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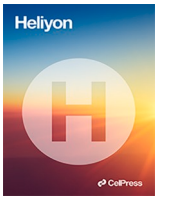

Review article

Social marketing targeting healthy eating and physical activity in young adult university students: A scoping review

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ABSTRACT

Adult obesity has remained a key health concern globally. Theory-based social marketing interventions are considered effective for improving dietary and physical activity (PA) behaviours. However, their application in universities is not yet established. This review aimed to identify social marketing strategies targeting healthy eating and/or PA behaviours of young adult university students and outline the intervention effectiveness. Literature search, screening, and data extraction followed the Joanna Briggs Institute (JBI) methodology for scoping reviews. PubMed/Medline and Scopus databases were searched for intervention and exploratory studies published between January 1, 2000, and September 20, 2023. Twelve articles were selected based on the eligibility criteria. Although different in study design, all studies reported improved healthy eating-related outcomes, while three showed improved PA-related outcomes. One study incorporated all six of the social marketing benchmarks, but the majority identified two. Most studies focused on behavioural objective, formative research, and marketing mix in their intervention design. Four studies incorporated behaviour change theories in development of the social marketing campaigns. Social marketing using social media could be a significant approach for improving healthy eating and PA in young adult university students when behavioural change theories and all social marketing benchmarks are adopted. More generalizable longer-term investigation into the effectiveness of this approach in university young adults is needed to tackle adult obesity related health issues.

1. Introduction

Obesity has remained a global epidemic and represents a key risk factor for the development of many chronic diseases [1]. This epidemic is reflected by the prevalences and trends of adult obesity in Australia and the US, with females showing higher rates of becoming obese than males [2,3]. For example, approximately 12.5 million Australian aged ≥18 years were categorized as overweight or obese in 2017/2018, equivalent to 2 in 3 adults being overweight or obese [4]. The prevalence of overweight and obesity in Australian aged ≥15 years has also demonstrated a steady upward trend, with a combined incidence of 60 % over the period 2006 to 2019, particularly those living in rural and regional city urban areas [5]. This trend aligns with recent observation from five US national studies where obesity incidence increased from age 15 years into young adulthood [6]. Similarly, obesity prevalence rates among Canadian young adults (≥18 years) increased from 23.9 % in 2007/09 to 26.4 % in 2012/13 [7]. These trends highlight the

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need for more efficient interventions targeting key modifiable risk factors to prevent and manage obesity in young adults. Obesity in young Australians, Americans, and Canadians (aged ≥18 years) is attributed to several risk factors such as poor diet, physical inactivity, sedentary behaviours, low socioeconomic status, and stressful life events [8–14].

One such life event is the transition to university life [15]. It represents a critical period where changes in lifestyle behaviours (e.g., decrease in physical activity (PA) and fruit/vegetable intake) and weight gains are more commonly documented [15]. Starting university in Australia, Canada, and the US is influenced by several barriers perceived to healthy eating/lifestyle such as unsupportive institutional environment, availability/cost of healthy foods, neglect of PA, easy access to fast food, peer influence on unhealthy eating behaviour/physical inactivity, insufficient sleep, and stress [16–19]. Students appeared to maintain those detrimental behavioural patterns such as excessive screen time and physical inactivity during the transition [20,21]. Alarmingly, a higher psychological distress risk was found in students who followed unhealthy patterns of behaviour such as physical inactivity and unhealthy diet while studying transition to university courses [22–24]. Different types of interventions have been used to improve dietary, PA, and weight-related outcomes (e.g., body fat, lean mass, waist-to-hip ratio, waist circumference) in the university setting, including strategies promoting healthy food purchases, online education and using web resources, and social media/technology devices [25].

Social media platform usage for educational and social interaction purposes is on the rise among university students [26]. Young Australian and US adults (aged ≥18 years) spend plenty of time on social media platforms, of which the most common ones include Instagram, Facebook, and Youtube, to obtain health information and discuss health topics with others (e.g., nutrition, fitness, healthy lifestyles) [27,28]. What is concerning is that unhealthy food and beverage marketing may be common in social media engagement activities on Australian university social media accounts (e.g., Facebook, Twitter) [29]. Promotion of health benefiting behaviours in the university setting can thus adopt intervention approaches such as social marketing based on usage preferences of young adults [27,29].

