and Eilander (2022) suggested that public health strategies should promote diet transition to more nutrient-dense plant foods, fortification or possibly supplementations due to the benefits. Other nutrient dense foods classified as ultra-processed like canned foods are also still good for you as the nutritional content is often retained and they are quite accessible and convenient (Comerford, 2015).

Canned food consumption may vary from region to region but the production market has seen steady growth due to its demand from consumers for various reasons from its convenience, extended shelf life, lifestyle changes, and urbanization (Shan, 2015) . However, some canned fruits and vegetables may have added sugars, higher contents of sodium, and increased nutrient loss in some cases from prolonged storage or heating, particularly for vitamins c and B which can be easily lost through heat. BPA exposure may also be a risk from canned foods (Ni et al., 2023). Can people be underestimating the impact of canned food on health? A recent article by Ni et al. (2023) suggests that even with many manufacturers finding alternatives for bisphenol A (BPA) usage in can linings, the alternatives still present similar health risks and have been found in the environment. . They also suggest that further research should be redone to determine the tolerable dose intake of these alternatives and to treat the residual exposure of bisphenol with caution even if it is below the current established specific migration limit. (Cordovo et al., 2023) made note that the mechanism by which UPFs cause adverse health impact is unclear.

This is supported by Scour et al. (2019) where in controlled experiments no reduction on health risk was noted from UPF consumption even after nutritional adjustments were made. They suggest that the physical and chemical properties in relation to industrial production methods, ingredients, and by-products may also play a role in ill health effects of UPF consumption. The UPFs that provide the highest risk of ill health are those containing higher levels of sugar, sweeteners, emulsifiers, colorants, and nitrates. Studies like Adams et al. (2019) suggest that personal responsibility should be taken when it comes to the consumption of UPFs but what are the main drivers for UPF choices?

Factors influencing ultra-processed food consumption

In addressing the high consumption of ultra-processed food it is important to understand the reasons why people make this choice. Studies suggest many factors that vary from region to region including time constraints and convenience, cost, their addictive properties, marketing along with cultural and social influences.

Convenience is amongst one of the biggest factors when making food choices especially when time is believed to be limited (Monteiro et al., 2016). This is why ready-to-eat meals, frozen dinners, and snack bars are in high demand as they allow minimal cooking time and some being able to be consumed on the go (Moubarac et al., 2017). Families with limited financial resources may often prioritize cost when making food purchases as ultraprocessed foods in some instances may be cheaper than fresh and whole foods such as fruits, vegetables and lean proteins. On the contrary, a study by Zapata et al. (2023) found that the higher the income the higher UPF consumption was. The inequality of socioeconomic status may be dependent on other confounding factors such as region and culture. Baker et al. (2020) indicated that in high-income countries where UPF might be lower in price, a more prominent intake among persons of a lower income status may be observed. On the other hand, Maia et al. (2020) have explained that poorer populations often prepare their meals that may sometimes cost less than the

UPFs available. The Zapata et al. (2023) findings were in line with the study by Baker et al. (2020) that revealed that high socioeconomic status in relation to higher education and high income is often associated with higher consumption of UPFs. Zapata et al. (2020) reflected that the reason behind individuals from lower socioeconomic backgrounds tend to have more incidence or prevalence of NCDs despite lower intakes can be associated with the upper class being able to afford a more varied diet that would also include healthier foods such as fresh fruits and vegetables. However, Moran et al. (2019) explain that even with accessibility and affordability to healthier food, it may not reduce the purchase of ultra-processed foods as parents and guardians buy based on their children's preferences. In their study, parents valued ultra-processed ready-to-eat meals as they have a good shelf life, are affordable, and are easy to prepare which made prioritizing in their busy schedules easier. Some of the parents believed that these preferences came from outside the home and television. Sadeghirad et al. (2016) expressed that there should be an improvement in the food environment when it comes to the marketing of ultra-processed food. Daniel (2016) also indicated that parents with budget restraints would often purchase a child's preference for ready-to-eat to eat meals as to avoid wastage from buying a healthier alternative.

