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Addressing nutritional issues and eating behaviours among university students: a narrative review

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Abstract

University life is a critical period for establishing healthy eating habits and attitudes. However, university students are at risk of developing poor eating habits due to various factors, including economic conditions, academic stress and lack of information about nutritional concepts. Poor diet quality leads to malnutrition or overnutrition, increasing the risk of preventable diseases. Food environments on university campuses also play a significant role in shaping the dietary habits of students, with the availability of and accessibility to healthy food options being important factors influencing food choices and overall diet quality. Disordered eating habits and body dissatisfaction are prevalent among university students and can lead to eating disorders. Income and living arrangements also influence dietary habits, with low household income and living alone being associated with unhealthy eating habits. This study is a narrative review that aimed to address nutritional issues and eating behaviours, specifically among university students. We investigated the eating behaviours of university students, including their dietary patterns, food choices and food environments. The objective of this review was to provide insights into the nutritional issues and eating behaviours of university students, with the aim of identifying target areas for intervention to improve the overall health and wellbeing among college students. University food environments need to be restructured to promote healthy eating, including the availability, accessibility, affordability and labelling of healthy foods, and policies to limit the availability of unhealthy foods and drinks on campus.

Keywords: **Food environments: University students: Vending machines: Beverage consumption: Eating attitudes: Body dissatisfaction**

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Introduction

Nutrition is an essential aspect of human life and plays a vital role in maintaining good health and wellbeing. However, the nutritional status of university students in recent years has become an issue of considerable concern[1]. Dietary habits are established in childhood and continue into adulthood, potentially influencing societal food choices and nutritional patterns over time[2]. As young adults gain independence when transitioning from adolescence to young adulthood, they face a multitude of challenges related to healthy food choices[3]. This period also brings about a new set of behavioural patterns related to weight control, excessive alcohol consumption and low levels of physical activity. As these behaviours can lead to negative health outcomes, it is crucial to identify interventions to enable young adults prioritise their health and make informed choices[4]. Incidences of poor eating practices and weight gain have increased in tandem with the rise in the number of students attending institutions[5,6]. Many students struggle to maintain a healthy diet due to various factors, such as busy schedules, stress, limited access to healthy food options and unhealthy eating behaviours[7–10]. Furthermore, young adults face a range of challenges in maintaining a healthy diet, including disinterest among males, influence from peers and family members with unhealthy eating habits, affordability of unhealthy foods, time constraints, lack of cooking facilities, and insufficient knowledge about nutrition. These combined challenges significantly impede the adoption and sustenance of nutritious dietary practices by young adults[11].

The consequences of poor eating habits can be severe. Obesity rates among university students have risen considerably in recent years, leading to an increased risk of chronic diseases such as diabetes and heart disease[5–10]. Additionally, inadequate diet can result in mental health disorders, including despair and anxiety, and lower academic performance[12,13]. According to several studies conducted among university students, the prevalence of overweight and obesity is approximately 30% with higher rates among male than female students[14–17]. The highest prevalence of mental health disorders of 22% has been reported among young adults[18]. Furthermore, major depression and anxiety, the two most common types of mental disorders in young adults, have a reported prevalence of 10·9% and 22·3%, respectively[18]. Studies have also shown that many students consume diets that are deficient in essential nutrients such as vitamins and minerals. Many students choose to consume foods that are high in calories, sugar and fat, such as fast food, processed snacks and sugary drinks[10,12].

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Unhealthy diet can lead to various health problems such as fatigue, poor concentration and weakened immune systems[10,19]. The issue is worsened by the scarcity of nutritious food alternatives on campus. Most institutions offer few affordable choices for nutritious meals on campus or offer food that, while healthy, may not be affordable to many students. This makes it challenging for students to access nutritious foods[5,9,10,12]. Due to a lack of time or resources, many students tend to skip meals which can cause energy deficits and nutritional shortages with detrimental effects on academic performance[20]. Moreover, students often eat high-calorie foods such as pizza, chips and ice cream when they stay up late to study. This can lead to weight gain and poor sleep quality due to snacking after midnight[21].

Additionally, eating problems, including anorexia, bulimia and binge eating disorder, which are prevalent among university students, exert a profound impact on their physical and emotional wellbeing[22,23]. The severity and prevalence of these diseases underscore that they are a significant public health concern, necessitating comprehensive and multidisciplinary treatment, often involving frequent hospitalisations[24–26].

These issues are particularly pronounced among young people, a demographic that includes most university students[27]. In a comprehensive epidemiological study by Andersen *et al.* (in collaboration with the Association Against Anorexia and Bulimia (ACAB) and partnership with universities from the Catalan Autonomous Community in Spain), at the time of the survey, 11·48% and 6·38% of university students were at risk of developing or actively experiencing eating disorders, respectively[28]. These data highlight the urgent need for targeted interventions and support systems to address the prevalence of eating disorders among the university student population. Such interventions require a multifaceted approach that involves education, policy changes and individual behavioural modification[29].

