PROPORTION OF THE PROCESSED FOOD AND ULTRA-PROCESSED FOOD (UPF) CONSUMPTION AND ITS ASSOCIATED FACTORS AMONG ADULTS ATTENDING GENERAL CLINICS IN HOSPITAL UNIVERSITI SAINS MALAYSIA

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LIST OF SYMBOLS

%	Percent
=	Equal to
≥	More than and equal to
≤	Less than and equal to
>	More than
<	Less than

LIST OF ABBREVIATIONS

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CI	Confidence Interval
IOM	Institute of Medicine
IPH	Institute for Public Health
KRK	Klinik Rawatan Keluarga
MANS	Malaysian Adult Nutrition Survey
MOH	Ministry of Health
MOH	Ministry of Health
MyCoSS	Malaysian Community Salt Study
NCCFN	National Coordinating Committee for Food and Nutrition
NCD	Non-Communicable Disease
OR	Odds Ratio
SPSS	Statistical Package for the Social Sciences
UPF	Ultra-processed food
USM	Universiti Sains Malaysia
WHO	World Health Organisation
YLL	Years Life Lost

LIST OF APPENDICES

KADAR PENGAMBILAN MAKANAN TERPROSES DAN MAKANAN ULTRA-TERPROSES SERTA FAKTOR-FAKTOR YANG BERKAITAN DALAM KALANGAN ORANG DEWASA YANG MENGHADIRI KLINIK AM DI HOSPITAL UNIVERSITI SAINS MALAYSIA

ABSTRAK

Penyakit berkaitan pemakanan telah muncul sebagai kebimbangan utama kesihatan awam, menyumbang kepada kematian pramatang dan memberi impak besar kepada peningkatan kes obesiti, penyakit tidak berjangkit, dan penyakit kardiovaskular. Makanan terprosess and ultra-terproses kebiasaannya dihasilkan secara perindustrian. Makanan ultra-terproses mempunyai kepadatan tenaga yang tinggi, kekurangan bahan berkhasiat, mempunyai rasa yang lazat, serta mempunyai kaitan yang kuat terhadap kesan kesihatan yang buruk. Kajian ini bertujuan untuk menentukan kadar pengambilan makanan yang terproses dan makanan ultra-terproses dalam kalangan orang dewasa yang menghadiri klinik am di Hospital USM serta faktor-faktor yang berkaitan dengannya. Ini adalah kajian keratan rentas yang mengumpulkan data primer daripada orang dewasa yang menghadiri klinik am di Hospital USM dengan menggunakan borang soal selidik kekerapan pengambilan makanan yang telah dirumuskan berdasarkan klasifikasi NOVA (bukan akronim). Kami menilai skor kepelbagaian pengambilan makanan ultra-terproses dengan menjumlahkan makanan ultra-terproses yang dimakan dalam tempoh seminggu, dan kemudian mengelaskan corak pemakanan ultra-terproses dalam kalangan responden kepada pemakanan yang tinggi ataupun rendah. Regresi logistik berganda (Multiple Logistic Regression) digunakan untuk meramalkan faktor-faktor yang berkaitan dengan peningkatan tahap pengambilan makanan ultra-proses dalam kalangan orang dewasa yang menghadiri klinik Am di Hospital USM. Majoriti responden adalah perempuan (64.6%), Melayu (90.8%), bujang (62.2%), dan tergolong

