frontiers | Frontiers in Sustainable Food Systems

TYPE Systematic Review
PUBLISHED 07 November 2023
DOI 10.3389/fsufs.2023.1252592

OPEN ACCESS

EDITED BY
Nona Naderi,
Universite Paris-Saclay, France

REVIEWED BY
Nur Aliah Mansor,
Tunku Abdul Rahman University, Malaysia
Nur Hafizah Muhammad,
Universiti Malaysia Kelantan, Malaysia

*CORRESPONDENCE
Chen Abang Brian
✉ abangbrian@gmail.com

RECEIVED 04 July 2023
ACCEPTED 17 October 2023
PUBLISHED 07 November 2023

CITATION
Abang Brian C, Stephenson ML and Tan AL (2023) Recent research patterns and factors influencing eating behaviour amongst Malaysian youths: a scoping review. *Front. Sustain. Food Syst.* 7:1252592. doi: 10.3389/fsufs.2023.1252592

Recent research patterns and factors influencing eating behaviour amongst Malaysian youths: a scoping review

Chen Abang Brian[1]*, Marcus L. Stephenson[1] and Ai Ling Tan[2]

[1]School of Hospitality and Service Management, Sunway University, Bandar Sunway, Malaysia, [2]Surrey International Institute, Dongbei University of Finance and Economics (SII-DUFE), Dongbei, China

Introduction: This scoping review focuses on the eating behaviour of Malaysian youths and the way in which their eating behaviour has been studied in recent years. There is a continuous need to comprehend the nature and structure of eating behaviour acquired during young adulthood as it is linked to the increasing number of adults who are overweight and obese. Past research has been employed using various methodologies in the analysis of different dimensions of eating behaviour amongst Malaysian youths. This enquiry reviewed recent studies to collate and map out the methodologies, areas of research and factors associated with eating behaviour amongst this target group.

Methods: The "preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews" (PRISMA-ScR) was adopted for this scoping review which utilised the EBSCOhost discovery platform and other such databases as Sage, ProQuest and Clinical Key™.

Results: The search resulted in a total of 34 articles which were then analysed. This gave rise to the identification of four main dimensions of eating behaviour amongst Malaysian youth, namely: "general adequacy and frequency of consumption of food groups"; "consumption of specific food groups"; "eating disorders"; and "weight control."

Conclusion: The majority of the recent studies focused on the general adequacy and frequency of consumption of food groups studied using quantitative approaches across multi-ethnic target groups within the central region of Malaysia. This leaves room for more studies on the consumption of specific food groups, eating disorders and weight control that could be more ethnic-centric within other geographical areas within Malaysia. Many studies suggested the need to apply qualitative measures to investigate the contradictions arising from current research concerning the interplay between interpersonal, intrapersonal and environmental factors affecting eating behaviour amongst Malaysian youths.

KEYWORDS

eating behaviour, youths, Malaysia, scoping review, dietary intake

1. Introduction

The tripling of the obesity rate of the human population worldwide from 1975 to 2016 resulted in 650 million adults (18 years and older) being classified as obese (World Health Organization, 2018). If these rates do not slow down there could over 1 billion obese adults by 2025 (World Health Organization, 2018), meaning that this health risk would be qualified as a global epidemic (Boutari

and Mantzoros, 2022). Obesity causes a multitude of health concerns, notably cancer and mental health disorders as well as reduced quality of life and life expectancy (Goh and Tham, 2023). Globally, 12% of all deaths from noncommunicable diseases (NCD) in 2019 were attributed to obesity (World Health Organization, 2018).

In March 2022, the Ministry of Health of Malaysia (MOHM) declared that one in two Malaysians are now considered overweight or obese [Institute for Public Health (IPH), 2020]. The rate of overweight and obesity reported by the 2019 National Health and Morbidity Survey (NHMS) is 15.1% amongst children under 18 and 50.1% amongst adults aged 18 years and above [Institute for Public Health (IPH), 2020]. The World Health Organization (2018) stated that concerns relating to being overweight and obese are directly linked to unhealthy eating habits amongst adults, which have been acquired since young adulthood. As such, food consumption during the transitional period of young adulthood requires academic attention and empirical investigation.

Food consumption and eating behaviour are complex subjects which have drawn the attention of various schools of thoughts over the years. On one hand, some argue that food consumption is directly dictated by appetite which is influenced by a myriad of internal biological mechanisms as well as social and environmental factors (Dovey, 2010). On the other hand, there are also researchers such as Rappoport (2010) who believe that eating behaviour is influenced by the interplay between such dominant food ideologies as hedonism, nutritionism and spiritualism. Rappoport (2010) elaborates that hedonism concerns an individual's search to maximise pleasure through food choice while nutritionism concerns an individual's need to consume food based on fulfilling nutritional requirements that are essential to bodily functions and subsistence. Meanwhile, beyond confining the notion of spiritualism to the context of religion, Rappoport (2010) contends that spiritualism refers to how an individual or group of individuals relate food consumption to their personal beliefs which may be influenced by other non-religious factors.

From the biological standpoint, Dovey (2010) argues that appetite is regulated by the interaction between homeostatic and hedonic mechanisms. Dovey (2010) elaborates further that homeostatic mechanisms can be defined by the biological necessity to maintain the body's energy reserves, while hedonic mechanisms are controlled by food reward and cravings for delicious food that are mediated by hormones within the body and the brain. This seems to coincide with Rappoport's (2010) food philosophy concerning the respective and rudimental components of nutritionism and hedonism. Heshmat (2011) indicates that appetite and daily consumption patterns are also impacted by external environmental factors that govern access, availability and barriers to food determined by the physical settings in which food consumption takes place. Social elements such as norms and pressures caused by the complexity of relationships with others such as family, friends and peers also sway individual food consumption patterns (Heshmat, 2011). The role of environmental factors in influencing eating behaviour is further echoed by Ungureanu and Mihai (2022), stating that eating behaviour constantly evolves with time and influenced by circumstances and events. This constant evolution points to the necessity of acknowledging continuous updated research on eating behaviour and biological, social and environmental factors affecting eating behaviour.

1.1. The need for a scoping review

A scoping review is the chosen methodology to target the breadth of the area identified, differing from a systematic review which is more aimed at determining the quality and effectiveness of past research (Munn et al., 2018). The scoping review, however, will focus on studying the extent and nature of a specific body of relevant literature as well as organising and summarising the subject matter, with the intention of identifying research gaps and informing future research (Peters et al., 2021). Through the adoption of a recognised and streamlined approach to scoping reviews, the PRISMA-Scr methodology will be employed to allow for the retrieving of articles with a predetermined objective. At present, there has been some scoping reviews on food consumption and eating patterns amongst Malaysians (Ramadas et al., 2021; Yaacob et al., 2021), though these reviews have only focused on the diet quality of the Malaysian population across one's lifespan (Ramadas et al., 2021) and obesity interventions among school children in Malaysia (Yaacob et al., 2021). There is a lack of focus on consolidating current knowledge on eating behaviour amongst Malaysian youths and factors affecting such eating behaviour. For the purpose of clarity, this study defines "youths" as being individuals aged 15–25 years old (United Nations, 2013).

Previous studies concerning eating behaviour amongst Malaysian youths were conducted separately and independently from one another (Ramadas et al., 2021). As such, these studies differ in the selection of populations, methodology, instrumentations and measurements, thereby addressing different dimensions of eating behaviour. This gives rise to the need to collate these efforts to allow for the identification of remaining gaps within this area and to implicate future areas of research. The scoping review is further supported by Malaysia's Ministry of Health, which has called for the continuous understanding of eating behaviour amongst young adults in Malaysia (Ministry of Health Malaysia, 2020). As such, this review inspects existing work concerned with documenting eating behaviour and related factors affecting eating behaviour amongst Malaysian youths.

The development of the current scoping review is based on two main research questions: Firstly, "how has eating behaviour amongst Malaysian youths been studied (over a specific period)?" Secondly, "what are the factors affecting such eating behaviour"? The following section contextualises the approach taken which is employed in order to obtain detailed responses to these two questions. The paper then describes the scoping review conducted and the collation of the literature before selecting, distinguishing and evaluating the research undertaken on eating behaviour characteristics and patterns amongst Malaysian youths. Finally, the paper critically discusses the research gaps and constructs key recommendations for future areas of research.

2. Methods

This section justifies and explains the methodology selected for this study, namely PRISMA-Scr. The discussion also explains the criteria for including and excluding particular resources, describes the

scoping review process, and elucidates on the data abstraction and analysis utilized.

2.1. Preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews

The PRISMA-ScR is a methodology for scoping reviews that has been used widely in recent studies on eating behaviour both internationally (Bédard et al., 2020; Chung et al., 2021; Walker et al., 2021; Gesteiro et al., 2022) and locally (Ramadas et al., 2021; Yaacob et al., 2021). Although initially developed for the medical field, scoping reviews assure that the PRISMA-ScR can also be suitable for social scientific areas of study; especially as this approach addresses respective research questions relating to the "breadth" of the literature. The PRISMA-ScR methodology allows for the capturing of the extent of the literature over a defined timeframe using specific predetermined search terms, involving a literature inclusion and exclusion criteria. In addition, the execution of scoping reviews using the PRISMA-ScR methodology provides for a detailed outline of the process conducted which can also serve as guidance for future scoping reviews.