Universities can play an important role in promoting healthy eating habits by providing access to healthy food options on campuses and educating students about the importance of good nutrition[30,31]. One approach that has been successful in addressing eating behaviours among university students is the implementation of nutritional education programmes. Although there are challenges in customising and adapting nutritional education programmes to meet the specific needs of young adults, their implementation is highly important for public health[32]. Through these programmes, students can receive information about healthy eating habits and develop skills to make healthier food choices. Moreover, the integration of new technology into nutritional education programmes can potentially play a crucial role in the programme's effectiveness and wider implementation among young adults. However, further research is required to determine the most optimal delivery methods[33,34]. Therefore, this review aimed to explore various nutritional challenges and eating behaviours of university students. The findings may help to identify areas of intervention potential to promote positive change and improve overall health and wellbeing.

Methods

In this narrative review to address nutritional challenges and eating behaviours of university students, a comprehensive search strategy was implemented. The search strategy aimed to identify relevant studies published up to September 2023. Literature searches were performed using the following electronic databases: PubMed, Web of Science, Science Direct, Google and Google Scholar. The information obtained from computerised database searches was subsequently synthesised into a comprehensive narrative review. The following key words were used: 'university students', 'nutrition', 'eating behaviours', 'diet quality', 'nutritional status', 'university food environment', 'dietary behaviours', 'dietary trends', 'beverage consumption', 'eating attitudes', 'body dissatisfaction', 'personal factors', 'eating disorders', 'socio-demographic correlates', 'food availability', 'food choice', 'unhealthy eating' and 'nutrition transition'. The following inclusion criteria were used to select relevant studies: (1) studies focused on university students as the target population; (2) studies that examined nutritional challenges, eating behaviours, dietary habits or food choices among university students; (3) studies that reported primary research findings, including observational studies, cross-sectional surveys, qualitative studies and intervention studies; and (4) studies published in English. Initially, titles and abstracts were screened, followed by a full-text review of potentially relevant articles. Finally, studies were included in this narrative review based on their relevance to the research aim, methodological rigour and contribution to the overall understanding of university students' nutritional issues and eating behaviours.

Diet quality and nutritional status in university students

A balanced diet and regular physical activity are important factors for good physical and mental health[35]. Diet is one of the most important factors that determines and helps to maintain the health of an individual. Additionally, it is related to the leading causes of death in the United States, including diabetes, coronary heart disease, atherosclerosis, stroke and cancer[36,37]. The consumption of certain foods has been linked to either an increased or decreased risk of developing various diseases, research has also repeatedly demonstrated the important role of diet in maintaining good health as well as its relation to life expectancy[37]. According to the World Health Organization (WHO), changes in lifestyle and diet can prevent up to 50% of diabetes cases and 40% of cancers[38]. Furthermore, poor diet quality contributes to the development of many chronic diseases, such as cardiovascular disease, type 2 diabetes and some types of cancer[39].

There is an urgent need for varieties of foods and nutrients to meet individuals' nutritional needs. Diet quality refers to a healthy diet that is safe, varied, balanced and adapted to individual requirements for optimal development and growth, prevention of diseases and ensuring good health status[40]. Diet quality can be measured by comparing an individual's dietary intake with current recommendations using the Diet Quality Indicators (DQI)[41,42]. Although diet quality usually improves with age, a deterioration in diet quality is often observed during adolescence into adulthood. However, some of the eating habits that young people develop are often linked to poor-quality diet, and the potential for these habits and behaviours to persist has an impact on individual's long-term health[39]. Nutritional status

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defined using a set of individuals' anthropometric indicators, is usually influenced by nutrient intake and utilisation, and is determined from the finding of physical, biochemical and nutritional studies[43]. The nutritional status of an adolescent has significant effects on their health and the onset of various chronic diseases and may indicate a break in the cycle of malnutrition[44]. Adolescence is one of the dynamic stages of an individual's development. Physical changes at this time affect the body's nutritional requirements, while lifestyle changes may have an impact on eating patterns and dietary preferences[44]. University students constitute a large segment of society, because worldwide their number has reached approximately 235 million students. The university enrolment rate is 40%, with significant differences among countries and regions[45]. In particular, they are an important target group for public health initiatives since attendance in a university implies a substantial lifestyle shift that may include new challenges with significant impact on the habits and health of young adults[37]. Furthermore, peer rivalry, the pressures of academic success, new types of relationships and, in some cases, moving away from home can all lead to new and risky behaviours that may affect the health of university students[37]. Resumption in a university usually marks the beginning of independence and the formation of a student lifestyle. During this period, previously learned patterns related to meeting nutritional needs or completely new behavioural patterns are established. Students' eating habits often deviate significantly from a healthy, balanced diet due to various factors, including distance from the family home, economic conditions, high academic workloads, time constraints and lack of information about nutritional concepts[46,47]. However, eating habits, the behaviour a person exhibits in relation to food consumption and meal selection, include the interplay of genetic, demographic, socioeconomic and cultural factors. Therefore, in different countries, cultural traditions, disparities in food access and social and economic considerations can all affect food intake[48]. Similarly, the 'Westernisation' of diet has become common, worldwide. It entails abandoning traditional, specific eating customs in favour of more sugar and sweets, sweetened beverages, fast food, red meat and processed foods consumptions[39,48,49]. Western diet is associated with a higher risk of developing chronic diseases and is most frequently observed during the transition from adolescence to adulthood. However, the health effects of poor food quality take time to manifest, which may explain why young people are often unconcerned with adhering to the rules of a healthy diet[48].