Further to this, the study by Vignola, Nazmi and Freudenberg (2016) explains how people are attracted to UPFs because of the sensory appeal they have. The additives make food appear more palatable and addictive which can lead to overconsumption and consequently negative health impacts (Schulte et al., 2015). As humans, it is common to find that eating is done with the eyes first (Spence et al., 2016). Manufacturers often add color to food that may have lost its appeal during processing or new colors to entice appeal to the consumer (Martin et al., 2016). Colors are said to unquestionably influence other sensory characteristics that leads on food choice, acceptability, and preference (Vignola, Nazmi and Freudenberg, 2016).

Marketing and packaging that are eye-catching also tends to emphasize how hassle free these ready-to-eat are. (Jaacks et al., 2018). Consequently, with increased busy lifestyles and long working hours, it has become a social norm in some regions to

consume UPFs. Many UPFs can be given the impression of being healthy especially when reformulated by manufactures and making claims on products such as swapping sugar for sweeteners and making claims such as “low fat” and “natural” to attract customers (Du, M. et al. (2018). Promotions and discounts are also provided on UPFs making them more affordable and accessible particularly for lower income people. Scrinis (2015) also explained that with many manufactures being pressured to accept responsibility for their food, it has brought about reformulation and functionality that has led to a lot of misperceptions of healthier food. It explained that examples of this type of marketing includes “ low in”, “no”, “rich in” terminologies making them appear healthier when they may not be as they utilize alternatives that can allow them to keep production cost low. Hall et al. (2019) suggest that reformulation may not address the issue and that it should be considered to remove them entirely from one’s diet.

Many factors have influenced cultural changes such as globalization, urbanization, and media influences. For example, countries such as Brazil, China and Japan have now incorporated fast food into their traditional diets following the expansion of fast food chains such as McDonald (Monteiro et al., 2016). Some may refer to this transition as McDonaldization. Steele et al. (2016) have shown the way the Western food culture including burgers, pizzas, and soft drinks has been adopted by countries like South Korea and India causing a shift in dietary preferences and altering cultural norms. Popkin (2017) also indicated that often when people move from rural to more urbanized areas, they tend to adapt to the practices of these areas due to the broader choice of food. A few decades ago as countries developed and ultra-processed food became more available explains how Asian countries including Thailand and China have adopted a western diet that is one of the factors associated with the high increase of incidence of NCDs seen in the region (Popkin and Gordon-Larsen, 2004 and Baker and Friel, 2014).

Despite the factor that drives choice, the ultra-processed food market is still on the rise and they argue that the problem is not the quality of the food but the quantity of it which is the responsibility of the end user (Lustig, 2020). However, quality can affect quantity.

How to identify ultra-processed food

Identifying processed foods may be considered different since food manufacturers are not compelled to state food processing on labels. However, they can be identified by using the ingredients list. The easiest means to identify if a product is ultra-processed is to check if the ingredient list includes anything you would not find in a normal household kitchen. These include cosmetic additives such as sweeteners, thickeners, emulsifiers anti-foaming, and others (Monteiro et al, 2019). Martins et al. (2016) stated that even when reformulations are done to appease the public by using natural substances they are still harm to us. They advised that colorants from derived from plant, animal, or mineral sources, can cause allergies and sensitivities because of their compound makeup. Some colorants may also provide nutritional properties such as beta-carotene and anthocyanins. Natural and artificial colorants are subject to regulations to ensure safety consumption which may vary from country to country. However, research should be conducted to determine the long-term health effects they may have on people who will chronically be exposed to the substances. This is because despite them being deemed safer than synthetic colorants there are still many reports of allergic and intolerance reactions when compared to the synthetic colorants.

Strategies used to combat ultra-processed food intake

Food high in sugar and fats such as chocolate and fried foods are known to activate regions of the brain associated with pleasure and reward such as the dopamine pathway. When the brain associates pleasure with certain foods, over time it can lead to cravings and overconsumption and consequently adverse health effects such as weight gain and diabetes. Hence because consuming highly palatable foods impacts the brain reward system it is important to avoid or balance these food choices with healthier options like fruits and vegetables (Lustig, 2020). A multi-sectoral approach is required to reduce the consumption of ultra-processed foods. The approaches that have shown chances for improvement in consumer behavior change include, nutritional education,

restricting marketing and advertising of UPFs, fiscal measures such as taxes and subsidies, food labeling regulations, and improving access to healthy foods (Koios, Macho and Lacy-Nichols, 2022).