dalam kumpulan pendapatan isi rumah B40 (68.1%). Makanan ultra-terproses yang paling kerap dimakan adalah roti bungkus, mi kuning, minuman koko, dan diikuti oleh minuman susu berperisa. Peratusan responden yang mempunyai skor kepelbagaian makanan ultra-terproses yang tinggi adalah 54%, menunjukkan lebih daripada separuh daripada responden mengambil makanan ultra-terproses lebih daripada tujuh kali seminggu. Faktor masa yang dihabiskan di hadapan skrin (AOR 2.148, 95% CI: 1.181–3.906, nilai p = 0.012), penerima bantuan kewangan (AOR 2.436, 95% CI: 1.267–4.684, nilai p = 0.008), dan tidak bekerja (AOR 2.436, 95% CI: 1.267–4.684, nilai p = 0.023) berkait secara signifikan dengan pengambilan makanan ultra-terproses yang tinggi dalam kalangan dewasa berumur 18–39 tahun yang menghadiri klinik Am di Hospital USM. Kesimpulannya, kebanyakan orang dewasa Malaysia yang hadir ke klinik Am di Hospital USM kerap memakan makanan ultra-terproses. Faktor-faktor yang dikenal pasti dalam kajian ini bermanfaat untuk dijadikan asas dalam tindakan yang boleh dilakukan oleh pelaksana polisi dan dasar dalam membuat perancangan untuk mengurangkan kebergantungan kepada pengambilan makanan ultra-terproses demi mencapai hasil kesihatan awam dan individu yang lebih baik.

Kata kunci : Ultra-terproses, NOVA, kesan buruk, Faktor-faktor berkaitan

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ABSTRACT

Nutritional-related diseases have emerged as a major public health concern, contributing to premature mortality and significantly impacting the increasing prevalence of obesity, noncommunicable diseases, and cardiovascular disease. Processed food and ultraprocessed food are usually formulated industrially. Ultra-processed food is characterised by its energy-density, reduced nutritious ingredients, and hyperpalatable taste, and it has strong links with adverse health outcomes. This study aimed to determine the proportion of the processed food and ultra-processed food consumption among adults attending general clinics at Hospital USM and its associated factors. This is a cross-sectional study that collected primary data from adults who went to general clinics at Hospital USM using a sociodemographic and Malay-validated food frequency questionnaire based on NOVA classification. We assessed the ultra-processed food diversity score by summing the different ultra-processed foods consumed within a week, which facilitated the classification of low and high consumption. Multiple logistic regression was used to predict factors associated with an increased level of ultra-processed food consumption among adults attending general clinics at Hospital USM. The majority of the respondents were female (64.6%), Malay (90.8%), single (62.2%), and belonged to the B40 household income group (68.1%). The most common ultra-processed foods consumed were packaged bread, yellow noodles, cocoa drinks, and flavoured milk drinks. The proportion of respondents who had a high ultra-processed food diversity score was 54%, indicating more than half had consumed ultra-processed food seven times per week. Screen time (AOR 2.148, 95% CI: 1.181–3.906,

p-value = 0.012), having received financial aid (AOR 2.436, 95% CI: 1.267–4.684, p-value = 0.008), and being unemployed (AOR 2.436, 95% CI: 1.267–4.684, p-value = 0.023) were significantly associated with high consumption of ultra-processed among adults aged 18–39 years old attending general clinics Hospital USM. In conclusion, most adults attending general clinics in Hospital USM consume ultra-processed food regularly. The factors identified in this study may suggest areas of action for policymakers to explore ways to limit ultra-processed food consumption to achieve better health outcomes.

Keywords : Ultra-processed foods, NOVA classification, factor associated, adverse health outcomes

CHAPTER 1

INTRODUCTION

1.1 Study Background

Nutrition is a vital aspect of public health. From a larger perspective, nutritional-related problems have a significant effect on the rising trends of obesity and malnutrition, non-communicable diseases (NCDs), and cardiovascular diseases (Adams et al., 2020). This has become a leading public health threat in recent years. The World Health Organisation (WHO) reported that NCDs kill around 41 million people every year, accounting for 74% of deaths globally. Each year, NCDs prematurely claim the lives of an estimated 17 million people, with low- and middle-income countries contributing to over 80% of these premature deaths (WHO, 2023). A similar situation was observed in Malaysia. The primary contributor to the disease burden is NCDs, which account for 72% of the Years of Life Lost (YLL). Meanwhile, ischemic heart disease is the leading cause of premature deaths among Malaysians (17.7%), followed by respiratory infection (9.7%), road traffic injuries (8.7%), cerebrovascular diseases (8.0%), and diabetes mellitus (3.9%). Apart from that, the NHMS (National Health Malaysia Survey) since 2011 has observed that obesity is still prevalent and has continuously kept rising in trends. This has caused significant escalated social and economic costs to the individual, family, and country (Ganasegeran et al., 2020).