University students display several common eating habits, including frequently snacking on energy-dense foods, skipping meals – especially breakfast, eating a lot of junk food and few fruits and vegetables, and tending to consume fast-cooked foods that take only minutes to prepare. These, in addition to low physical activity and prolonged computer and TV use, can lead to malnutrition or overnutrition, which increase a person's vulnerability to preventable diseases[44]. This is consistent with a narrative review of thirty-seven papers from Europe, North America, the Middle East, South America and Africa that found fast food, sugar-sweetened beverages (SSBs) and sweet and salty packaged snacks to be more popular than fruits and vegetables among college students[50]. According to similar research conducted in Turkey, 39·7% of university students consume fast food at least once in 15 d, and this is considered their favourite food[51]. A cross-sectional study in Saudi Arabia that aimed to evaluate the dietary habits lifestyle of university students and found that most students consumed fast food and a large number of soft drinks and few fruits and vegetables, despite their knowledge of the benefits of vegetables and fruits and the detrimental effects of soft drinks[52]. While these studies in Turkey and Saudi Arabia had similar findings, in a study conducted in Slovakia, Germany and Poland, which examined differences in dietary quality and nutrition knowledge among 394 students, showed differences in diet according to country[48]. A cross-sectional study of 1055 students in Spain assessed diet quality using the Spanish Healthy Eating Index and showed that only 184 students (17·4%) followed a healthy diet. In addition, there was a weak level of adherence to the recommendations, particularly regarding the number of fruits, vegetables, cold meats and sweets that they ate[37]. Furthermore, a study in Australia measured diet and examined the state of food security and other factors that could affect diet quality in 141 university students. The results showed that diet quality was generally poor, food insecurity was associated with lower nutritional quality, and cooking skills were associated with higher diet quality[53]. Therefore, based on these three studies, Polish, Spanish and Australian students consumed a low-quality diet, while German students consumed a high-quality diet.

The Arabian Gulf has undergone rapid sociocultural changes over the past few decades because of the booming economy. These changes have had a significant impact on food preferences and eating customs, to becoming 'Westernised'[54]. The Western diet is characterised by a higher proportion of fast food and sweetened drinks, along with reduced consumption of traditional foods. This shift in dietary patterns, which has led to a decline in diet quality, explains the relationship between the changing patterns and their effects. These dietary alterations, which have been associated with poor diet quality, are often the cause of people not maintaining healthy lifestyles, resulting in increased risk of chronic diseases[54]. A cross-sectional study at Taibah University in Saudi Arabia, which assessed the quality of diet among 658 female university students in three different majors, showed that undergoing a university major may affect their quality diet[54]. Due to the remarkable changes that have occurred in the economic and social development of Saudi Arabia, several variables have led to a change in the type of food consumed by Saudi female students. They include the introduction and consumption of fast food rich in fat that may contribute to increased blood cholesterol levels. The current generation no longer consumes fruits and vegetables; instead, these are frequently replaced by soft drinks and snacks consumed several times a day[55]. The health and nutritional status of young people is affected by the fact that the food they eat no longer meets their daily nutritional requirements[55,56]. As poor diet quality may cause nutrition-related health issues, it is necessary to take preventive action that can lead to changes in the eating habits of university students, as they are still capable of making long-lasting dietary changes[57].

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University food environment: implications for student dietary behaviours

Food environments are considered the collective set of physical, policy, economic and social circumstances that affect people's decisions regarding what to eat and drink, as well as their nutritional status[58,59]. Food environments generally encompass the variety of food sources and products that surround people in their daily lives[60,61]. Today, many food environments and food systems face challenges in supporting food choices that are consistent with healthy and adequate diets with good nutritional outcomes[61]. Currently, nutrient-poor, energy-dense and processed foods are widely available, relatively less expensive, and widely promoted in trophic environments[62]. Unhealthy or poor food environments appear to have a supply-side 'push' effect on excessive energy intake and unhealthy diets, which is the main cause of populations' unhealthy weight gain[62–64].

Furthermore, unhealthy food environments in universities are a major concern, particularly because most students as young adults, are more susceptible to poor dietary habits due to limited disposable income, restricted cooking skills, insufficient nutrition knowledge and limited access to kitchen facilities, particularly in shared housing and on-campus accommodation[11,65]. Therefore, creating 'healthy food environments' is crucial to reducing obesity and non-communicable diseases[66]. In such environments, the foods, beverages and meals, which contribute to populations' diet, meeting the national dietary guidelines are widely available, affordably priced and widely promoted[59].

One strategy to improve food environments and make them healthier is to set standards or guidelines for the types of foods and beverages that retailers must sell[67]. The commitment by the management of the University of New South Wales, Sydney, to improve the food environment on campus is a real-life example of the development of the university food environment[68]. In addition, a healthy food and drink framework needs to be developed in universities[69]. Such a framework should include key elements to increase the availability of healthy foods and beverages, setting limits on the size of unhealthy foods, removing unhealthy foods from highly prominent areas, and limiting meal offers to healthy products only[70,71].