Social marketing is an approach of social innovation, which creates positive social networks changes by influencing individual behaviours [30]. Social marketing interventions use Andreasen's six social marketing benchmark criteria: behavioural objectives, audience segmentation, formative research, exchange, competition, and marketing mix. These are considered effective behaviour change tools to increase healthy eating across a variety of populations, including children, adolescents, and adults [31]. Several interventions targeting university students (aged 18–35 years) have focused on the effects of social media on diet and PA-related behaviours, which resulted in modified food intake and increased PA levels [32]. However, the limited application of social marketing approach that aims to improve university students' dietary/PA behaviours suggests a need to adopt theory-driven social marketing programs. Few theory-driven social marketing interventions designed for Australian young adults to improve dietary and/or PA behaviours were reported. Only six studies have been found to utilise social marketing campaigns to improve healthy eating and PA among university students in Australia, Canada, Japan, and the US. Moreover, theoretical frameworks or models to improve healthy lifestyle among students have not been frequently applied. This review aimed to outline how social marketing campaigns were designed in either the university setting or young adults, including the use of theoretical models or frameworks. It highlights the significance of applying social marketing approaches to promote healthy eating and PA among young adult university students. To our knowledge, this is the first comprehensive review for this purpose.

2. Methods

This review followed the guidelines of Joanna Briggs Institute (JBI) scoping review methodology and included the following steps: developing the objective and research question; addressing the inclusion and exclusion criteria; documenting search strategies; extracting and presenting of results, and writing the conclusion [33].

2.1. Objective and research question

The objective of this review was to identify social marketing strategies targeting healthy eating and/or PA behaviours of young adult university students.

The research question was "What strategies of social marketing targeting healthy eating and/or PA behaviours have been reported?"

2.2. Inclusion and exclusion criteria

Studies were included if they were written in English, published between January 1, 2000 and September 20, 2023, carried out on university students, focused on social marketing benchmark criteria, targeted healthy eating and/or PA, and used observational and interventional study designs (Table 1). Studies were also included if they targeted young adults aged 18–35 years, as students start university at age 18 years and may finish their university education at around the age of 35 [32].

Inclusion and exclusion criteria were developed based on the research question. Criteria regarding the study setting, study focus, and sample characteristics were used to generate literature search keywords. The language and publication period criteria were used to refine literature search results. All criteria were used to screen for eligibility during title and abstract screening and full-text screening.

Table 1
Inclusion and exclusion criteria.

Criteria	Inclusion	Exclusion
Language	English	Other languages
Time period	2000+	<1999
Setting	University	Other educational settings
Study focus	Studies focused on social marketing targeting healthy eating and/or PA	Studies not relevant to the study objective
Sample	University students and/or young adults (aged 18–35 years)	Children and older adults
Study design	Observational, intervention	Commentaries, reviews

2.3. Search strategies

The electronic databases (PubMed/Medline and Scopus) were searched in June 2023 and updated search on September 25, 2023 to identify relevant articles. Keywords were derived from the research objective and inclusion and exclusion criteria ('Setting', 'Study focus', and 'Sample'). They included social marketing, adults, university student, food choice, and PA (Table 2). Search terms for each keyword were brainstormed, reviewed, and agreed upon by authors. The Boolean operator 'OR' was used between search terms for each keyword and 'AND' was used to combine search terms for each keyword during literature search. Search results were refined with publication period and language filters as stated in Table 1.

2.4. Data extraction

The following information was extracted from each article screened as eligible: authors, year of publication, country of study, sample, study design, data collection, study outcomes, social marketing strategies, theoretical framework, and main findings. Data were extracted and presented in tables by one reviewer (NA), and then checked for accuracy by another reviewer (LL). Discrepancies during screening and data extraction were discussed and modified based on mutual agreement by both authors.