Non-communicable diseases and their risk factors result from complex interactions between genes, behaviours, psychological factors, and the environment (WHO, 2023). Overweight and obesity are linked primarily to unhealthy dietary intake and overconsumption of calories and sugar, including high energy intake. Unhealthy dietary intake is strongly associated with the increased prevalence of diabetes mellitus, hypertension, cardiovascular disease, and obesity worldwide, as well as in Malaysia. Dietary factors that pose a strong correlation to mortality include high sodium intake, low intake of

whole grains, and reduced fruit and vegetables (Wang et al., 2014). Diets that are high in sugar and fat (particularly trans-fat and saturated fats) also increase the risk of NCDs. Collectively, dietary risk factors become the second-leading risk factors attributable to the global mortality of females, while the third-leading risk is for males (Murray et al., 2020).

Malaysia is not exceptional. Malaysia is currently seeing a nutritional transition while adopting modern processed foods. This may be part of the results of urbanisation and the progressing industrialization of the food industry. Modern food processing requires the use of salt and sodium for food supply. This had led to increasing demand for salt and sodium utilisation in the food supply, thereby affecting the unhealthy overall contents of food. Sodium-containing compounds such as sodium benzoate, sodium nitrate, and sodium ascorbate are being used in food processing (IOM, 2010). Meanwhile, the Malaysian Adult Nutrition Survey (MANS) showed that food sources of high sodium content mostly came from local delicacies/desserts (79%), breads (76.9%), rice-based foods such as bihun, kueyteow, laksa, laksam, loh si fun (76%), ketchup (75.6%), and noodles (75.2%) (Institute for Public Health (IPH), 2019). Recent findings from My Community Salt Survey (MyCoSS) reported that the top 10 high-sodium foods most consumed by Malaysian adults were fried vegetables, white or wholemeal bread, omelettes, fried chicken with spice, fried rice, nasi lemak, roti canai, fried bihun, fried noodles, and chicken curry (Institute for Public Health (IPH), 2019). Modernization does not necessarily mean that Malaysian food culture adopted western food; however, it is interesting to note that home-cooked food and eaten-away food from home contributed to increased sodium intake.

Food processing has given rise to concern regarding ultra-processed food (UPF). Food processing generally refers to actions that alter foods from their natural state, such as drying, freezing, milling, canning, or adding additives for preservation. The industrialisation and globalisation of food systems over the past decades have led to the advancement of food

processing, which has resulted in the processing of different types of food and given rise to various health issues (Baker et al., 2020). The recognition of health issues associated with industrial processing and the impact of diet quality on chronic diseases has prompted the development of food classification systems that differentiate various types of processed food. Among those classifications is the NOVA (a name, which is not an acronym) classification, developed by researchers from Brazil, is a framework of grouping foods based on the extent and purpose of food processing. It is widely used worldwide and is considered the most comprehensive, specific, coherent, and workable classification system (Monteiro et al., 2016). The NOVA classification system categorises foods into four distinct groups based on the extent and purpose of their processing. Group one (unprocessed or minimally processed foods) consists of unprocessed and minimally processed foods, such as fresh fruits, vegetables, grains, and meats that undergo minimal processing, primarily for preservation, packaging, or convenience. Group two (processed culinary ingredients) includes processed culinary ingredients derived from Group 1 foods or from nature, such as oils, fats, sugar, and salt, which are used in cooking to prepare, season, and cook foods. Group three (processed foods) consists of products manufactured by the industry that essentially add salt, sugar, or another substance to process foods to make them stable and more palatable, such as canned vegetables, fruits in syrup, and freshly made breads. Group four, also known as ultra-processed foods, comprises ingredients primarily for industrial use, formulated from foods or synthesised from other ingredients rarely used in home cooking. These include manufactured products such as soft drinks, sweet or savoury packaged snacks, and pre-prepared frozen dishes. These foods are primarily derived from industrial processes and are distinguished by their appealing taste and extended shelf life. The increasing consumption of processed foods and ultra-processed foods has raised concerns due to their association with various health issues, including obesity, cardiovascular diseases, and other noncommunicable diseases.