2.2. Resources

The primary search was done through the aid of EBSCOhost discovery platform which collates a robust myriad of databases including PubMed, Ovid MEDLINE, Embase and ScienceDirect. Specifically, this platform indexes close to 872 food science and food related journals. This study further drew on a multitude of databases at the advice of Younger (2010), who emphasises that researchers should utilize more databases in an endeavour to increase the probability of obtaining more relevant articles. Accordingly, secondary searches using the same search strategy were also extended to other established sources such as Sage, Proquest and Clinical Key™.

2.3. The systematic review process for selecting articles

In ensuring that the literature review corresponded to the predetermined aims of the scoping review, articles were first identified and screened. Accordingly, the eligibility criteria of the articles were established and content of each selected article was abstracted and finally analysed.

2.3.1. Step one: identification of articles

The selection of articles was based on a systematic process which involved three main stages: (1) the identification of keywords based on the research questions determined for this study; (2) a search of similar and related terminologies listed in dictionaries, the thesaurus, and past research enquiries; (3) the list of keywords was compared to the list of keywords of similar published scoping reviews on eating behaviour both locally (Ramadas et al., 2021; Yaacob et al., 2021) and internationally (Bédard et al., 2020; Chung et al., 2021; Walker et al., 2021). These combined keywords were then compiled into search strings applied for the primary search on the EBSCOhost discovery platform on February 8, 2022 resulting in a total of 30,529 articles being identified. Subsequently, a secondary search was enacted on the other platforms, notably Sage, Proquest and Clinical Key™, resulting in the identification of an additional 123 articles (see Table 1).

TABLE 1 Search string and strategy as of 8th February 2022.

Stage	Description	No. articles
1	Initial key words used for Boolean search on EBSCOhost discovery platform. "Eating habit"* OR "eating behaviour"* OR food habit* AND "youth" OR "adolescents" OR "young people" OR "teens" OR "young adults" OR "teenagers" AND "Malaysia"	30,529
2	Replication of search on Sage, Proquest and Clinical Key™	123

2.3.2. Step two: screening

An initial pre-screening was done to remove duplicate articles and a total of 30,637 records were obtained. These articles were then screened based on an inclusion and exclusion criteria determined by the researcher. Firstly, for primary sources only peer-reviewed articles were considered. Wilsdon (2016) argues that to ensure the validity and quality of primary sources only peer-reviewed articles were chosen. Accordingly, all publications in the form of scoping/systematic reviews and proceedings of conferences were excluded. Wilsdon (2016) advises that this would avoid overlap of areas covered by the articles that are also included in reviews and proceedings. Secondly, the articles selected had to be current as the study of eating behaviour is in constant evolution, influenced by social and environmental conditions that change with time (Gahagan, 2012). Moreover, the Council of Canadian Academies (2012) proposes a timespan of three to 5 years for research contributions to be classified as current. Thus, there seems to be consensus of opinion from scholars that research conducted over the past 5 years is deemed to be current. Indeed, Milojević (2012) contends that research practices within the realm of social sciences should use current sources of research limited to 5 years. As such, the articles chosen were then limited from 1st January 2017 to 31 December 2022. Thirdly, non-English articles as well as studies conducted outside of Malaysia were excluded. These three criteria components resulted in 30,156 articles being excluded (Table 2).

2.3.3. Step three: eligibility

A total of the 481 articles remaining were then examined in terms of titles, abstracts, and main contents, particularly to gauge the eligibility of the articles in achieving the objectives of the current research. Therefore, 447 articles were excluded on the basis that they did not focus on eating behaviour amongst youths, nor were they conducted on Malaysian youths or within Malaysia (Figure 1). The final list of articles was then verified by a food research expert based on criteria set.

The final number of 34 articles obtained was deemed reasonable by the researchers. This was because other published scoping reviews with a wider (Ramadas et al., 2021) or even similar (Yaacob et al., 2021) scope had also resulted in a similar quantity of articles being utilised and analysed in depth.

TABLE 2 Inclusion and Exclusion Criteria.

Inclusion	Exclusion
Empirical research to evaluate eating habits/behaviour amongst Malaysian youth	Review articles (e.g., narrative, scoping, or systematic reviews)
Empirical research done to evaluate predictors of eating habits/behaviour amongst Malaysian youth	Study Protocols (templates and guides to the research processes)
Empirical research done to evaluate the association between eating habits/behaviour and any outcomes (specific medical outcomes or general well-being/quality of life) on Malaysian youth	Studies conducted "*in vitro*" or "*in vivo*" (research that deals with experimentation on living beings in or outside the living organisms themselves such as clinical trials)
	Studies on development of diet tool development or validation

2.3.4. Step four: data abstraction and analysis

Data extraction was completed in two stages. First, a google spreadsheet was used to extract the main information of the articles, including such items as the title, date of publication, author(s), study design, objective, population and setting, main findings, limitations and suggested future areas of studies. Second, the studies were then categorised according to: (i) population or setting; (ii) methodology and measurements used; (iii) dimensions of eating behaviour; (iv) factors influencing eating behaviour amongst Malaysian youths, and (v) limitations of studies and future areas to be further investigated.

3. Results

Corresponding to the aims of the scoping review highlighted in section 1.1 above, the recent approaches to studying eating behaviour amongst Malaysian youths were analysed. The analysis is divided into (1) study settings and study populations; (2) methodology and measurements used; (3) dimensions of eating behaviour studied, and (4) factors affecting eating behaviour.

3.1. Study settings

The physical context of 34 analysed studies represented two main categories of settings: "institutional settings" and "community

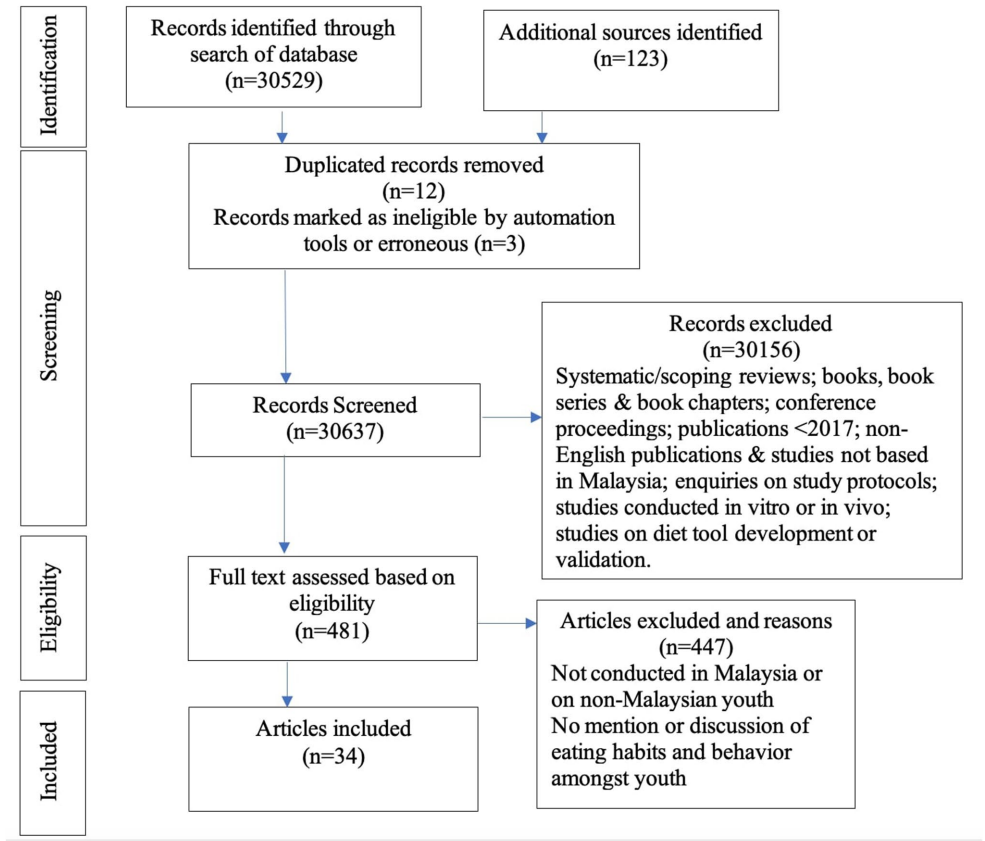

FIGURE 1
Flow chart of scoping review process.

settings." Of the 34 studies, 10 studies did not specifically mention the institutional setting, but the remainder of the studies were equally distributed between universities ($n = 12$) and secondary schools ($n = 12$; Figure 2). When it came to community settings, 11 studies did not specify community setting and the major portion of the remaining studies concerned urban settings ($n = 9$), followed by rural settings ($n = 8$), online communities ($n = 3$), a mix of rural and urban settings ($n = 2$), and *Orang Asli* households ($n = 1$).