3. Results

Our search identified 32,928 records for possible inclusion, with 32,571 duplicates removed. A total of 357 articles were screened by title and abstract for inclusion, and 325 articles were excluded based on Table 1. Of the 32 full-text articles that we screened as potentially relevant, 12 met the inclusion criteria (Table 1), which involved more than 52,280 university students/young adults (aged 18–35 years). A PRISMA flow diagram of articles inclusion is summarized in Fig. 1. The results were divided into two themes: university setting and young adults.

3.1. University setting

Social marketing campaigns used in the university setting have a limited evidence base (Table 3). Six studies met the inclusion criteria (Table 1). Three studies were conducted in the US, with others in Australia, Canada, and Japan.

A US study assessed the effects of the *Energize Your Life!* social-marketing campaign on improving knowledge and attitudes related to fruit consumption among university students. Focus groups at the intervention campus were conducted to rate the brochure and poster contents about the health benefits of fruit and improve behavioural facilitators that increase fruit consumption and determine barriers to fruit consumption. Students believed that fruit reduced the risk of obesity/cancer, provided energy, tasted good, was less expensive, and easy to get on campus [34]. A 3-week social marketing intervention was designed to assess the effect of "benefit-based messages" (motivation phrases such as taste, having more energy) with multifaceted methods (flyers, posters, colorful photographs, table tents) on selections and perceptions of 10 healthy foods available in the dining hall among US university students. The main intervention outcome demonstrated significant increases in healthy food selection and intake, and students became aware of healthy food choices [35]. In a US study aimed to understand the factors related to electronic word-of-mouth (eWOM) about promoting leisure-time PA, students felt that leisure-time PA is interested, fascinated, and influenced by strong ties on social network sites. Those who forwarded information about leisure-time PA were more likely to provide and seek opinions from others [36].

An Australian study evaluated the effect of kilojoule (kJ) labeling with or without a social marketing campaign on sales and selection of less energy-dense foods over a 5-week period among university students. A social marketing campaign included advertising

Table 2
Keywords and search terms.

Keywords	Search terms
Social marketing	social marketing* OR campaign* OR intervention* OR technique*
Adults	Young adults*
University student	college students* OR undergraduate students*
Food choice	food choice* OR healthful food choice* OR healthy eating* OR healthy eating habit* OR healthy eating behaviour*
PA	PA

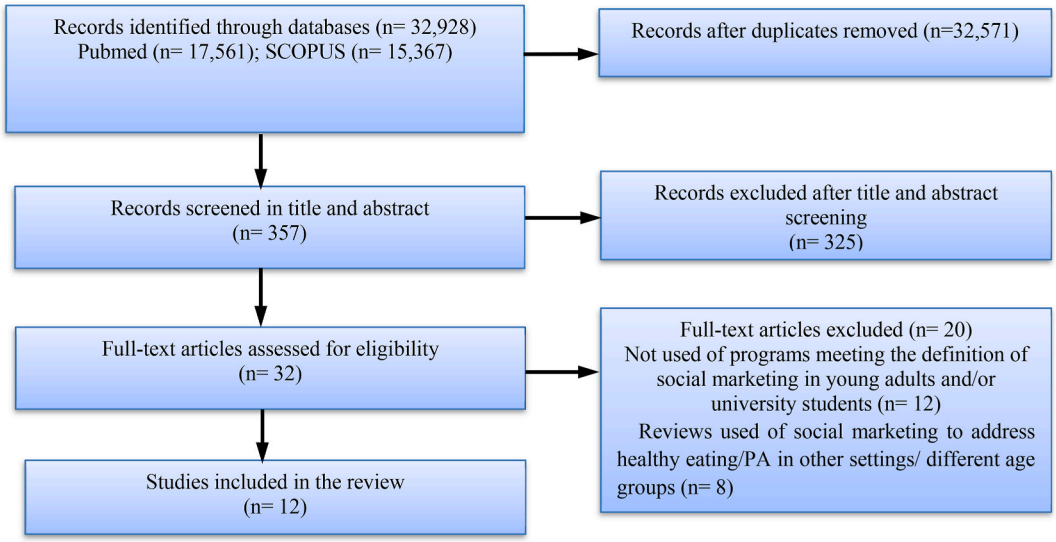

Fig. 1. PRISMA flowchart of article inclusion.