Ultra-processed food is not just food that is modified, but rather edible products

formulated from food-derived substances along with additives that heighten their appeal and durability. Many studies have linked excessive ultra-processed food consumption with an increased risk of non-communicable diseases such as cancer, ischemic heart disease, functional dyspepsia, and obesity. Ultra-processed food usually contains high calories, sugar, refined starch, unhealthy fats, and sodium. A large observational study done by Srour et al. (2020) showed that a higher proportion of ultra-processed food consumption is associated with a higher risk of type 2 diabetes mellitus. González-Palacios et al. (2023) conducted a large sample study among patients with metabolic disease and also suggested consumption of ultra-processed food leads to worsening cardiometabolic risk factor. People who consumed more ultra-processed foods were more likely to have an increased body mass index (BMI), especially in the obese population (Rauber et al., 2021).

In Malaysia, a study involving respondents living in low-cost communities found that adults were more likely to have unhealthy dietary patterns and high consumption of ultra-processed food (Eng et al., 2022). Ali et al. (2020) found that the frequency of ultra-processed food consumption is lower than that of processed food; however, sucrose (63.0%), sodium (26.0%), and energy (24.0%) contributed the highest amount of consumption. Other studies have also shown similar results. However, studies on the consumption of ultra-processed food in Malaysia are still scarce (NCCFN, 2021) and more studies are required to present comprehensive data on the local situation.

1.2 Problem statement

Dietary consumption plays a significant role in public health issues. Given compelling evidence of a correlation between nutritional consumption and chronic illnesses, it is imperative to implement proactive measures to tackle unhealthy diets that contribute to the development of risk factors for chronic diseases. The growing use of processed and ultra-processed food among Malaysians is leading to a nutritional transition that will undoubtedly

have adverse consequences in the future. This would undoubtedly lead to a significant public health burden as the prevalence of nutrition-related chronic diseases continues to rise in Malaysia. Moreover, Malaysia is anticipated to experience a progressively older population in the coming years. Due to the current prevalence of unhealthy eating patterns, particularly the excessive consumption of energy-dense ultra-processed food, the younger population has an increased risk of developing chronic diseases in the future. This, in turn, will add to the financial strain of public health interventions. Hence, it is crucial to investigate the risk factors associated with excessive consumption of ultra-processed food and facilitate future intervention. Furthermore, it is imperative to prioritize population health in order to mitigate the burden on public health issues.

1.3 Rationale of the study

The global situation of ultra-processed food consumption is showing increasing trends, without exception to the Malaysian situation. Ultra-processed food consumption has a significant association with adverse health outcomes, as demonstrated by various studies worldwide. High consumption of ultra-processed food leads to a higher risk for non-communicable diseases, cardiovascular risk, and overall risk for all-caused cancer. Nutritional transition has become part of dietary change following urbanisation and modern lifestyles. In the Malaysian setting, the number of studies regarding the effects of ultra-processed consumption is scanty, particularly pertaining to risk factors for high consumption of ultra-processed food among the Malaysian population. More study is much needed to obtain more reliable data to draw conclusions as well as to construct future plans for health advocacy and policy regarding ultra-processed food consumption in local settings. This study aims to give better insight regarding risk factors for increased ultra-processed food consumption and fill in the gaps in current knowledge pertaining to the subject matter. This is also the first study to

investigate the risk factors of increased ultra-processed food consumption among healthy adults attending general clinics among Malaysian population.

1.4 Research question

The purpose of this study is to describe the proportion of processed food and ultra-processed food consumption among the adult population attending to general clinic and then determine the factors associated with the increased level of ultra-processed food consumption. The following research questions have been identified for this study:

1. What is the proportion of processed food and ultra-processed food consumption among adults attending general clinics?
2. What are the factors associated with ultra-processed food consumption among adults attending general clinics?