University campuses have complicated food environments that serve many different cultures. They typically include a large number and variety of food retail establishments, vending machines, student residences, food provision and catering services, food cooperatives, institutional and student-run events and promotional activities that serve students and staff members and influence their dietary preferences[72,73]. The WHO has recognised university dining environments as key health-promotion settings[74] that influence faculty, staff and, particularly, students, who are young adults in their vital developmental and transitional stage[75].

The university campus is one of the few places where many young adults live and spend most of their time (35 h per week for about 4 years). Studies have demonstrated that certain health behaviours (including those related to nutrition) are nurtured on campus and may continue into adulthood[76]. As reported, food environments in universities offer unhealthy choices that may lead to obesity[77,78]. The possible causes of weight gain in university students include academic stressors, various social pressures, alterations in family and/or peer networks and the college campus food environment[79]. As the college campus food environment is heavily populated by inexpensive, tasty, generously sized and calorie-dense foods, university life for young adults may be characterised by these unfavourable environmental factors that may lead to bad eating habits and weight increase[78].

Influence of vending machines

Vending machines are sources of products high in saturated fat, sugar and caffeine and low in fibre and nutrients[80–82]. These items are frequently the main sources of food and beverages in public places such as universities, where they are widely distributed and are particularly appealing to the time-pressed students and staff in higher education institutions[83]. Vending machines serve as a ready and convenient source of a range of beverages and foods. However, access to vending machines has been associated with an increased consumption of snacks and the rise of an obesogenic food environment in universities[84,85].

In vending machine audit studies conducted by universities in Australia, the United Kingdom and the United States, the proportions of the nutritionally poor-quality foods and drinks varied from 85% to 100% and 49% to 86%, respectively[83,86,87]. Grech *et al.* found that vending machines at universities mostly supply energy-dense nutrient-poor beverages and snacks. Only few options of healthy snacks were found at a higher cost and with poorer marketing, compared with other types of snacks[83]. Velazquez *et al.* showed in four university campuses in Emarat, after assessing the nutritional value of snacks and beverages in vending machines that 65% included high levels of sugar, salt and saturated fat and were calorie dense[88]. This contrasts with the expected norm in a post-secondary education setting, where the promotion of healthy behaviour can set the foundation for lifelong healthy choices[89].

Assessment of canteens and cafeterias at universities

Various dining options are available for students on campus. In a California university campus, 12% of entrées and 36% of main dish salads were classified as healthy. Furthermore, the two campus stores had numerous nutritious food options, including fresh produce of acceptable quality, low-fat milk, 100% fruit juice, diet soda, baked chips, whole-grain bread and low-sugar cereals[90]. Moreover, prices for healthier options were not higher than those for regular options, save for baked chips[90]. In fifteen higher education institutions in the United States, Horacek *et al.* found that the availability and quality of groceries scored significantly higher than those of convenience store foods. However, groceries were more expensive compared with those foods in convenience stores[91]. Furthermore, as reported, Australian university environments do not comply with the best practice guidelines for creating a healthy food environment because healthy foods were unavailable, inaccessible or unaffordable, and labelling was lacking. Moreover, there were no policies limiting the availability of unhealthy foods and drinks on campus[92]. As one critical study also indicated, university

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food environments lack healthy foods and promote the consumption of ultra-processed foods (UPFs) and beverages[93].

The food environment on university campuses has a significant impact on the diet of students. Regional trends suggest a universal need for interventions promoting healthier food choices on campuses, emphasising the significance of creating environments aligning with national dietary guidelines[77,82,84,92]. The reported evidence underscores the urgency of addressing unhealthy food environments in universities to safeguard student health and wellbeing.

University food environment and its influence on students' food choices

The impact of a food environment on a individuals' dietary decisions can be explained by investigating university campuses practices. In many 4-year colleges and universities in the United States, first-year students eat the majority, if not all, of their main meals on campus, even if they reside off-campus. Therefore, the food outlets on campus provide food to a large percentage of the students. However, evidence indicates that the food served on campus does not promote healthy eating[94]. According to an audit of 263 dining outlets across fifteen tertiary education institutions in the United States, only 40% presented healthy main dishes and the convenience stores on campus lacked healthy items, including low-fat products, whole-grain cereals, fruits and vegetables. Similarly, the support for healthy eating at college dining halls was limited, while snack machines provided salty snacks such as chips, pretzels and candy[91]. An observational study conducted on 6 university campuses in New Zealand found that only 11% of fifty-seven food outlets could be categorised as healthy, based on the availability of healthy and unhealthy food products[95]. Therefore, university students consume nutrient-poor and excessively energy-dense foods that do not meet the recommendations for nutrient-dense foods[65].