materials in the food outlet such as info-graphics, interactive calculators for students to estimate kilojoule requirements, and informational websites. Evaluation results indicated that the social marketing campaign was successful in improving students' awareness and understanding of calorie labeling and attitudes towards ordering lower kJ food items compared with students using the kJ labeling alone [37]. A social marketing approach conducted to promote PA among Canadian university students. Awareness of the campaign, compared to other campaigns (green dot, ghost and safetalk) was increased among students after follow-up. Higher levels of awareness were associated with self-efficacy, outcome expectancies, and intentions to be active [38].

The one study in Japan investigated the effects of social media interactions by creating dietary diaries via a smartphone app after a 3-month follow-up, with the aim to motivate college students to become more conscious of their own eating habits. The numbers of healthy topics students thought about when they made food and drink decisions were increased when using dietary diaries. Students enjoyed participating in activities (e.g., reading posts/comments, taking photos, seeing what the other students ate) and became more aware of their eating habits. They felt shame if not eating well when they showed their diaries to others. They also mentioned the usefulness of the smartphone app. to exchange healthy eating tips, and requested improved access to the app by using special techniques [39]. Table 3 summarizes social marketing approach applied in university-based studies.

3.2. Young adults

The review identified six eligible studies, all based in Australia. Four theory-driven social marketing studies targeted young adults (aged 18–35 years) have shown the ability to improve healthy eating and/or PA.

A 12-month intervention study was conducted to evaluate a social marketing strategy using Andreasen's social marketing benchmark criteria that aimed to maximize interaction with the 'No Money No Time' (NMNT) healthy eating website [40]. Adults were segmented based on motivators such as healthy diet and blog/recipe articles. The intervention resulted in increased numbers of users who accessed NMNT by completing the Healthy Eating Quiz diet quality score. The organic search (entering information into web search engines such as Google) was the strongest engagement with users, which included a search engine optimization audit and a backlink/content strategy. A national radio program was found to be a successful promotional strategy. The most common device used to access the website was the mobile/smartphone. Cheap, fast, and healthy recipes had the highest number of page views. The proportion of return users to the website was increased after program completion.

A mixed methods study was undertaken to evaluate social marketing intervention using social cognitive theory (SCT) that aimed to improve well-being in young adults [41]. The program resulted in reduced screen time, more engagement in leisure activities/physical relaxation, and development of skills to improve sleep and engage in moderate-to-vigorous PA. Adults preferred videos/assignments in a workbook as part of the delivery format of the program, and also reported the usefulness of accessing to the program, so the potential in return could be high.

A mixed-methods study was carried to understand perceived causes of obesity, skills related to food preparation, and normative beliefs about healthy eating in six different market segments using the integrative model of behaviour change (IBM). Market segment individuals believe obesity is caused by lack of willpower, medical conditions, and energy imbalance. Individuals except those defined by the segments of "Aspirational Healthy Eaters", "Balanced All-Rounders", "Contemplating another Day", and "Blissfully Unconcerned" perceive they have advanced levels of skills in healthy meal preparation/planning. Satisfaction with healthy eating, high intention to eat healthier food, motivation to adhere to healthy foods, perceived nutrition knowledge/expertise, and nutrition knowledge Mavenism were the most normative beliefs the "Lifestyle Mavens" and "Health Conscious" individuals demonstrated [42].

Table 3
Summary of studies reporting the use of social marketing approach among university students.