In terms of geographical distribution of the studies, 14 studies did not indicate the geographical location where the studies were conducted. Amongst the remaining 20 studies which identified the locality of study, none were conducted in East Malaysia (Figure 3). Within West Malaysia, the main concentration of the studies was in the central region ($n = 9$), followed by the east coast ($n = 7$), northern region ($n = 4$) and the southern region of the Malaysian peninsular ($n = 2$; Figure 3). This leads to a total of 22 studies within West Malaysia instead of 20 as there is an overlap of two studies conducted across two states within West Malaysia. These two studies are Alwi et al.'s (2021) study, involving both Pahang and Selangor, and Alwi et al.'s (2021) study, involving both Perak and Selangor.

3.2. Study populations

Almost all the studies involved a target group of multi-ethnic populations ($n = 29$), incorporating a minimum of the three main ethnic groups of Malaysia: Chinese, Malay and Indian. There was one study that involved a combination of the Chinese and Indian Community. The remaining studies involved specific ethnic groups: Chinese ($n = 1$) and *Orang Asli* ($n = 1$; Table 3). Surprisingly, none of the studies focused specifically on youths with Malay ethnicity or Indian ethnicity. Nonetheless, there were studies that focused on specific groups with medical conditions, i.e., youths with diabetes and hypertension ($n = 2$).

3.3. Methodology and measurements used

The quantitative approach was the most utilised methodological approach in studying eating behaviour amongst Malaysian youths ($n = 30$; Table 4). Within this approach, all except one study took the form of a cross-sectional study, and the remaining were longitudinal-based ($n = 29$). The studies that employed a qualitative approach ($n = 3$) employed exclusively a phenomenological design. The remaining study employed a combination of qualitative and quantitative approaches.

Of the 34 studies, only 11 sought to measure the population's physiological attributes. Amongst the measurements used in these studies include "body mass index" (BMI; $n = 10$), height and weight (HW; $n = 5$), waist and hip circumference (WHC; $n = 1$), total body fat (TBF; $n = 1$), blood pressure (BP; $n = 2$) and cholesterol (CH; $n = 1$; Table 5). The other studies ($n = 23$) explored different dimensions of eating behaviour without linking them to physiological attributes.

3.4. Dimensions of eating behaviour

From the studies undertaken, eating behaviour amongst Malaysian youths was studied across four main dimensions: (1) general adequacy and frequency of consumption of food groups (2) consumption of specific food groups (3) eating disorders, and (4) weight control (Table 6). The "general adequacy and frequency of consumption of food groups" refers to general healthy eating habits, intake of food groups and water, and the diversity of food as prescribed by Malaysian Dietary Guidelines 2020 and the Malaysian Food Pyramid (Ministry of Health Malaysia, 2020). The "consumption of specific food groups" refers to the study of certain types of foods in isolation of other food groups. These studies are done according to the classification of food within the food pyramid, involving such food as fruit and vegetables, or according to the typology of food such as organic, halal, or fast food. "Eating disorders" concern severe and persistent disturbance in eating behaviour that either result in the over- or underconsumption of food. Finally, "weight control" involves

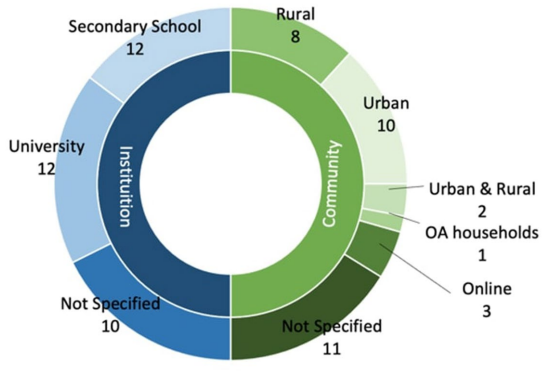

FIGURE 2
Distribution of studies according to study settings.

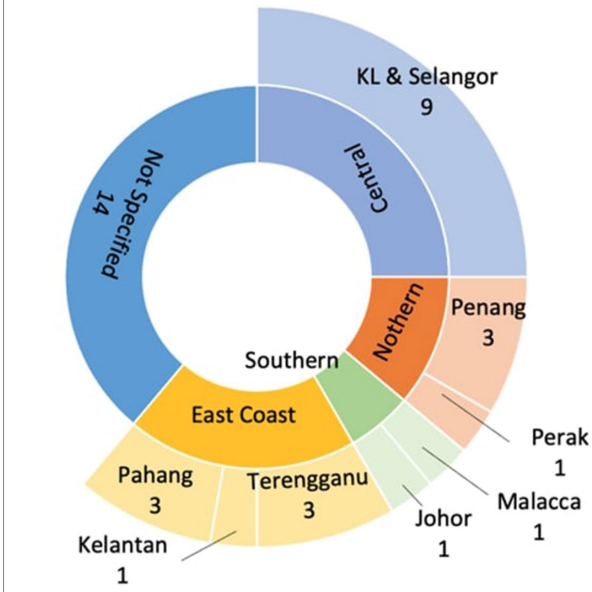

FIGURE 3
Distribution of studies according to geographical location.

TABLE 3 Distribution of studies according to population groupings.

Population	No. of Studies	References
Multi-ethnic	29	Gan et al. (2018); Jalil et al. (2018); Md Yasin et al. (2018); Hamzah et al. (2019); Jaafar et al. (2019); Lee et al. (2019); Marina et al. (2019); Ramlee et al. (2019); Tan et al. (2019, 2022); Yen et al. (2019); Zuraini et al. (2019); Al Mamun et al. (2020); Cheng et al. (2020); Chin et al. (2020); Drewnowski et al. (2020); Evelyn et al. (2020); Hanim et al. (2020); Sharif et al. (2020); Vaidehi et al. (2020); Alwi et al. (2021); Azizan et al. (2021); Cheong et al. (2021); HairolAnuar et al. (2021); Lim et al. (2021); Palaniveloo et al. (2021); Rohin et al. (2021); Thangiah et al. (2021); Zulhamri Abdullah et al. (2022)
Malay	0	
Chinese	1	Lek et al. (2018)
Chinese & Indian	1	Lek et al. (2018)
Orang Asli	1	Gan et al. (2020)
Specific Groups (diabetes and hypertension)	2	Liew et al. (2019); Sien et al. (2020)

TABLE 4 Distribution of studies according to methodology adopted.

Methodology		No. of Studies	References
Quantitative	Cross-Sectional	29	Gan et al. (2018); Jalil et al. (2018); Lek et al. (2018); Md Yasin et al. (2018); Hamzah et al. (2019); Jaafar et al. (2019); Liew et al. (2019); Marina et al. (2019); Ramlee et al. (2019); Tan et al. (2019, 2022); Yen et al. (2019); Zuraini et al. (2019); Al Mamun et al. (2020); Cheng et al. (2020); Cheong et al. (2020, 2021); Chin et al. (2020); Drewnowski et al. (2020); Evelyn et al. (2020); Hanim et al. (2020); Sharif et al. (2020); Sien et al. (2020); HairolAnuar et al. (2021); Lim et al. (2021); Palaniveloo et al. (2021); Rohin et al. (2021); Zulhamri Abdullah et al. (2022)
	Longitudinal	1	Thangiah et al. (2021)
Qualitative	Phenomenology	3	Gan et al. (2020); Alwi et al. (2021); Azizan et al. (2021)
Mixed approach		1	Vaidehi et al. (2020)

the conscious effort of individuals to maintain what is perceived to be the ideal weight.

3.5. Factors influencing eating behaviour

Across all 34 studies reviewed, three main factors associated with influencing eating behaviour can be broadly identified from the literature: (1) "intrapersonal" factors, which involve acknowledgement of a person's mind or self; "interpersonal" factors which occur through interaction with other people or group(s) of people; and "environmental factors" which concern the physical, social or economic surroundings of the individual (Table 7).

The largest focus was placed on intrapersonal factors with close to half of the total studies investigating the relationships of these factors with the eating behaviour of Malaysian youths. Within the category of intrapersonal factors, knowledge, attitudes and perceptions towards food, food groups and consumption patterns were the most studied topics (n = 15). This was followed by motivation ($n = 9$), body image or body dissatisfaction ($n = 4$), genetic predisposition (n = 2), taste sensitivity ($n = 2$), depressive symptoms ($n = 2$) and the internal values of individuals ($n = 1$).

Environmental factors were the second largest focus of the studies ($n = 15$). Within environmental factors, physical accessibility to food ($n = 6$) was analysed the most in relation to eating behaviour amongst youths in Malaysia. This was followed by the restrictions of movement caused by the COVID-19 pandemic ($n = 2$), the influence of social media ($n = 1$), the effect of globalisation ($n = 1$) and factors surrounding university life ($n = 1$).

TABLE 5 Distribution of studies according to measurements used.