Most young adults earn lower incomes and seek perceived value for money, so they may be more vulnerable to the price and volume aspects of their food environment[96]. In addition, the level of the environment's restrictions and possibilities for healthy food choices can have an impact on diet-related outcomes such as obesity and weight gain[97]. Besides acknowledging the impact of university food environments on student dietary habits, it is also important to consider other influencing factors, such as personal beliefs and peer influences. These additional factors can play a significant role in shaping students' food choices alongside the environment they are exposed to at the university.

Possible interventions: creating healthier food environments

The unavailability of healthy foods on campuses is of concern because students' purchases are usually restricted to the campus offerings. Healthy environmental changes that encourage young adults to choose nutritious foods could have a favourable impact on their eating habits. Evidence suggests that expanding the variety and access to healthy foods, such as fruits, vegetables and low-fat snacks, may boost their sale[98,99]. In addition, promoting low-fat snack choices through labels and signage can have a significant impact on their sales and increase consumer awareness and preference[97].

A United Arab Emirates qualitative study highlighted the need to improve the nutritional quality of on-campus foods and establishing dietary guidelines[100]. Studies conducted at multiple universities have shown various strategies that can be used to improve the food environment. These intervention studies provide valuable insights on how to make positive changes to the food environment[101]. According to Hua *et al.*, the availability of healthier products, combined with the advertising of vending machine meal options, had a substantially greater influence on sales volume[102]. A systematic review conducted in 2020 concluded that effective interventions to improve the nutritional environment and increase the consumption of healthy foods on campus include: promoting healthy foods, increasing their availability and decreasing their prices[101].

In addition, food guidance by a simplified point of purchase nutrition information on menu options could be of strategic importance in encouraging healthier food choices[103]. This is because point-of-purchase nutrition information has the potential to influence healthful eating patterns in entire populations[104]. A quasi-experimental study at an urban university found that identifying healthier options with a symbol at the point of purchase improved sales over time[105]. It is evident that interventional measures are required to enhance the dining environments at universities. Furthermore, understanding the impact of unhealthy food environments on university campuses extends beyond individual dietary behaviours. Urgency is amplified when considering the potential long-term consequences, such as obesity and weight gain, and their broader implications to public health. Addressing these challenges is crucial not only for the health and wellbeing of university students but also for the wider community[106].

Solutions and interventions to improve the college food environment involves exploring several strategies to assist campus vendors, first, by supporting the long-term implementation of incentives to increase the purchase of healthy foods while minimising the impact on profits. Second, the feasibility of using locally grown produce to supplement food supplies and reduce purchasing costs should be studied[107]. Third, supplier consolidation among campus vendors should be encouraged to decrease food purchasing costs through increased bargaining power[108]. Finally, setting discount targets on some healthy food items along with the provision of nutritional education, and compensating for any loss in profits by increasing the prices of unhealthy foods to support and encourage the consumption of healthy foods[109]. Furthermore, revenues generated from unhealthy food tax may help fund health promotion programmes and subsidise the cost of healthy choices[110].

Dietary trends and beverage consumption among university students: implications for health and wellness

Healthy eating is one of the most effective ways to improve overall health. A balanced diet should consist of natural and fresh foods, fruits, vegetables and foods rich in vitamins and minerals[111]. It also includes consistent activities and dietary

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habits, which are important for maintaining both physical and psychological health[112]. A healthy diet is known to play an important role in the lives of university students, who are a sizable population group that might be targeted to prevent various health problems[113]. Although the consumption of unhealthy foods is common among university students, a large percentage of university students eat healthy foods regularly.

Studies conducted in Malaysia[114], Lebanon[115] and China[116] found that 57·4%, 61·4% and 83·6% university students, respectively, regularly consumed healthy meals. The study conducted in Malaysia also indicated that 60% of the students were eating balanced meals, 81·8% consumed vegetables and legumes frequently, and 48·5% consumed fruits at least three times a week. These are encouraging results, compared with those in many other countries[114]. Contrary with many studies, the Malaysian study found that 78·8% of the group rarely consumed fast food. Another study involving students from a United Arab Emirates university indicated that the students were interested in buying fresh fruits, dry roasted nuts and popcorn[75]. However, many barriers exist against healthy foods consumption by college students.

Young adults' dietary patterns and lifestyles have been an object of research in nutritional epidemiology. University students face extensive lifestyle changes directly after transitioning from high school to college[117]. Many students leave the parental house and live alone with financial responsibilities, which may lead to shifts in their dietary and lifestyle patterns[117]. Previous research has indicated that changes in young adults' economic and social status encourages weight gain, unhealthy eating and physical inactivity attitudes[117,118]. Therefore, a higher consumption of UPFs, energy-dense snacks, skipping meals and sedentary behaviours was observed during young adulthood[119,120]. Therefore, researchers have assumed that university students usually ignore public health recommendations and dietary guidelines[120].