Authors	Year of publication	Country of study	Sample	Study design	Data collection	Study outcomes	Social marketing strategies	Theory	Main findings
Shive & Morris [34]	2006	USA	College students (n = 1367; aged 24–32 yrs)	Quasi-experimental, pretest-posttest intervention	Formative: Student focus groups in the intervention college; Impact: Survey of randomly selected classes in the intervention and control colleges; independent samples pre- and post-intervention	Fruit intake	Behavioural objective, part of marketing mix (promotion through brochures and posters on cafeteria tables)	NA	Improved students' attitudes toward intake
Peterson et al. [35]	2010	USA	College students (n = 104; aged 18–23 yrs)	Pretest-posttest intervention	Impact: written pre-intervention survey on intervention site, post-intervention survey online among same participant cohort	Healthy foods	Behavioural objective, part of marketing mix (promotion through posters, flyers, table tents and colorful photographs)	NA	Improved students' healthy food selection and intake
Zhang et al. [36]	2017	USA	College students (n = 439; aged 18–24 yrs)	Exploratory study	Online survey	PA	Formative research	NA	Students have perceived strength of ties and affective involvement on opinion seeking about PA
Roy et al. [37]	2016	Australia	University students (n = 713; aged 19–24 yrs)	Pretest-posttest intervention	Impact: Weekly sales data from food outlet vendor; during two 5-week intervention phases; Intercept survey of student patrons during last 4 weeks of the two intervention phases	Less energy-dense foods	Behavioural objective, part of marketing mix (promotion through placemats, bar top screen, flyers, and poster	NA	Improved students' attitudes, awareness knowledge, and use of energy labels
Scarapicchia et al. [38]	2015	Canada	College students (n = 2784; aged 22 yrs)	Cross-sectional, a web-based survey	Formative: Focus groups and online survey of students; Impact: online survey 6 months post-intervention with no baseline data	PA	Behavioural objective, part of marketing mix (promotion through social media platforms and postcards/ posters)	NA	Improved students' self-efficacy, outcome expectancies, and intentions to be active
Watanabe-Ito et al. [39]	2020	Japan	College students (n = 42; aged 19–22 yrs)	Pretest-posttest online survey	Impact: Online surveys at baseline, immediately after food record creation (i.e., intervention day 1), and 1 month post intervention	Eating habits (choosing healthy meals/ drinks)	Formative research and exchange (increase student's engagement with smartphone app and social media)	NA	Students have familiarity with using smartphone as the most method to keep track of healthy eating

NA: not applied.

Table 4
Summary of evidence-based social marketing campaigns among young adults.

Authors	Year of publication	Country of study	Sample	Study design	Data collection	Study outcomes	Social marketing strategies	Theory	Main findings
Ashton et al. [40]	2021	Australia	Young adults (n = 42413; aged 18–34 yrs)	Web-based intervention	Process: Google analytics during 12- month intervention	Healthy eating	Behavioural objectives, segmentation, formative research, exchange, competition, and marketing mix	NA	Improved regular promotional activities, engine optimization audit, and backlink strategies
van Hierden et al. [41]	2022	Australia	Young adults (n = 15; aged 18–35 yrs)	Mixed methods	Impact: Self-report survey pre- and post-intervention; timing and survey channel (online, by post or face-to-face) not reported; Process: Telephone interview	Well-being behaviours, including PA	Formative research, exchange, and part of marketing mix (type of product promoted and delivery format; e.g., videos, assignments, mobile application)	SCT	Improved sleep, reduced screen time, and engaged in moderate-to-vigorous PA
Dix et al. [42]	2021	Australia	Young adults (n = 195; aged 18–24 yrs)	Mixed methods	Formative: Online forums, unspecified types of challenges, polls, ongoing journals to ascertain target population profiles; online survey to segment target population	Healthy eating	Formative research and segmentation (market segments of adults)	IBM	Lifestyle Mavens and Health Conscious adults have high motivation to comply with healthy foods and nutrition knowledge
Dix et al. [43]	2022	Australia	Young adults (n = 2019; aged 18–24 yrs)	Mixed methods	Same as above	Healthy eating	Formative research and segmentation	IBM	Blissfully Unconcerned adults have less engaged with social media for health content, while Lifestyle Mavens" adults created health content on social media
Brennan et al. [44]	2020	Australia	Young adults (n = 195; aged 18–24 yrs)	Qualitative	Same as above with following additional information: 4-week progressive data collection in a private online community commonly used for market research, with one male and female moderator; data collection coincided with University exam period	Healthy eating	Formative research and segmentation	TTM	Adults have different attitudes towards healthy eating messages, and demonstrated motivation/ interest in messages but struggled to adopt them