Measurement	No. of Studies	References
BMI	10	Lek et al. (2018); Md Yasin et al. (2018); Liew et al. (2019); Tan et al. (2019, 2022); Vaidehi et al. (2020); Alwi et al. (2021); Cheong et al. (2021); Lim et al. (2021); Palaniveloo et al. (2021)
HW	5	Liew et al. (2019); Tan et al. (2019, 2022); Sien et al. (2020); Cheong et al. (2021)
WHC	1	Lek et al. (2018)
TBF	1	Lek et al. (2018)
BP	2	Liew et al. (2019); Thangiah et al. (2021)
CH	1	Thangiah et al. (2021)

While some studies identified factors associated with eating behaviour in isolation, there were studies that combined different categories of factors. Hence, Al Mamun et al. (2020) looked at intrapersonal factors (e.g., knowledge, attitudes and perceptions) alongside motivation and environmental factors (e.g., culture). There were also studies which scrutinised factors within the same category. Accordingly, Alwi et al. (2021), for instance, combined two interpersonal factors: family relationships and relationships with friends (Table 7).

Besides intrapersonal, interpersonal and environmental factors, the studies reviewed also indicated demographic factors which influenced eating behaviour amongst Malaysian youths. Gender was seen to be the most frequent demographical factor influencing eating behaviour ($n = 11$). Also, ethnicity ($n = 6$), household income ($n = 5$), locality ($n = 4$) and age ($n = 3$) were also seen to be relatively important influences. Other demographical factors include education ($n = 1$), religion ($n = 1$) and age/generational ($n = 1$). While most studies considered demographical factors independently, there were studies that combined factors. Thus Azizan et al. (2021) considered gender and ethnicity together and Gan et al. (2020) considered household income and locality together.

4. Discussion

In this scoping review, recent existing literature was collated to understand the way in which research has understood and contextualised eating behaviour and factors affecting such behaviour amongst Malaysian youths. From the findings, it is anticipated that researchers and public health professionals can understand the multiple factors influencing and impacting eating behaviour, including the double burden of overnutrition and undernutrition. In this section, the findings are discussed in two subsections: (1) opportunities in approaches to research, and (2) opportunities in research areas of eating behaviour amongst Malaysian youths and factors influencing eating behaviour.

4.1. Opportunities in approaches to research

The 34 studies analysed varied in terms of physical settings, geographical distribution and composition of populations selected for the studies. Additionally, the studies also varied in terms of methodology adopted and measurements used. The absence of the mention of physical settings and geographical locality in certain studies can lead to difficulty in collating and comparing findings from the studies. The importance of physical settings in which the studies take place is exemplified through literature characterizing eating behaviour differences according to the relationship of youths within institutions and communities (Cheong et al., 2020, 2021; Gan et al., 2020; Sharif et al., 2020; Azizan et al., 2021). For example, studies that were conducted in universities found that eating behaviour is very much influenced by youths' freedom over the control of their finances, time and food choice (Ramlee et al., 2019; Tan et al., 2019; Sharif et al., 2020). On the other hand, studies conducted in secondary schools revealed that healthier eating behaviour is observed amongst youths when subsidies are given, intervention programs are administered and food items in school canteens are monitored (Azizan et al., 2021). Additionally, familial relationships are seen to play a bigger role in secondary school students' eating behaviour. Gan et al. (2018) notes that secondary school students who live with their parents tend to eat better when parents actively encourage healthier eating. Youths attending university, who live away from home, may lack familial connections resulting in negative impacts on their eating behaviour. Gan et al. (2018) explains that these familial connections and parental guidance help individuals' self-esteem and positive body image, diverting them from experiencing unhealthy eating behaviour.

The communities in which youths are situated have characterized their food intake. The general assumption that overnutrition concerns mostly urban areas can be seen through the higher rate of fast-food consumption (Lek et al., 2018; Cheong et al., 2021). Inaccessibility to healthy food and food in general within rural and *Orang Asli* communities has led to the inadequate consumption of vegetables and fruits, and also hunger (Tan et al., 2019; Gan et al., 2020). Consequently, the geographical location of the studies is a crucial variable within the 34 studies that can influence young people's eating behaviour. In fact, studies conducted by those such as Cheong et al. (2020) and Gan et al. (2020) do suggest that youths from different geographical locations have different eating behaviour. Cheong et al. (2020), for instance, found that the youths within the Central Zone (Kuala Lumpur and Selangor) are more exposed to industrialised food items and alternative proteins that are unhealthy. Similarly on the other spectrum, Ramlee et al. (2019) noted that the youths living within the Federal Land Development Authority (FELDA) communes in Pahang, situated outside the Central Zone, suffer less from the impact of globalisation and hence experience less of a modification of eating and drinking habits due to the introduction of foreign products and eating cultures. Nonetheless, there has been a low representation of studies concerning youths from outside of Peninsular Malaysia, where no study has taken place in East Malaysia (Sabah and Sarawak).

With the exception of the consumption of high fat foods, all other dimensions of eating behaviour have been studied across multi-ethnic populations, though the composition of these populations has not been consistent in these studies. As a guideline, the Department of Statistics reported that in 2022 Malaysia consisted of around 57.8%

TABLE 6 Summary dimensions of eating behaviour.

		No of studies	References
General adequacy and frequency of consumption of food groups		16	Md Yasin et al. (2018); Hamzah et al. (2019); Jaafar et al. (2019); Liew et al. (2019); Ramlee et al. (2019); Cheong et al. (2020); Evelyn et al. (2020); Gan et al. (2020); Sien et al. (2020); Vaidehi et al. (2020); Alwi et al. (2021); HairolAnuar et al. (2021); Lim et al. (2021); Palaniveloo et al. (2021); Thangiah et al. (2021); Tan et al. (2022)
Consumption of specific food groups	Vegetable	2	Tan et al. (2019); Rohin et al. (2021)
	Fruits	2	Tan et al. (2019); Sharif et al. (2020)
	Protein	1	Drewnowski et al. (2020)
	Healthy food	2	Al Mamun et al. (2020); Azizan et al. (2021)
	Halal food	2	Jalil et al. (2018); Zuraini et al. (2019)
	Organic food	2	Cheng et al. (2020); Zulhamri Abdullah et al. (2022)
	Fast food	2	Hanim et al. (2020); Cheong et al. (2021)
	High fat foods	1	Lek et al. (2018)
	Salt	1	Marina et al. (2019)
Eating disorders		3	Gan et al. (2018); Yen et al. (2019); Chin et al. (2020)
Weight control		1	Lek et al. (2018)

Malays, 12.2% other Bumiputera, 22.7% Chinese, 6.6% Indians and 0.7% "others." Accordingly, most studies defined Malaysia's multi-ethnic population in terms of the three main ethnicities: Malay, Chinese and Indian. Some studies included other such ethnicities as "Indigenous people" (Cheong et al., 2020), "Pribumi/Bumiputera Sabah and Sarawak" (Ramlee et al., 2019), or "non-Malay Bumiputera" (Drewnowski et al., 2020). However, other studies grouped ethnicities outside of the three main ethnicities (Malay, Chinese and Indian) as "others" (Gan et al., 2018; Al Mamun et al., 2020; Lim et al., 2021).

The population groups embedded within the selected studies were not comparable from one study to another. For example, amongst those studies that focused on the "general adequacy and frequency of consumption of food groups," the percentage of the population of Malay ethnicity ranged from 47.6% (Lim et al., 2021) to 81.6% (Thangiah et al., 2021). Similarly, inconsistencies were noted in the Indian population standing only at a mere 1.8% in some studies (Palaniveloo et al., 2021), though soaring to 22% in others (Lek et al., 2018). The ratios of the different ethnicities were thus not consistent. In some studies, it was noted that the ratio of the Indian population was similar or equal to the Chinese population (Hamzah et al., 2019) and at times greater than the Chinese population (Gan et al., 2018; Tan et al., 2022). Studies which were specific to target groups included one study involving the Chinese and Indian population (Lek et al., 2018), one study concerning the *Orang Asli*/indigenous population (Gan et al., 2020) and two studies focusing on such specific groups as diabetic patients (Sien et al., 2020) and hypertension patients (Liew et al., 2019). The differences in the composition of populations embedded in the studies were caused by the differentiating sampling methodology chosen for the studies. While some studies adopted random sampling (Gan et al., 2018, 2020; Ramlee et al., 2019; Al Mamun et al., 2020; Rohin et al., 2021), there were more studies that used non-random sampling methods such as convenience, purposeful or snowball sampling (Lek et al., 2018; Gan et al., 2020; Sien et al., 2020; Alwi et al., 2021)

The major gaps in terms of methodology and measurements used in recent research on eating behaviour amongst Malaysian youths, includes the lack of qualitative approaches to research and the non-alignment of measurements used in existing studies. For example, using quantitative measures, Palaniveloo et al. (2021) found positive relationships between total energy intake, BMI and obesity. However, reasons behind the high energy intake amongst obese youths necessitates further qualitative investigation. Similarly, low knowledge on food labels is linked to unhealthy consumption and cardiovascular diseases (Evelyn et al., 2020). Again here, reasons behind the low knowledge on food labels did not surface through the quantitative approach, provoking Evelyn et al. (2020) to recommend that this matter should be explored further through qualitative-based research. While most studies utilized BMI as a benchmark to measuring the outcomes of eating behaviour, there were studies that contested the sole consideration of BMI; instead suggesting the need to measure total body fat, and waist and hip circumference (Lek et al., 2018). Other potential measurements could also include blood pressure and cholesterol which were used in studying eating behaviour and such specific illnesses as hypertension (Liew et al., 2019) and cardiovascular disease (Thangiah et al., 2021).