Several studies have indicated that Western choices have a considerable impact on the changing nutritional patterns of different populations and show correlation with a higher consumption of takeaway foods, refined grain, fast food and highly processed meat[121]. A study examined various nutritional habits patterns in young adults in the United States. The results indicated a high occurrence of high-energy dietary patterns with characteristics that align with Western pattern[122]. In addition, several studies in countries such as Australia, Italy, the United Kingdom, Brazil and Denmark have reported similar results[121–126]. Several studies have identified a relationship between lifestyle patterns and Western culture. Consuming high-energy foods is associated with unhealthy lifestyles, which threatens young adults' health[44,121]. Critical research has indicated that university students with lower levels of physical activity and extended periods of TV viewing tended to engage in the consumption of unhealthy and energy-dense foods[121]. It is suggested that dietary habits represent an essential lifestyle element and that lifestyle interventions may be required to support healthier food choices and eating behaviours[127]. Moreover, dietary trends and eating habits play a fundamental role in academic performance and may compromise students' health[4,128]. Extensive published research has examined the association between grade point averages (GPA) and eating habits in young adults[129]. A higher consumption rate of soft drinks, pizza, noodles and trans-fat foods among students correlated with a lower GPA and was negatively associated with academic achievement, compared to consumption of greater quantities of fruits and vegetables[129]. In Australia, a study of 278 students investigated the relationship between nutritional intake and academic achievement. The results indicated a direct relationship between quality of diet and academic achievement; furthermore, a higher GPA was associated with a diet high in fruits and vegetables and low in energy-rich foods, poor nutrients and SSBs[130]. According to Reuter *et al.*, increasing the number of weekday breakfasts consumed significantly enhanced the participants' self-reported GPA[128]. Conversely, students who ate fast food at least seven times a week had significantly lower GPAs than those who did not, in the previous week. Deliens *et al.* found that students reporting a higher soft drink and French fry consumption rate and greater weight and waist circumference had lower GPAs and examination attendance rates[131].

These studies primarily established correlations between dietary habits and academic performance. Causative evidence is not provided, and it is essential to consider other potential factors that could explain these relationships. For example, time constraints caused by a heavy academic workload and limited cooking skills could be factors to consider. People with limited cooking skills may depend on pre-packaged or takeout meals, which are often less healthy than home-cooked meals. Consequently, they may be more likely to make unhealthy dietary choices, such as consuming pre-packaged or takeout meals, high amounts of processed foods, and sugary beverages. These choices have been associated with lower academic achievements[4,5,53]. Additionally, the intersection of lifestyle choices, stress levels and the convenience of fast food can affect eating habits and academic performance[4,132].

University students enjoy a wide array of drinks, among which SSBs are particularly popular. An SSB is any liquid that has been sweetened with any form of added sugars, such as brown sugar, corn sweetener, corn syrup, dextrose, fructose, glucose, high-fructose corn syrup, honey, lactose, malt syrup, maltose, molasses, raw sugar or sucrose[133]. Examples of SSBs include soft drinks, flavoured fruit drinks, tea and coffee drinks, sweetened milk, sports drinks, energy drinks and any other beverage with added sugar[134]. Scientific studies have shown that excessive consumption of SSBs may increase the risk of many health problems such as obesity, diabetes, tooth decay, osteoporosis, undernourishment, heart disease and neurological disorders[135]. Furthermore, SSB consumption among youth is associated with demographic characteristics, and nutritional and behavioural factors[136]. Higher consumption of SSBs among students was associated with less healthy dietary practices and sedentary behaviours[137]. Food insecurity, psychological factors and stress among university students were also associated with increased consumption of SSBs, a diet-related behaviour[138]. The WHO recommends limiting added sugars to <10% of the total daily calorie requirement, and that further limiting added

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sugars to <5% of the total daily calorie requirement provides additional health benefits[139]. Hence, reducing SSB intake is a major public health priority.

Globally, the consumption of SSBs was found to be high among young adults aged 20–39 years[140]. In the United States, 69% of the participants in a study consumed seven servings (12 ounces) of SSBs per week[141]. Recently, a Malaysian university reported an 89% prevalence rate of at least daily consumption of SSBs and 52% of daily high SSB consumption (defined as the intake of three or more SSBs per day) on average days[136]. In contrast, in Saudi Arabia, the weekly and daily average volume of SSB and soft drink consumption by students was 4·2 litres versus 1·5 litres, and 650·6 ml versus 224·6 ml, respectively[142]. A reported, university students consume a wide variety of favourite drinks. Bawadi *et al.* found that their most-consumed sugary drinks were hot drinks, at a rate of four servings per day[143]. In contrast, in a Polish study, their most-consumed drink was 100% fruit juice, which contains natural sugars[144]. The high rates of SSB consumption reported in previous studies may raise serious concerns about the potential impacts on the health and safety of university students. Therefore, there is an urgent need for strategic policies and approaches to ensure public safety and reduce levels of SSB consumption among students. These include health education campaigns, addressing issues of hidden sugar in drinks, and educating students about the names of the different sugars that are commonly added to drinks[145].