Many have considered taxing SSBS to be unethical because it reduces their right to free choice and claim that its consumption does not harm others (Goiana-da-Silva et al., 2020). However, Tremmel et al. (2017) state that this is not the case as the higher increase in SSB has been linked with obesity which impacts healthcare service resources significantly. This in turn affects the quality of service that may be received by others (Goiana-da-Silva et al., 2020). Regardless of the claims against SSB taxation, it is said to be effective in evoking behavior change similar to the alcohol and tobacco taxes. Nevertheless, Lustig (2020) has explained that no intervention works on its own and is the most effective when combined. The study suggests using a combination of strategies and the carrot-and-stick approach. They explained that for example, the tax revenue received from high-alcohol spirits can be used to subsidize lower-alcoholic drinks such as beers or non-alcoholic beverages. They highlighted that the same outcome may be possible when it comes to ultra-processed foods. Implementation of these taxes has sometimes seen no change in consumption of these products as producers will often reformulate their products to fall outside the criteria and adjust marketing as previously outlined. In 2018, after the implementation of sugar taxes the purchase did not decrease but remained the same due to reformulation. However, the level of sugar present was lower (Pell et al., 2021). Manufacturing companies may also fight against taxes by threatening the livelihood of a population because they are being attacked. They may claim that SSB is not the sole contributor to many NCDs as people have stopped exercising and continue to smoke which is just as bad. Taxes on beverages and food may also be considered regressive by some as they cause a financial burden on those of the lower class which may explain why the most reduction seen in SSB consumption is amongst people of this class (Colchero et al, 2015). This effect may be cushioned by offering subsidies alongside taxes that can help promote healthier choices (Pineda et al., 2024). For the best health option and reduction in welfare inequality, Caro et al. (2020) suggest that a combination of fiscal policies should

be adopted instead of standing alone. These taxes faced opposition by beverage industries that led to lobbying, and investments in studies to refute claims being made by the health departments (Zenone and Kenworthy). For example, in 2018 the Canadian Beverage Association lobbied against the policy that banned advertisements targeted to children (Weeks, 2018). In 2015, Coca-Cola also invested millions in research that redirected the cause of obesity towards non-diet-related factors such as physical activity (O'Connor, 2015). Regardless of the opposition that is to be expected, a systematic review by Andreyeva et al. (2022) revealed that taxes on SSBs across various countries have seen a reduction in the purchase of these drinks. However, they stated that evaluations conducted by these studies were mainly price and sales-centered. There was no clear indication whether the tax had a positive impact on the consumption of non-SSB drinks and there was only an average reduction of 15%. They also explained that individuals often resort to buying alternative brands or cheaper non-tax carbonated drinks and not non-carbonated drinks.

Besides taxes, other policies include front-of-package food labeling, traffic light systems (Basu et al. 2020), and bans on SSB purchases in workplaces (Choi et al. 2020). It will also encourage retailers to provide a variety of fruits and vegetables that may later increase their demand (Liu et al, 2023). Taillie et al. (2020) explained that understanding food labels may also depend on factors such as nutritional knowledge and socio-economic status. Its effectiveness is also said to be dependent on whether these policies are mandatory or voluntary. Voluntary labeling leads to the underrepresentation of information as businesses may be more likely to label healthier foods only. Further studies are needed to assess the “real-world” impact of food labeling on behavioral change (Kanter, Vanderlee and Vandevijvere, 2018). Given the vast variety of processed food available, consumers may often find it difficult to understand what they are consuming and purchasing (Khan, Ahmad and Bano, 2020). Furthermore, Koios, Machado and Lacy-Nichols (2022) found that dietary advice may be confusing as many guidelines are nutrition-focused and not on the levels of processing. They suggest that “actionable and consumer friendly messages about UPFs be developed. A holistic

approach should be considered when developing interventions geared towards promoting healthier food choices. A systematic review conducted by Thakur and Mathus (2022) revealed that mere knowledge does not depict behavioral change. The other factors that influence this sort of behavior include education, parents/guardians' nutritional knowledge, peer influence, and occupation. It has been advised that more guidelines should follow the lead of Brazil by including the disapproving messages of UPFs in their nutritional guidelines. Studies have also suggested that Mediterranean diets be promoted along with nutrition literacy which is known to be a predictor of diet adherence (Taylor et al., 2019). This may aid in an effort to create a healthier environment.