4.2. Opportunities in research areas of eating behaviour amongst youths in Malaysia and factors influencing eating behaviour

The demographics associated with the different dimensions of eating behaviour, include: age / generation, gender, ethnicity, marital status, education level, household income, religion and locality (Table 8). In the enquiries identified, gender is the widely studied demographic factor impacting youths' eating behaviour. With the exception of studies focusing on the specific consumption of "healthy food" and "high fat food," gender is associated with all the other dimensions of eating behaviour. Overall, males are more susceptible

TABLE 7 Factors influencing eating behaviour.

Category	Factor influencing eating behaviour	No	References
Intrapersonal	Knowledge, Attitudes and Perceptions	15	Lek et al. (2018); Hamzah et al. (2019); Al Mamun et al. (2020); Cheng et al. (2020); Cheong et al. (2020, 2021); Evelyn et al. (2020); Gan et al. (2020); Sharif et al. (2020); Azizan et al. (2021); Lim et al. (2021); Palaniveloo et al. (2021); Rohin et al. (2021); Thangiah et al. (2021); Zulhamri Abdullah et al. (2022)
	Motivation	9	Gan et al. (2018); Lek et al. (2018); Md Yasin et al. (2018); Hamzah et al. (2019); Al Mamun et al. (2020); Evelyn et al. (2020); Alwi et al. (2021); Azizan et al. (2021); Zulhamri Abdullah et al. (2022)
	Body Image/dissatisfaction	4	Gan et al. (2018); Lek et al. (2018); Tan et al. (2019); Chin et al. (2020)
	Genetic predisposition	2	Lek et al. (2018); Hanim et al. (2020)
	Taste sensitivity	2	Marina et al. (2019); Hanim et al. (2020)
	Values	1	HairolAnuar et al. (2021)
	Depressive symptoms	2	Gan et al. (2018); Chin et al. (2020)
Interpersonal	Family relationships	4	Tan et al. (2019); Alwi et al. (2021); Cheong et al. (2021); Rohin et al. (2021)
	Parental feeding	3	Cheong et al. (2020); Vaidehi et al. (2020); Azizan et al. (2021)
	Relationships with friends	1	Alwi et al. (2021)
Environmental	Culture and subjective norms	4	Hamzah et al. (2019); Al Mamun et al. (2020); HairolAnuar et al. (2021); Palaniveloo et al. (2021)
	Accessibility	6	Gan et al. (2020); Sharif et al. (2020); Vaidehi et al. (2020); Alwi et al. (2021); Azizan et al. (2021); Lim et al. (2021)
	COVID-19	2	Azizan et al. (2021); Tan et al. (2022)
	School/University life	1	Sien et al. (2020)
	Social Media	1	Alwi et al. (2021)
	Globalization	1	Jaafar et al. (2019)

TABLE 8 Demographics associated with eating behaviour.

Demographic	No	References
Age	3	Azizan et al. (2021); Lim et al. (2021); Rohin et al. (2021)
Gender	11	Gan et al. (2018); Jalil et al. (2018); Lek et al. (2018); Hamzah et al. (2019); Marina et al. (2019); Yen et al. (2019); Cheong et al. (2020, 2021); Chin et al. (2020); Sharif et al. (2020); Azizan et al. (2021)
Ethnicity	6	Gan et al. (2018); Liew et al. (2019); Marina et al. (2019); Chin et al. (2020); Azizan et al. (2021); Cheong et al. (2021)
Education Level	1	Jalil et al. (2018)
Household Income	5	Ramlee et al. (2019); Tan et al. (2019); Al Mamun et al. (2020); Cheong et al. (2020); Gan et al. (2020)
Religion	1	HairolAnuar et al. (2021)
Generation	1	Zuraini et al. (2019)
Locality (urban/rural)	4	Cheong et al. (2020, 2021); Gan et al. (2020); Palaniveloo et al. (2021)

to eating behaviour problems than women, leading to concerns pertaining to overnutrition and undernutrition (Tan et al., 2019). This is further supported by males' higher intake of calories and higher energy levels, for which excessive amounts could lead to being overweight or obese (Palaniveloo et al., 2021). Additionally, Malay males are identified as the group with the highest preference for salt (Marina et al., 2019), which explains the higher association of hypertension amongst males (Liew et al., 2019). Nevertheless, males are also associated with healthy eating habits such as a higher intake of vegetables (Rohin et al., 2021). With regards to eating disorders, there is a tendency for males to be vulnerable to certain depressive symptoms (Yen et al., 2019). The higher susceptibility of males to problems associated to eating behaviour suggests that females have healthier eating habits. However, the study on fast food consumption showed that there is a higher prevalence of consumption amongst females (Cheong et al., 2021). In addition, females are more associated with such eating disorders as binge eating (Gan et al., 2018) and scoring a higher fat percentage, thereby placing them at a higher risk of developing cardiovascular diseases (Thangiah et al., 2021). When it came to perceptions of halal food and its consumption, females scored

higher in terms of knowledge on halal food compared to their male counterparts. Jalil et al. (2018) explains that disparity in scores between males and females is due to the females having more knowledge and understanding of the slaughtering methods that lead to the perception that halal meat is of better quality.

Ethnicity was another demographic factor which was frequently studied in its relation to eating behaviour. However, not many of the studies investigated specific ethnicities in isolation. There was only one study that looked at the consumption of high fat foods within a population consisting of Chinese and Indian youths (Lek et al., 2018), and one study that focused on food insecurity within *Orang Asli* communities (Gan et al., 2020). Amongst the studies that involved multi-ethnic populations, Malay youths are linked to unhealthier eating behaviour such as having the highest preference for salt (Marina et al., 2019) and fast food (Cheong et al., 2021). Accordingly, the Malay have the highest prevalence of certain diseases such as hypertension (Liew et al., 2019). In contrast, the consumption of high fat foods that may lead to cardiovascular diseases can result in Chinese youth being more susceptible to developing such diseases compared to Malay youths (Thangiah et al., 2021). No study significantly highlighted the eating behaviour of Indian youths.

Orang Asli youths are mostly affected by food insecurity due to barriers in obtaining food. These barriers include the depletion of food supplies in the local surroundings and the *Orang Asli's* low purchasing power caused by high prices of food items in relation to the overall high demand for food in the market and high transportation costs (Gan et al., 2018). Ethnicity was thus found to be strongly associated with dietary intake (Ramlee et al., 2019; Cheong et al., 2021; Lim et al., 2021), where each ethnic group can be characterised through their own food consumption patterns and cultural practices (Raji et al., 2017). Given that the majority of the 34 studies analysed had employed a multi-ethnic approach, the four dimensions of eating behaviour: "general adequacy and frequency of consumption of food groups," "consumption of specific food groups," "eating disorders" and "weight control" can be further explored through studies that are specific to different ethnic groups.

Following ethnicity, household income is the next most frequently associated demographic with eating behaviour. Findings amongst the studies consistently show that lower income households are tied to poorer dietary habits in general (Cheong et al., 2020) and food insecurity (Ramlee et al., 2019; Tan et al., 2019; Gan et al., 2020). When it came to specific foods like "healthy food" or "organic food," lower household income also affects intentions to consume (Jalil et al., 2018; Al Mamun et al., 2020). Studies that linked locality to eating behaviour showed consistency where dietary patterns vary according to geographical zones, with adolescents in East Malaysia and Central Zone of Peninsular Malaysia (i.e., Kuala Lumpur) most associated with unhealthy dietary patterns (Cheong et al., 2020). This coincides with the prevalence of the intake of fast food within the same localities (Cheong et al., 2021). The only other study linking locality to eating behaviour concerned *Orang Asli* youths' limited access to healthy food due to the barriers mentioned above (Gan et al., 2018).

There were limited studies associating age with eating behaviour. The study by Lim et al. (2021) noted that youths from the lower age group are less likely to the practice healthy eating behaviour, helping to prevent cardiovascular diseases. In addition, Cheong et al. (2021) also found that youths from the lower age group who consume more fast food are more likely to have other unfavourable dietary patterns such as an imbalance intake of grains, meats and vegetables. However, this study was contradicted by Rohin et al.'s (2021) work which found that youths from the lower age group have a healthier BMI and a higher intake of vegetables. The three demographic factors of education, religion and age were specifically linked to the consumption of halal food. Accordingly, it was found that young people with higher education levels (Jalil et al., 2018), particularly Muslims from Generation Z (Zuraini et al., 2019), tend to be more aware of halal food and paid more importance to its consumption.