Caffeine is the most-consumed central nervous system stimulant worldwide[146], and caffeinated beverages are most popular among university students. The main source of caffeine in the American diet is coffee. Other sources of caffeine, include tea, soft drinks, energy drinks, hot cocoa, chocolate milk and some nutritional supplements, although the caffeine content in these products varies greatly[146–148]. The health effects of caffeine vary depending on the dosage consumed, and moderate coffee consumption is linked to positive health impacts, such as improvements in mental alertness, concentration, fatigue and athletic performance[148,149]. Furthermore, moderate caffeine consumption has also been associated with weight loss, improved glucose tolerance and a lower risk of type 2 diabetes, Parkinson's disease and cancer[149]. It is estimated that adults consume an average of 180–190 mg of caffeine or approximately two to three cups of coffee per day[147–151]. Numerous studies have shown that moderate caffeine consumption has a protective effect against many diseases. However, excessive caffeine consumption may lead to harmful effects on health[152]. A recent systematic review highlighted several unwanted symptoms associated with high daily caffeine intake including palpitations, headaches, tremors, anxiety, agitation, insomnia and other sleep problems[153]. Evidence indicates possible reasons by population for caffeine consumption: by surgeons to combat fatigue; by athletes to improve their physical performance; and by adolescents to increase their energy levels, because they enjoy the flavour of the product, and to improve appearance[154,155]. In particular, most university students consume caffeine to feel alert, combat insufficient sleep, enjoy the taste, socialise, increase physical energy, improve mood and relieve stress[156]. University students may be at a particularly high risk of negative effects due to excessive caffeine intake[157]. A study conducted at five universities in the United States showed that 82% of university students consumed caffeine. The average daily caffeine consumption of all students was 159 mg/d, with an average intake of 173 mg/d among caffeine consumers[150]. In contrast, the consumption of caffeine by University of Bahrain students was higher with 98% of students consuming caffeine[152]. The average daily caffeine consumption was 265 mg/d, with a greater consumption among male than female students[151]. This result is consistent with that of a study involving dental students in Saudi Arabia showing higher caffeine consumption in male than female students[158].

Eating attitudes, body dissatisfaction and individual-level factors among university students: implications for understanding eating disorders

The relationship between university life and eating attitudes is influenced by various factors, including the transition into academic life and broader societal elements. Understanding these factors is crucial in promoting healthy eating behaviours among students. The transition into university life can lead to changes in dietary patterns due to the availability of different food options and routines. Additionally, societal factors such as social media and Westernisation can impact students' perceptions of food, body image and eating behaviours. Some studies have found that disordered eating attitudes and body dissatisfaction affect university students due to different sociocultural, biological, genetic and psychological factors[159,160]. Body dissatisfaction and concerns among university students and adolescents may be linked to disordered eating behaviours[160]. Eating habits and attitudes are formed during the initial years of life and during adolescence which are transferred to adulthood[160]. Oppenhein defined the term 'attitudes' as 'long-lasting clusters of feelings, beliefs, and cognitions in general, which may be positive or negative, toward a specific object that leads to actions that are coherent to the cognitions and feeling toward the specific object'[161]. People can develop a relationship with food, but the term 'eating attitude' is more appropriate to describe it, as this term includes one's beliefs, thoughts and feelings towards food[162].

The transition into academic life can lead to changes in students' eating habits[4]. Previous studies also showed that various factors such as lifestyle shifts can contribute to unhealthy attitudes towards food[117,163] as well as feelings such as fear, anxiety and insecurity among students as their academic routines begin[164]. It has been observed that students tend to consume processed foods, skip meals and maintain a sedentary lifestyle with insufficient intake of essential nutrients[65,120]. Furthermore, negative eating attitudes heighten the risk of eating disorders among university students[165,166]. Eating disorders include a wide range of food-related behaviours and attitudes, such as binge eating, restrictive diets, use of laxatives, diuretics, anorexigenics and/or enemas, self-induced vomiting and excessive exercise. The prevalence of these behaviours indicates a strong need for extensive scientific research to identify the psychosocial risk and protective factors, to decrease the effects of unhealthy eating attitudes that increase the incidence of bodily self-destruction[167,168]. Meanwhile, studies have indicated that

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the incidence of disordered eating attitudes appears to rise in young adults and adolescents as they age[169,170]. To be more specific, disordered eating behaviours rapidly proliferate within a short period, notably amongst young adults and, particularly, amongst young women[159,169]. Eating disorders often alter individual's eating attitudes, behaviours, weight perception and physical appearance[171].