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Table 4 (*continued*)

Authors	Year of publication	Country of study	Sample	Study design	Data collection	Study outcomes	Social marketing strategies	Theory	Main findings
Molenaar et al. [45]	2021	Australia	Young adults (n = 166; aged 18–24 yrs)	Qualitative	Same as above with additional information: Online screening survey to determine eligibility for participation	Healthy eating	Formative research and marketing mix (promotion, product, price, and place)	NA	Adults liked advertisements that appeared frequently and tailored to their interests

NA: not applied.

In another study, health-related information seeking on social media was observed among individual segments with the "Lifestyle Mavens" and "Health-Conscious". The "Lifestyle Mavens" individuals were the most likely to create health content on social media, whereas the "Blissfully Unconcerned" individuals were the least likely to effectively engage with social media for health content [43].

In a qualitative study, marketing segmentation was used and supported by the transtheoretical model of behaviour change (TTM) to gain insights into attitudes/beliefs towards healthy eating messages among adults by grouping them into different segments (people in the pew, sinner, and saint). The study found sinners opposed healthy eating messages, whilst saints believed and practiced those messages. People in the pews showed motivation/interest in messages but struggled to adopt them [44]. A qualitative analysis of food-related advertisements on social media platforms was conducted on adults using marketing mix strategy (price, product, place, promotion). Adults were aware of food products when promoted online. They felt shame and guilt if they were not consuming the healthy products advertised. They also liked advertisements that highlighted special offers/discounts, and mentioned healthy food-related advertisement seen on social (YouTube, Instagram, Facebook) and traditional (billboards, TV, radio) media [45]. Table 4 summarizes Australian evidence on social marketing campaigns in young adults.

4. Limitations and challenges

There are several limitations associated with study design common to the studies reviewed. One critical challenge was the lack of comprehensive evaluation measures of the social marketing strategies adopted. Only one [40] out of seven intervention studies [34,35,37,39,41] reported how well the social marketing strategies had been applied to achieve the desired outcomes. The validity, transferability, and generalizability of the intervention strategies or observed associations require further assessment. One common contributing factor to this limitation is the uncertainty of causality due to the nature of pre- and post-comparison without controls and cross-sectional analysis (Tables 3 and 4). Several other factors related to study design, particularly data collection approaches, might have also impacted the validity of the findings reviewed. Most studies analyzed self-reported survey data [34,36,38,39], which may have introduced biases in measurements of processes and outcomes. For example, the influence of social desirability was possible even during online surveys in combination with the nature of self-reporting where facilitation was not available [36]. Bias associated with social desirability might have been more common in studies adopting intercept surveys [35,37].

The majority of intervention studies had a limited duration (from 3 weeks to 3 months) [34,35,42,44,45]. Data usage by the type of media channels was only reported weekly or monthly when available. The limited duration of report and the scarcity of media channel type usage data warranted investigation to confirm whether outcomes observed would remain unchanged in the longer-term, and how long it would take for communication using different media types to take effect. Validity, particularly in the longer-term, was also hindered by when [38,39] and from whom [34] impact data were collected. Collecting data one month [39] or six months [38] post intervention might have allowed time for other environmental factors such as concurrent interventions to take effects. This was reported by Peterson et al. who postponed the intervention until after a national nutrition initiative that took place after their baseline data were collected [35]. This helped avoid overlapping their intervention with the national initiative, the carry-on effects of which, however, could not be eliminated. While most pre- and post-studies [35,37,39,41] followed the same group of participants, findings from one study came from pre- and post-intervention samples independent of each other, adding to uncertainty of study validity [34]. Study validity was suggested to be impacted also by lack of data of other environmental factors influencing lifestyle choices [42,45]. For example, data about the proportion of young adult participants taking full control of own food purchase and preparation was not collected.