The main clinical outcomes associated with almost all the dimensions of eating behaviour studied concerned overweight and obesity (Table 5). The exceptions included studies focusing on specific food groups such as "healthy food," "halal food" and "organic food." Instead of focusing on the clinical outcomes caused by the consumption of these types of food, studies focused on the factors driving the consumption of these food categories (Al Mamun et al., 2020; Azizan et al., 2021). Other clinical outcomes associated with poor eating behaviour, included hypertension (Liew et al., 2019), diabetes (Tan et al., 2019) and cardiovascular diseases (Thangiah et al., 2021). These clinical outcomes were studied in relation to the general adequacy and frequency of the consumption of food groups. Interestingly, the consumption of salt has not been studied in relation to any clinical outcomes.

The main focus of factors affecting eating behaviour amongst youths across the 34 articles examined concern intrapersonal factors, leaving room for more research on intrapersonal and environmental factors. Within the category of intrapersonal factors, research on the "knowledge, attitudes, and perceptions" (KAP) of youths towards healthy eating behaviour showed that these individuals generally have a good grasp of what it means to eat healthy food - as prescribed by "Malaysian Dietary Guidelines" (MDG). For example, Hamzah et al. (2019) found a high level of KAP of youths towards the overall adherence of the consumption of food groups according to MDG's prescribed portions. Similarly, Azizan et al. (2021) found a high mastery of the food pyramid amongst youths. Also, there were studies that focused on more specific dimensions of eating behaviour. This is exemplified by Lim et al. (2021), who found a high level of KAP concerning the role that healthy eating behaviour can have in preventing cardiovascular diseases. In addition, Rohin et al. (2021) found that while gender also has a role in predicting vegetable consumption, the overall KAP of youths on the consumption of vegetables are deemed to be good. On the contrary, Cheong et al. (2021) noted that despite a higher understanding of healthy eating habits, female youths within the Central Zone of Peninsular Malaysia and East Malaysia consume more fast food and excessive amounts of protein and carbohydrates while lacking in vegetable consumption. The general tendency of knowledge, attitudes and perceptions of healthy eating behaviours in relation to health was seen to be high in most studies (Hamzah et al., 2019; Azizan et al., 2021; Rohin et al., 2021). However, Lee et al.'s (2019) study found that while knowledge on weight control was high, only 50.1% of the youths perceived obesity being bad for health.

Consequently, there are seemingly other mediating or moderating factors that can also be observed through the inconsistencies of KAP and resulting eating behaviour. Such divergence is exemplified in the contrasting high levels of KAP towards vegetable consumption and fruits, though only 9% of youths are actually consuming enough vegetables on a daily basis (Rohin et al., 2021) and 53.7% of youths are

not consuming enough fruits on a daily basis (Sharif et al., 2020). Additionally, while Lee et al. (2019) found that for youths to attain a healthy weight they need to acquire high levels of knowledge of eating behaviour, Azizan et al. (2021) noted the low consumption of healthier food options by youths in school canteens. Studies by Al Mamun et al. (2020), Azizan et al. (2021), and Sharif et al. (2020) suggest other interpersonal and environmental factors to be investigated to explain the contradictions between KAP and actual eating behaviour. Hamzah et al. (2019), Lim et al. (2021), and Thangiah et al. (2021) called for more consideration of the cultural and ethnic factors that play a role in food consumption and can vary in youths from different ethnic groups. This is supported by the significant association between ethnicity and dietary patterns resulting in Malay adolescents having the highest scores for unhealthy dietary patterns (Cheong et al., 2020). In addition, the different internal values of youth motivated by religious beliefs (HairolAnuar et al., 2021) and subjective norms (Al Mamun et al., 2020) differ across ethnicity and was also found to have impacted positive eating behaviour. This seems to point towards the need for deeper inquiries concerning ethnic specific norms, values and practices.

Interpersonal factors affecting eating behaviour amongst the youth were mostly due to the interactions between family and friends. Indeed, family meals consumed in the home environment can positively or negatively impact the food consumption patterns of young people. Tan et al. (2019) found that those who do not consistently have specific meals prior to attending educational institutions, notably breakfast or lunch and depending on when their schooling hours begin, were more hungry and more susceptible to poor food choices made at school. Additionally, youths in the younger age group, who are more inclined to have their food consumption patterns dictated by their parents, tend to eat more healthily (Cheong et al., 2020) and avoid unhealthy meals such as fast-food (Cheong et al., 2021). In addition to relationships with parents, influences of friends can play a role in determining eating habits. Young people may want to fit in by assimilating or imitating their friends' dietary patterns and type of foods they consume. Influences of friends can be seen through time spent physically together and through social media engagement (Alwi et al., 2021).

From the studies observed, the main environmental factor seen to influence the way youths consume food is accessibility. Lack of accessibility to food can be caused by economical constraints, or other circumstances such as the hectic life of young people being caught up in the education system or safety measures imposed by the COVID-19 pandemic. Physical constraints, such as the lack of availability of fruits or the lack of appropriate vegetable and fruit portions served at eateries in educational institutions, are identified as one of the main causes leading to the inadequate consumption of fruits and vegetables (Sharif et al., 2020; Vaidehi et al., 2020). On the other hand, the availability of unhealthy food at these eateries and unlicensed food vendors outside the perimeters of the educational institutions can encourage unhealthy consumption. For youths within *Orang Asli* communes located in isolated locations within Pahang, logistical concerns in the supply of food prevent proper consumption (Gan et al., 2020). Economical constraints represented by the low socio-economic status of youths and their families also mark an important influence on eating behaviour (Cheong et al., 2020). One study noted that the high cost of fruit result in 55% of rural youths not purchasing or consuming adequate amounts of fruit (Sharif et al., 2020), where high prices negatively impact the intention of the youths to consume "healthy food" (Al Mamun et al., 2020; Azizan et al., 2021). Other barriers in accessing healthier food options concern the restriction of movement during the COVID-19 pandemic (Alwi et al., 2021) and also the boredom associated with the lockdown, leading to a higher intake of unhealthy cereal and grain products, sweets and comfort foods (Tan et al., 2022). Moreover, the pressure for educational excellence paired with a hectic school/university life can lead to the irregular consumption (or skipping) of meals (Sien et al., 2020).

5. Recommendations

The findings of this scoping review on eating behaviour amongst Malaysian youths resulted in the construction of recommendations that serve as a point of critical reference for future studies. Therefore, researchers need to be more specific in detailing the geographical demographics of research when studying the eating behaviour of this target group. Accordingly, the physical settings of studies should be clearly identified based on the objectives of the research. As a general guideline and as indicated in present studies, overnutrition mostly affects youths from urban communities and the Central Zone of Peninsular Malaysia. On the other hand, undernutrition and issues of food insecurity affect youths from more rural communities and zones beyond the Central Zone. Therefore, there are opportunities for research to be conducted within the states of Sabah and Sarawak in East Malaysia, particularly as no studies have really looked into youths' eating behaviour. The diversity and socio-cultural differences in Malaysia's population seem to suggest significant variance in eating behaviour amongst youths according to ethnic groups. This is concurrent with evidence presented in current studies that show differences in the eating behaviour of youths of different ethnicities between states within West Malaysia/ Peninsular Malaysia itself.

Future studies concerning the multi-ethnicity variable may want to consider different sampling methodologies that may result in the study's population being more reflective of the national ratios of ethnic groupings. This would render such studies more comparable for future research. Alternatively, studies focusing on individual ethnic groups may also prove to be useful as current studies have indicated that factors influencing eating behaviour may differ from one ethnic group to another. This can also be taken a step further to analyse eating behaviour of youths of a certain ethnic group within different institutional, community or geographical settings. With current studies identifying youths from the Malay and Indian ethnic groups as having the most unfavourable forms of eating behaviour and thus experiencing higher rates of obesity, more empirical attention needs to directed to these ethnicities to comprehend how and why ethnic attributes (including religious and cultural dimensions) influence eating behaviour.

A more varied methodology employed for research in this area should be considered given that almost all studies are quantitative and have collectively called for more qualitative approaches. Qualitative approaches can seek to understand the eating behaviour perceptions, attitudes and value systems of individuals and groups. Additionally, qualitative efforts will help to further investigate the contradictions between the factors that should positively impact eating behaviour and actual eating behaviour. Future attention ought to be given to measuring the outcomes of eating behaviour. The contestation of BMI

as the only method of measurement for outcomes of eating behaviour seems to suggest the consideration of other measurements such as total body fat, waist and hip circumference, and blood pressure and cholesterol level. Ideally, a consensus should be achieved in aligning measurements used which would once again render studies more comparable. Similarly, other clinical outcomes can also be studied concerning youths' eating behaviour. Currently, almost all studies focus on how particular forms of eating behaviour are associated with obesity. Future studies should attempt to analyse the relationships between eating behaviour and other non-communicable diseases such as hypertension, heart and kidney diseases, and diabetes.