1.5 Objectives of the study

1.5.1 General objectives

To study the proportion of processed food and ultra-processed food (UPF) consumption, and its associated factors among adults attending general clinics.

1.5.2 Specific objectives

i. To determine proportion of processed food and ultra-processed food (UPF) consumption among adults attending general clinics.

ii. To determine the factors associated with ultra-processed food (UPF) consumption among adults attending general clinics.

1.6 Research hypothesis

1. Null hypothesis:

   There is no association between age, gender, ethnicity, socioeconomic status, education level, household income, number of household members, occupational status and screening time with the ultra-processed food consumption among adults attending general clincs.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review was undertaken by utilising various freely accessible search engines on the internet, mainly PubMed and Google Scholar. In addition, the university's subscribed database was also used to search for literature. The literature search was not restricted to current publications alone due to the limited number of papers available on the issue, particularly in relation to Malaysia or Asia. A variety of search tactics were employed, including the use of Boolean operators (AND, OR, NOT) to combine terms. List of keywords applies during the searches such as ultra-processed food, dietary pattern, associated factors, health outcomes and NOVA classification.

2.2 Ultra-processed food and health outcomes

Research consistently links the consumption of ultra-processed foods to unhealthy diet. Throughout various studies, UPF consumption has been linked to growing evidence of adverse health outcomes. One narrative review analysed 43 studies highlighting association of ultra-processed food with negative health outcomes found that exposure of UPF in diet linked to various health issues such as obesity, cardio-metabolic risks, cancer , type-2 diabetes , cardiovascular risk , irritable bowel syndrome, depression, frailty conditions, and all-cause mortality. None of the studies included in the review found any positive health outcomes linked to the consumption of ultra-processed foods (UPF) (Elizabeth et al., 2020). A prospective cohort study among adults in the UK demonstrated that higher consumption of UPF was significantly associated with a higher risk of developing overall obesity (Rauber et al., 2021). Neri et al. (2022) found that eating ultra-processed foods is a major cause of rising obesity in kids and teens. Those with visceral obesity ate more ultra-processed foods than

those without visceral obesity. A prospective cohort with large sample study exploring the association in the Spanish adult population between consumption of UPF and all-cause mortality found a positive association between them (Blanco-Rojo et al., 2019). Furthermore, high intake of ultra-processed food is associated with a high risk of cardiometabolic diseases, frailty, and cancer (Lane et al., 2022). In addition, a strong association is also indicated with non-communicable diseases, cardiovascular disease, coronary heart disease, and cerebrovascular diseases (AOR; 1.09, 95% CI : 1.05,1.13 ; P < 0.001), (Beslay et al., 2020). Higher consumption of ultra-processed food was associated with slightly increased all-cause mortality, according to a recent large prospective cohort study with a long period of follow-up. Groups with meat, poultry, or seafood-based ready-to-eat products generally showed a strong, consistent association with mortality, while other subgroups of food showed a modest association. This study supports limiting long-term consumption of certain types of ultra-processed food (Fang et al., 2024). With the abundance of research findings regarding the ultra-processed food effect, excessive consumption of ultra-processed food undeniably has strong links with negative health outcomes.

2.3 Ultra-processed food and NOVA classification

The NOVA classification proposed a method of classifying food based on the level of processing. It employs a novel way to classify food according to the nature, extent, and purpose of food processing. Previous work referred to this classification as the 'new classification' and later granted it the name NOVA. Notably, the NOVA classification coined the definition of ‘ultra-processed foods’ that subsequently influenced the dietary guidelines in developing and developed countries (Petrus et al., 2021). Ultra-processed foods, as defined using the NOVA food classification system, comprise a range of ready-to-eat products, including packaged snacks, carbonated soft drinks, instant noodles, and ready-made meals. The products are industrially manufactured foods formulated with a number of