One common contributing factor impacting the transferability and generalizability is participant characteristics. Many studies recruited participants primarily from low-income and/or minority ethnic backgrounds [34,35,42,44,45]. Most studies were dominated by one gender [34,40,44,45], particularly young women [34,36,38,40,44,45], where gender information was reported. Some studies also seemed to focus on young adults from particular educational background or institution [35,37,38,40,42,44,45]. Findings from studies constrained by such participant characteristics may thus require confirmation in the wider university student population to overcome possible bias towards one gender or another socio-demographic characteristic. This way design and evaluation of further social marketing campaigns to address healthy eating and PA issues in this cohort can be more targeted to increase efficacy and efficiency. In fact, designing social marketing interventions targeting segments of young adults with specific characteristics seemed to be the primary rationale for studying and publishing a series of extensive formative research from the 'Communicating Health Study' [42,

45]. The data collection tools used might have limited study transferability and generalizability. For example, the dietary data estimation tools used were specific to the study setting and population in two studies [35,39]. The high attrition rate in the 'Communicating Health Study' series [42,45] was also not helpful to ensure transferability or generalizability. It indicates that the study design was a challenge for many participants and those who completed the study were likely much more health or nutrition motivated than those unable to complete. What further prevents transferability and generalizability of findings was the lack of consensus on the use of social media, which was variably reported using data regarding the type, quality, and richness of channels investigated or the frequency of media use in Refs. [34,37,39–41,43]. The quantity of studies identified and reviewed also contribute to limited transferability and generalizability of the study findings. Only twelve papers were assessed, where university students/young adults were based in a limited number of countries, namely Australia, Canada, Japan, and the US. Four of the twelve papers were also published from the same research project [42,45].

This review identified several factors/challenges contributing to problematic social marketing campaigns, echoing some nominated by other authors [46,47]. For example, 6/12 studies included lacked the use of theories in social marketing health interventions (Tables 3 and 4). This was particularly so among studies in the university setting (Table 3). Only 1/12 studies included seemed to have adopted all six social marketing benchmark criteria proposed by Andreasen [40]. Other factors already reported in the literature include insufficient number of academic courses on social marketing, failure to address social marketing's identity, poor branding of the discipline, audience targeted remaining in deprived societies, and focus on an individual level when attempting to change behaviour in social marketing [46–48]. Low levels of attendance and recruitment into exercise session in social marketing campaign may present the challenge facing low-income groups attempting to increase opportunities for social interaction and participation in PA [49]. Perceived financial burden and low levels of support for healthy diet in low-income groups were the main barriers to healthy eating, which have deterred a social marketing campaign from being successful [50]. The financial burden was found to comprise of perceived higher expenses of healthier food choices and concerns about food and thus financial loss due to short-shelf life of perishable items. Insufficient support was identified for nutritional knowledge and healthy eating skills acquisition. More social support was also warranted to strengthen a healthy eating social norm, motivation, and perceived behavioural control and intention to maintain healthy eating behaviours. It was proposed that common social media platform could be used to mitigate the support gap identified. In contrast to above factors, interventions using social marketing benchmarks could potentially promote successful positive behaviour changes towards healthy eating and engagement in PA. Social marketing interventions that adopt the six key criteria lead to significant improvements in healthy diet and PA in different settings (community, schools, workplaces) and target groups (children, adults, socio-economic/ethnic), in which policy adoption was maintained over the intervention periods [51]. However, prevention interventions using social marketing approach on behavioural change require monitoring and assessment of methodological quality to ensure effectiveness [52].