Before a policy is set forth for ultra-processed food consumption, the trend or contributing factors should be considered to ensure the best strategy or combination can bring about the desired outcome in a maintainable effective manner. To the best of the knowledge of the researcher for this paper, there is no solid evidence published indicating that the lack of knowledge was the cause of the impact of UPF consumption. However, studies such as Gibbs et al. (2018) and Taylor et al. (2019) indicated that persons with lower understanding and knowledge of UPF consumed the most. From this review of the research published on ultra-processed food, the consistent factors that were identified in the literature are lack of understanding and consumer choice. A study by Sarmiento-Santos et al. (2022) investigated the understanding of UPF in Brazil several years after it was mentioned in their nutritional guides. They found that the population was still confused by the categorization even among those of higher education. Earlier, Cornish and Moraes (2015) already explored and confirmed that consumer confusion about nutrition affects their perception of healthy foods and dietary behaviors. (Scrinis, 2015) expressed that food literacy is important despite the exact framework is not clear it can help to improve understanding and possibly reduce the influence of the marketing strategies used for various UPFs. The questions this researcher suggests be asked by any stakeholder are:

- How can behavioural change be encouraged to select traditional foods over UPFs to reduce demand of UPFs and pushing manufacturers to produce true healthier options?
- Given that UPFs offer convenience in an age where time is costly and precious, what skills can be provided to combat the need for this type of food?
- How can the understanding of UPFs be improved and are there alternative terminologies that may be easily understood by the public?

Poor nutrition literacy can lead to the inability to make healthy food choices and select more western diets; whereas good nutrition literacy can aid healthy food choices and promote a more Mediterranean diet (Taylor et al., 2019). Taylor and company expressed that despite the exact means by which nutrition literacy aids food choices if not fully examined it is known to have an impact on food choice. Thakur and Mathus (2022) have advised that the goal should be to develop healthy eating skills among children and adolescents whilst improving the food environment. Sultana (2017) states that “Children can be taught what is best”. The study explained that training children from an early age is said to be a predictor of dietary choices throughout their lifetime that can help them to avoid many NCDs such as kidney failure and diabetes. Sultana said that nutrition education in the school curriculum and family involvement may assist in curbing children’s dislike and change in taste when exposed to Western diets. The study demonstrated a causal effect of lack of nutrition knowledge in children and their choice of fast food consumption and dislike for homemade food. It predicts that knowledge of how these foods can affect their health later in life rather than immediately may deter children from indulging in their consumption and eventually passes along these values to their children once they continue to become parents themselves. This is supported by Godos et al. (2022) who have also expressed that education programs be put in place to provide information on what UPFs are before their availability and popularity. Fulkerson et al. (2017) have shown that families, partaking in cooking skills development, meal planning, and nutritional activities are more likely to have parents with an improved sense of self-efficacy when eating healthier and managing children’s consumption of SSBs.

People are moving away from traditional foods and consuming more UPFs (Vitale et al., 2012) that are high in refined sugar and fats (Serafini and Toti, 2016). Consumption of minimally processed foods or unprocessed is often formed in the Mediterranean region and is often known to have a lower risk for the development of many non-communicable diseases and premature deaths (Godos et al., 2022). When promoting the cooking aspect of food literacy it should be taken into account that there are many different perspectives on cooking and some people may do it with fresh ingredients others with convenience goods (Wolfson et al., 2016). Reicks et al. (2014) indicated that barriers to cooking interventions include general preferences, resistance to change, and financial restraints. They further indicated that involving the family in cooking interventions may help reduce resistance to healthy diet changes. The study acknowledged that interventions are not able to address all barriers such as lack of cooking skills, facilities, and food accessibility, hence as suggested by Sultana (2017) it would be ideal to tackle this gap by implementing nutrition education and food literacy in schools. They also suggest evaluating cooking interventions is needed to assess the long-term health outcome or cooking behavior of the general population. As explained by Velardo (2015) nutrition literacy can be defined as the ability to access, understand apply nutrition knowledge to make healthy food choices. Nutrition literacy often provides the ability to interpret food labels and identify and understand portion sizing. Whereas, food literacy expands on nutrition literacy and includes understanding where food originates, production methods along with cooking and preparation skills. It includes food safety and hygiene, food marketing, and meal planning.