The "general adequacy and frequency of consumption of food groups" was the most widely researched dimension of eating behaviour amongst youths in recent studies. The only factor influencing eating behaviour not considered within this dimension is the educational background and level of the target group, which could be explored in future studies. However, there is a greater need to focus on the other dimensions of eating behaviour such as the consumption of specific food groups, eating disorders and weight control. With only one study focusing on the perceptions and motivations of youths to consume organic food (Zulhamri Abdullah et al., 2022), there is much room to further investigate other factors that influence youths' consumption of organic food. Following that, eating disorders and weight control have only been studied in relation to people's backgrounds based on differences of gender, leaving the other influencing factors such as age, ethnicity, religion, education level and locality to be thoroughly investigated. Moreover, high fat foods have only been studied in relation to household income and thus other influencing factors ought to be further examined.

With regards to factors affecting eating behaviour amongst youths, there is a dominant focus on intrapersonal factors affecting the "general adequacy and frequency of consumption of food groups". This implies that there is much opportunity in studying those intrapersonal factors which intersect with the consumption of specific food groups, eating disorders and weight control. Similarly, there are only a few studies focusing on interpersonal factors and environmental factors affecting the different dimensions of eating behaviour, thereby suggesting more work to be done in these areas.

6. Conclusion

As a limitation to this study, it should be recognised that this scoping review was only completed by using the perimeters specified. This only includes studies conducted in Malaysia, written in English, published within the said timeframe and available on the platforms mentioned. Hence, there may well be a need to expand the timeframe to provide a more comprehensive picture of studies conducted on eating behaviour amongst Malaysian youths. However, as noted, this study serves only as an update to the recent research approaches and should not be taken for a summary of all studies ever done on the subject matter. Similar scoping reviews can also be conducted involving other age groups which could help to stimulate comparative studies concerning differences across generational groupings. One productive outcome would be for research findings to crucially and critically inform policy makers and relevant parties ameliorating eating behaviour.

The recent literature on eating behaviour amongst Malaysian youths reflect on how factors affecting eating behaviour have been studied across the different eating behaviour dimensions. The four main dimensions of eating behaviour that emerge from the articles studied, include: (1) the "general adequacy and frequency of consumption of food groups"; (2) "consumption of specific food groups"; (3) "eating disorders", and (4) "weight control". While extensive research has been applied across these dimensions, there are still areas to be investigated further through the application of updated and relevant research methodologies as well as aligned methods of measurement. Despite the current literature focusing on intrapersonal factors affecting eating behaviour, contradictions exist between youths' knowledge, attitudes and perceptions and their actual eating behaviours. These contradictions suggest the importance of other roles that are interpersonal and environmental in nature that should be further scrutinised. The recognition that eating behaviour is constantly evolving alongside socio-cultural, economic and environmental changes warrants continuous research monitoring. This need is in line with one of the many research priorities listed under the Nutrition Research Priorities in Malaysia for the 12th Malaysia Plan (Ministry of Health Malaysia, 2020). Under the overall purpose to improve understanding on the epidemiology of obesity, researchers are requested to look into, amongst others, food cultures, and the socio-cultural determinants of food habits - with the overall objective concerning the improvement of the health and wellbeing of the people of Malaysia.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

CA made a substantial contribution to the concept and execution of design of the article, the acquisition, analysis, or interpretation of data for the article as well as drafting the article. MS and AT revised drafts critically for important intellectual content. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Al Mamun, A. A., Hayat, N., and Zainol, N. R. B. (2020). Healthy eating determinants: A study among Malaysian young adults. *Foods* 9:974. doi: 10.3390/foods9080974

Alwi, M.N.R., Hanafi, W.N.W., Ali, I.M., and Baharuddin, S.S., (2021). Determinants of eating behaviours: A study of college students in Malaysia. Global Business & Management Research, 13.

Azizan, N. A., Papadaki, A., Su, T. T., Jalaludin, M. Y., Mohammadi, S., Dahlui, M., et al. (2021). Facilitators and barriers to implementing healthy school canteen intervention among Malaysian adolescents: a qualitative study. *Nutrients* 13:3078. doi: 10.3390/nu13093078

Bédard, A., Lamarche, P. O., Grégoire, L. M., Trudel-Guy, C., Provencher, V., Desroches, S., et al. (2020). Can eating pleasure be a lever for healthy eating? A systematic scoping review of eating pleasure and its links with dietary behaviors and health. *PLoS One* 15:e0244292. doi: 10.1371/journal.pone.0244292

Boutari, C., and Mantzoros, C. S. (2022). A 2022 update on the epidemiology of obesity and a call to action: as its twin COVID-19 pandemic appears to be receding, the obesity and dysmetabolism pandemic continues to rage on. *Metabolism* 133:155217. doi: 10.1016/j.metabol.2022.155217

Cheng, T. L., Mun, Y. W., Nair, M. N. N., and Chuan, S. B. (2020). To buy or not to buy? Consumers' attitudes and purchase behavior for organic food in Malaysia. *J. Pengurusan* 60, 1–12. doi: 10.17576/pengurusan-2020-60-01

Cheong, S. M., Hock, L. K., Ying, C. Y., Cheong, K. C., Kuay, L. K., Huey, T. C., et al. (2021). Is fast-food consumption a problem among adolescents in Malaysia? An analysis of the National School-Based Nutrition Survey, 2012. *J. Health Popul. Nutr.* 40, 1–9. doi: 10.1186/s41043-021-00254-x

Cheong, S. M., Salleh, R., Ahmad, M. H., Baharudin, A., Koon, P. B., and Aris, T. (2020). Dietary patterns and associated factors among adolescents in Malaysia: findings from adolescent nutrition survey 2017. *Int. J. Environ. Res. Public Health* 17, 34–31. doi: 10.3390/ijerph17103431

Chin, Y. S., Appukutty, M., Kagawa, M., Gan, W. Y., Wong, J. E., Poh, B. K., et al. (2020). Comparison of factors associated with disordered eating between male and female Malaysian university students. *Nutrients* 12, 318–326. doi: 10.3390/nu12020318

Chung, A., Vieira, D., Donley, T., Tan, N., Jean-Louis, G., Kiely Gouley, K., et al. (2021). Adolescent peer influence on eating behaviors via social media: scoping review. *J. Med. Internet Res.* 23, 19697–19705. doi: 10.2196/19697

Council of Canadian Academies (2012). Expert Panel on Science Performance and Research Funding. Informing rsearch coices: indicators and judgment. Council of Canadian Academies (Conseil des académies Canadiennes).

Dovey, T., (2010). *EBOOK: Eating behaviour*. McGraw-Hill Education: UK.

Drewnowski, A., Mognard, E., Gupta, S., Ismail, M. N., Karim, N. A., Tibère, L., et al. (2020). Socio-cultural and economic drivers of plant and animal protein consumption in Malaysia: the SCRiPT study. *Nutrients* 12, 1530–1539. doi: 10.3390/nu12051530

Evelyn, H., Aziz, A. F., and Sariman, S. (2020). Associations of knowledge, attitude and practices of food label on cardiovascular diseases (CVD) risk amongst university students in Selangor, Malaysia. *J. Nutr. Sci. Vitaminol.* 66, S275–S282. doi: 10.3177/jnsv.66.S275

Gahagan, S. (2012). The development of eating behavior-biology and context. *J. Dev. Behav. Pediat.* 33, 261–271. doi: 10.1097/DBP.0b013e31824a7baa

Gan, W. Y., Mohamad, N., and Law, L. S. (2018). Factors associated with binge eating behavior among Malaysian adolescents. *Nutrients* 10, 66–75. doi: 10.3390/nu10010066

Gan, W. Y., Sulaiman, N., Law, L. S., Zalbahar, N., Ahmad Fuzi, S. F., and Wilkes, M. A. (2020). Exploration of food-seeking behaviour, food preparation, and restrictions to sufficient food among the Jahai sub-tribe (indigenous people) in Gerik, Malaysia. *Int. J. Environ. Res. Public Health* 17:348. doi: 10.3390/ijerph17010348

Gesteiro, E., García-Carro, A., Aparicio-Ugarriza, R., and González-Gross, M. (2022). Eating out of home: influence on nutrition, health, and policies: a scoping review. *Nutrients* 14, 1265–1270. doi: 10.3390/nu14061265

Goh, G. B. B., and Tham, K. W. (2023). Combating obesity: a change in perspectives. *Singap. Med. J.* 64, 153–154. doi: 10.4103/singaporemedj.SMJ-2023-043

HairolAnuar, N. A., Noor, M., and Fakhrurrazi, A. (2021). Relationship between value-based behaviors among university students in Malaysia. *Akademika* 91, 17–26.

Hamzah, S. R., Suandi, T., Ismail, M., and Muda, Z. (2019). Association of the personal factors of culture, attitude and motivation with health behavior among adolescents in Malaysia. *Int. J. Adolesc. Youth* 24, 149–159. doi: 10.1080/02673843.2018.1482772

Hanim, A. S., Ruhaya, H., Norkhafizah, S., and Marina, A. M. (2020). Relationship between PROP (6-n-propylthiouracil) taster status and preference for different taste food groups among university students. *Malays. Appl. Biol.* 49, 53–59. doi: 10.55230/mabjournal.v49i5.1637

Heshmat, S. (2011). *Eating behavior and obesity: Behavioral economics strategies for health professionals*. Springer publishing company. New York, USA.