5. Conclusions and future directions

This scoping review identified the study design, social marketing strategies, and if applicable the effectiveness of interventions adopting social marketing strategies in intervention and exploratory studies promoting healthy eating and PA in the university setting or among young adults. The findings indicate that few interventions adopting social marketing strategies delivered to university students have demonstrated the ability to promote healthy eating and/or PA (Table 3). Theory-driven social marketing interventions delivered to young Australians have demonstrated more effectiveness than those without formal theoretical support (Table 4). Young adults receiving social marketing campaigns in their programs demonstrated positive changes in preparation/planning, knowledge, intention, motivation, attitudes, and normative beliefs towards eating healthy [41,44]. Such observations suggest these constructs may have positive implications for the eating behaviours of university students. Four theories of behaviour change with demonstrated effectiveness improving healthy eating and PA are SCT, TPB, TTM, and IBM (Table 4). Briefly, the SCT focuses on the psychosocial effects of behaviour and provides direction for behaviour change methods [53,54]. SCT plays a significant role in health promotion and illness prevention, and hypothesises that cognitive, emotional, and environmental variables will influence one's knowledge, skills, and values [55,56]. SCT assumes that self-efficacy is a key factor because it influences health behaviour via its impact on outcome expectations, goals, social/structural impediments, and perceived facilitators [56]. The TPB introduced by Ajzen [57], is useful for better understanding of individual health-related behaviours. TPB considers perceived behavioural control, intention, and attitude to be the most effective predictors in the promotion of health-related behaviours [58]. The TTM postulates that creating positive change in individuals' health-related behaviours (e.g., healthy eating, PA, quit smoking) depends on different stages of change (contemplation, precontemplation, action, maintenance, preparation), in which self-efficacy, decisional balance, and process of change control movement through these stages in order to achieve given goals and increase motivation to participate in health behaviours [59]. The IBM assumes that intention is the core factor of individual behaviour, which can be predicted by perceived norms, self-efficacy, attitudes, and perceived behavioural control to perform the health behaviour of interest [60]. Results from electronic health (E-health)/web interventions based on SCT, TPB, TTM, and IBM, in which health information delivered through electronic devices (smartphone, Facebook, text-messaging, emails), highlighted the effectiveness of those theories in promoting PA [61,62], and healthy diets [61,63], in university students. It is imperative to incorporate established behavioural change theories such as SCT, TPB, TTM, and IBM while designing interventions adopting social marketing strategies.

Findings from this review indicate areas for consideration in practice and future research in social marketing interventions targeting heathy eating and PA. Further studies should consider which theoretical models and constructs can be more effective in changing dietary and PA behaviours among university students, to be used in social marketing intervention programs. It is important for future research to design more comprehensive and consistent strategies to better understand the effectiveness of interventions

utilizing a wide range of social marketing theories. Research is needed examining how social marketing campaigns before and after enrollment in university have an impact on student's eating habits and PA. Long term evaluation of social marketing strategies is warranted. Most studies in this review have focused on behavioural objective, formative research, and marketing mix in their design (Tables 3 and 4). Focusing on these strategies appear to be insufficient. It would be beneficial to examine the effectiveness of incorporating all six of the social marketing strategies, particularly among low-income minority university students, in order to change dietary and PA behaviours.

This review also demonstrates that university setting-based social marketing for improving student's diet and PA has received less attention for policymakers, social marketers, and governments. Meanwhile, university social media platforms may have the potential to increase the marketing of unhealthy foods and drinks and contributing to obesity issues among university students [64]. There is a need to implement advertising policies targeting social media platforms in universities to regulate advertising of unhealthy foods. Further, the application of a social marketing approach in the university setting, including the use of various media such as university social media platforms, can provide social marketers and/or policymakers with the details needed to make decisions to improve healthy eating and PA behaviours and understand the determinants influencing the implementation of the program. University students should be educated about social marketing strategies for more effective changes in lifestyle behaviours. Training university students to develop social marketing campaign messages and materials may contribute to the prevention and reduction of health issues associated with adult obesity. In addition, prioritising investment at the government and institutional levels required for such interventions are important for sustaining implementation and outcomes of social marketing interventions in the university setting.

6. Data availability statement

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CRediT authorship contribution statement

Naser A. Alsharairi: Writing – original draft. **Li Li:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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