A study conducted by Shamim, Khan and Ahmad (2020) shows that despite 70 % of their population look at the labels when purchasing UPFs, only approximately 30 % of them do it all of the time. Some of the reasons for not paying attention include lack of time, no interest, and inability to understand some terminologies used on the labels. This article supports interventions at an elementary education level so that the young generation to instill an understanding of food labels and the importance of “balanced

food habits”. Studies supporting nutritional literacy in adolescents have advised that educational content can be developed and shared using social mass media that is often used by this population (Koca and Arkan, 2020). It has been noted that whole foods are an easier term to familiarize one’s self with when compared to differentiating between ultra-processed foods (Fulkerson *et al*, 2017). Whole foods are often in their natural form and have not or have been minimally processed and include fruits, vegetables, nuts and lean protein such as fish and tofu (Dobrow, 2014). They may be easier to understand as food they are not likely to have additives not recognized by the consumer. They are often nutrient dense, low in added sugar and sodium with a good fiber content and known to reduce risk of chronic diseases such as type 2 diabetes , cardiovascular diseases and cancer (Wright *et al.*, 2017).

These suggestions are in line with the report set forth from the NOURISHING policy brief. The nutrition policy index was an assessment conducted across 30 European countries to provide insight into how well governments are doing in helping people to eat a healthy diet to prevent overweight and obesity (Nutrition Policy Index, 2023). The report found that despite most countries having taken action in nutrition labelling and creating public awareness, improvements are needed in areas of nutrition advice and counselling in the healthcare setting, restricting food advertisement and other forms of commercial promotion, and the provision of nutrition education and skills. There were reports that there may not be enough evidence to support whether the countries have sufficiently put incentives in place to create healthy retail and food service environments and ensure food affordability. Ways to improve policies included targeting children and adolescents, and making schools and their nearby vicinity provide food of a nutritional level. In improving the nutritional quality of the whole food supply nutrition limits should be put in place. Developing public awareness campaigns with specific target groups such as adolescents. Dietary shift is essential to nutrition transition (Popkin and Ng, 2021). Hence, it is important to enhance food literacy to modify taste and reduce the resistance being faced in the efforts to combat the spread of poor-quality processed foods (Scrinis, 2015).

Strengths and Limitations

This type of study can allow persons with little knowledge on the subject of UPFs to gain a reasonable understanding of the food, its advantages, and disadvantages and present strategies in place in an attempt to reduce their use in a manner that provides little to no bias. However, due to the varying samples and context of the studies, it may not be able to be generalized or recreated. Nevertheless, critically reviewing and attempting to identify a gap or focus in the existing strategies can help policymakers identify a longer-term solution to the current issues being faced. Another limitation of the study would be that recommended policies have been implemented in some countries, however, they are fairly new and sources on their effectiveness on a long-term basis have not been found. The paper was also unable to cover in-depth cultural differences when it comes to food choice as only English articles were included.

Future research recommendations

From the review of literature, further studies can be done to evaluate the effectiveness of nutrition literacy programs on the food choices of their participants from the starting of the program and over few follow up years.

Summary

In conclusion, UPFs are indeed linked to adverse health. However, all UPFs are not equal as others may be beneficial to health. The more detrimental ones are often those with refined sugar and fat along with many additives including colorants, preservatives, and sweeteners. The best way to identify them is by consulting the nutrient labels and seeing how many ingredients are not often found in one's kitchen cabinet or pantry. Each policy to combat the consumption of ultra-processed foods has its challenges; however, it boils down to consumer choice. Given that even the manufacturers of UPF pass on blame and responsibility to the end user; stakeholders should investigate questions such as how can people's preferences be changed in a manner that can encourage and sustain unprocessed or minimally processed food choices. Interventions work better together than alone and nutrition and food literacy are important in molding healthier food choices among parents and children alike. It is recommended that these interventions be introduced at a young age to increase the likelihood of compliance to a more non-western diet such as the mediterranean diet that is made up of a lot of fruits, vegetables, and lean meat. These educational programs may assist in healthier food choices and the understanding of other policies such as food labels. It is best to investigate the major drivers for food choice in any region to determine the best-suited policies and it is recommended that further studies be carried out to investigate whether food literacy and self-efficacy will impact food choice on a long-term basis.

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