Institute for Public Health (IPH) (2020). *National health and morbidity survey 2019: non-communicable diseases, risk factors & other health problems (Volume II)*. Selangor, Malaysia: IPH, Ministry of Health.

Jaafar, A., Syafril, S., Anwar, F., and Hakim, R. (2019). Impacts of globalization on Adolescents' behavior in Malaysia. *Islamiyyat* 41, 3–8.

Jalil, N. S. A., Tawde, A. V., Zito, S., Sinclair, M., Fryer, C., Idrus, Z., et al. (2018). Attitudes of the public towards halal food and associated animal welfare issues in two countries with predominantly Muslim and non-Muslim populations. *PLoS One* 13:e0204094. doi: 10.1371/journal.pone.0204094

Lee, C. Y., Yusof, H. M., and Zakaria, N. S. (2019). Knowledge, attitude and behaviours related to weight control and body-image perceptions among Chinese high school students. *Malays. J. Med. Sci.* 26, 122–131. doi: 10.21315/mjms2019.26.5.11

Lek, F. Y., Ong, H. H., and Say, Y. H. (2018). Association of dopamine receptor D2 gene (DRD2) Taq1 polymorphisms with eating behaviors and obesity among Chinese and Indian Malaysian university students. *Asia Pac. J. Clin. Nutr.* 27, 707–717. doi: 10.6133/apjcn.092017.09

Liew, J. K., Cheong, X. P., Law, L., Teo, W. H., Eng, S. S., Ngim, C. F., et al. (2019). Prevalence and factors associated with hypertension among adolescents in Malaysia. *IIUM Med. J. Malaysia* 18:3. doi: 10.31436/imjm.v18i1.225

Lim, B. C., Kueh, Y. C., Arifin, W. N., and Ng, K. H. (2021). Modelling knowledge, health beliefs, and health-promoting behaviours related to cardiovascular disease prevention among Malaysian university students. *PLoS One* 16:e0250627. doi: 10.1371/journal.pone.0250627

Marina, A. M., Husna, A. N., and Ruhaya, H. (2019). Detection threshold and sensory preference for salty taste among Malay, Chinese and Indian students in health campus, Universiti Sains Malaysia. *Malays. Appl. Biol.* 48, 141–147.

Md Yasin, Z. A. M., Ponliran, D., Ab, T., Rahaman, T. S. R., and Zuliple, Z. A. (2018). An investigation on the lifestyle factors influencing the body mass index (BMI) of students in UiTM Melaka using logistic regression. *ESTEEM* 14, 95–101.

Milojević, S. (2012). How are academic age, productivity and collaboration related to citing behavior of researchers? *PLoS One* 7:49176. doi: 10.1371/journal.pone.0049176

Ministry of Health Malaysia (2020). Nutrition research priorities in Malaysia for the 12th Malaysia plan. Ministry of Health Malaysia. Available at: https://nutrition.moh.gov.my/wp-content/uploads/2021/06/FA-TERKINI-NUTRITION-RESEARCH-PRIORITIES-IN-MALAYSIA-FOR-12TH.pdf [Accessed April 5, 2022].

Munn, Z., Peters, M. D., Stern, C., Tufanaru, C., McArthur, A., and Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med. Res. Methodol.* 18, 1–7. doi: 10.1186/s12874-018-0611-x

Palaniveloo, L., Salleh, R., Baharudin, A., Man, C. S., Ahmad, M. H., Aziz, N. S. A., et al. (2021). Associations of gender and BMI-for-age status (BAZ) with nutrient intake among adolescents in Malaysia: findings from adolescent nutrition survey (ANS) 2017. *Malays. J. Med. Health Sci.* 17, 10–16.

Peters, M. D., Marnie, C., Colquhoun, H., Garritty, C. M., Hempel, S., Horsley, T., et al. (2021). Scoping reviews: reinforcing and advancing the methodology and application. *Syst. Rev.* 10, 1–6. doi: 10.1186/s13643-021-01821-3

Raji, M. N. A., Ab Karim, S., Ishak, F. A. C., and Arshad, M. M. (2017). Past and present practices of the Malay food heritage and culture in Malaysia. *J. Ethn. Foods* 4, 221–231. doi: 10.1016/j.jef.2017.11.001

Ramadas, A., Tham, S. M., Lalani, S. A., and Shyam, S. (2021). Diet quality of Malaysians across lifespan: A scoping review of evidence in a multi-ethnic population. *Nutrients* 13:1380. doi: 10.3390/nu13041380

Ramlee, I. S., Ali, A., Zalbahar, N., Wahab, R. A., and Jaafar, S. N. A. (2019). Food insecurity among university students at two selected public universities in Malaysia. *Malays. Appl. Biol.* 48, 101–110.

Rappoport, L. (2010). *How we eat: Appetite, culture, and the psychology of food*. Ecw Press.Toronto, Canada.

Rohin, M. A. K., Hadi, N. A., Sariff, S., Shariff, S. S. M., Ridzwan, N., and Jumli, M. N. (2021). Knowledge, attitude and practice on vegetables intake among adolescents in rural Terengganu, Malaysia. *Malays. J. Med. Health Sci.* 17, 98–105.

Sharif, S. N. S., Rohin, M. A. K., and Abd Hadi, N. (2020). Correlation of cAMP response element binding and brain derived neurotrophic factor protein levels in adolescents with adequacy fruit intake: A cross sectional study. *Malays. J. Med. Health Sci.* 16, 176–184.

Sien, P. L. M., Jamaludin, N. I. A., Samrin, S. N. A., Ismail, R., Anuar Zaini, A., and Sameeha, M. J. (2020). Causative factors of eating problems among adolescents with type 1 diabetes mellitus: A qualitative study. *J. Health Psychol.* 25, 1310–1318. doi: 10.1177/1359105319890397

Tan, S. T., Tan, C. X., and Tan, S. S. (2022). Changes in dietary intake patterns and weight status during the COVID-19 lockdown: a cross-sectional study focusing on young adults in Malaysia. *Nutrients* 14, 280–288. doi: 10.3390/nu14020280

Tan, A. K., Yen, S. T., Fang, X., and Chiang, F. S. (2019). Body weight and physical activity of adolescents in Malaysia. *Int. Health* 11, 150–158. doi: 10.1093/inthealth/ihy072

Thangiah, N., Su, T. T., Chinna, K., Jalaludin, M. Y., Mohamed, M. N. A., and Majid, H. A. (2021). Longitudinal assessment between lifestyle-related risk factors and

a composite cardiovascular disease (CVD) risk index among adolescents in Malaysia. *Sci. Rep.* 11:19135. doi: 10.1038/s41598-021-98127-0

Ungureanu, C. I., and Mihai, C. (2022). Changes in eating behavior brought by Covid-19: from normality to dysfunctionality-a narrative review. *Bull. Integ. Psychiatry* 92, 51–58. doi: 10.36219/bpi.2022.1.04

United Nations (2013). Youth fact sheet. Available at: https://www.un.org/esa/socdev/documents/youth/fact-sheets/youth-definition.pdf [Accessed February 13, 2022]

Vaidehi, U., Shashikala, S., and Vaidehi, K. (2020). Association between food habits and nutritional status of secondary school students in Kuala Lumpur, Malaysia: baseline findings from Nuteen project. *J. Nutr. Sci. Vitaminol.* 66, S256–S261. doi: 10.3177/jnsv.66.S256

Walker, A. E., Wattick, R. A., and Olfert, M. D. (2021). The application of systems science in nutrition-related behaviors and outcomes implementation research: a scoping review. *Curr. Dev. Nut.* 5:105. doi: 10.1093/cdn/nzab105

Wilsdon, J. (2016). The metric tide: independent review of the role of metrics in research assessment and management. The Metric Tide, pp.1–192.

World Health Organization (2018). 10 facts on diabetes. World Health Organization. Available at: https://www.who.int/features/factfiles/diabetes/en/ [Accessed February 13, 2022].

Yaacob, N., Talib, R. A., Ismail, A., and Mahmud, M. I. (2021). The characteristic of obesity intervention studies among school children in Malaysia: A scoping review. *Malays. J. Health Sci.* 19, 83–98. doi: 10.17576/jskm-2021-1902-11

Yen, H. T., Yusof, B.-N. M., Chin, Y. S., Kiung, E., Ghani, R. A., Mottalib, A., et al. (2019). Nutrition-related factors and binge eating behaviour in a sample of Malaysian university students. *Malays. J. Health Sci.* 17, 57–65. doi: 10.17576/JSKM-2019-1701-08

Younger, P. (2010). Using google scholar to conduct a literature search. *Nurs. Stand.* 24, 40–46. doi: 10.7748/ns.24.45.40.s51

Zulhamri Abdullah, K. Y. S., Syed Hassan Raza, P., and Bekti Istiyanto, S. (2022). Contrariwise obesity through organic food consumption in Malaysia: a signaling theory perspective. *BMC Public Health* 22, 1–18.

Zuraini, M. I., Afiq, M. M., and Nurzulain, Z. (2019). The influence of cross-generation attitude on halal food products. *Malays. Appl. Biol.* 48, 41–46.