The present review explored how commencing academic life can affect students' eating habits, including the consumption of more processed foods, skipping meals and becoming more inactive, which can all lead to negative attitudes towards eating and a higher risk of developing eating disorders. In addition, several other factors and patterns in individuals local community, family, peer group and social media, such as unrealistic beauty ideals, may contribute to developing unhealthy habits and attitudes[159]. Experimental studies[172] and extensive correlational studies[173] have indicated an association between body image and eating disorders due to social media influences. However, there are inconsistencies in the findings of these studies. While some reported association of eating disorders and body dissatisfaction with negative feedback and social comparison, others showed association with the amount of time spent on social networking sites[173,174]. Researchers defined body dissatisfaction as a 'normative' condition of negative feelings and self-assessment of one's body image[175,176]. Previous studies have suggested that individuals who internalise the ideal body shape tend to engage in self-evaluation, comparing their own bodies to this ideal. Consequently, as observed, an association exists between the internalisation of the ideal body shape and individuals' perceptions of the difference between their bodies and this ideal[177,178]. This association is often linked to an increase in body dissatisfaction, particularly when individuals experience challenges in achieving the ideal body shape[177,178]. Of note, young adults have a higher risk of body dissatisfaction[179,180], which tends to persist throughout adulthood, affecting their eating habits[176]. A longitudinal survey conducted in the United States over 15 years, including >1000 participants indicated that 50% of young females and 26% of young males were dissatisfied with their bodies and had unhealthy weight control practices. Furthermore, the prevalence of body dissatisfaction was significantly higher in females than in males[180]. Moreover, the effects of Westernisation on eating attitudes cannot be overlooked. Studies have found an increasing number of eating disorders and body image disturbances among Western populations, particularly among Western women[181,182]. Recently, in Middle Eastern countries, the prevalence of thin-ideal and muscular-ideal internalisation has risen due to sociocultural changes and Westernisation[183–185]. In addition, several studies in Arab countries support the association between Westernisation and prevalence of disordered eating attitudes in developing countries[184,185]. One study in Saudi Arabia indicated that the internalisation of Western culture plays an increasing role in eating disorders and pathology rates, with a prevalence of 6·96% among Saudi undergraduate females[23]. These results were comparable to those observed in Western cultures[182,186]. The researchers postulated that the leading cause of these findings was the internalisation of Western political values and media changes that have considerably impacted educated young women[183].

Studies have shown a complex relationship between body image, eating disorders and societal influences, with some research suggesting that body dissatisfaction is associated with internalized ideal body shapes and a higher risk among young adults, particularly women[159,180]. Additionally, while Westernisation has been linked to disordered eating attitudes and body image disturbances, this trend is not limited to Western cultures, as similar results have been observed in Middle Eastern countries, suggesting the influence of broader sociocultural changes on these issues[181,185].

Eating habits and sociodemographic factors among university students

Shaping healthy dietary habits and attitudes during adolescence is critical to preventing young adults from developing lifestyle-related diseases[187]. Children and young adults are more vulnerable to adopting unhealthy eating habits[188]. Previous studies have indicated significant differences between the dietary habits and eating attitudes of young males and females. First, most studies indicated that female university students tend to make healthier choices, such as consuming more fruits and vegetables and having a higher dietary fibre intake than male students[189–191]. Men are more likely to consume fast food overall, and some studies have shown that young males tend to consume more fast food, such as pasta, rice, fried potatoes and crisps, for lunch, than young females (48·3% versus 39·1%, respectively)[192]. Conversely, young women tend to consume chocolate more often than men and eat fast food as a snack (25·7% versus 19·5%, respectively)[192]. Location-specific variations in eating habits have also been noted. A study conducted in Turkey revealed that males prefer consuming bread and meat while females prefer fruits and vegetables. They also found that women were more likely to have normal weight or be underweight than men and that there were more overweight men than women[193,194]. Furthermore, the regularity of breakfast consumption varies according to gender and has significant implications for overall nutrition.

According to a study of 1755 Japanese university students, eating breakfast is linked to better nutrition and more fruit and vegetable intake. Less than half of male students ate breakfast regularly, while approximately 70% of female students were more adherent to eating breakfast. Logistic regression analysis was performed to reach these conclusions[195]. Furthermore, skipping breakfast has been linked to negative effects on weight control and overall health[196]. However, studies in Australia show inconsistency regarding the breakfast-skipping habits of the population, with one study suggesting that female adolescents are more likely to skip breakfast and another study indicating that young males tend to skip breakfast more frequently as they age[196,197]. Some studies have concluded that the cause of the differences between the genders depends on knowledge about nutrition, health awareness and healthy dietary attitudes, which tend to be more common among female university students than among male students[191,198]. In contrast,

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other studies have concluded that there are no differences in eating attitudes between the two genders and that students' lifestyles are affected by other factors, such as the university microenvironment and, specifically, on-campus living, eating behaviours in the university, and student social culture[198,199].

Furthermore, sociodemographic factors, such as income, play a crucial role in shaping the dietary habits of university students. A study conducted at a Saudi university found a relationship between low household income and fast-food consumption[200]. In contrast, a study conducted at a Turkish university observed a relationship between higher average scores of nutritional behaviours among students (and their families) with higher incomes[201]. It is imperative to consider the intricate and multifaceted relationship between income, gender differences and dietary choices. A study involving Polish adults age >19 revealed that both males and females with higher income and education tend to consume more dietary antioxidants from nuts, seeds, chocolate and cocoa[202]. However, the same study found that women with lower education were more likely to experience central obesity, diabetes and hypertension, whereas such relationships were not observed in men[202]. Further insights from a nationally representative sample in Australia indicated gender-specific variations in dietary patterns associated with income[203]. Females with lower income generally exhibit lower scores for vegetables, cereals, proportion of lean meat, and fluid intake, coupled with higher trans-fat intake and lower monounsaturated fatty acids intake. Conversely, males with lower income demonstrated lower scores for water intake and higher scores for alcohol intake[203].

In addition to income disparities, residential choices among university students contribute to divergent dietary preferences. Deshpande *et al.* concluded that students living off campus chose foods different from those living on campus[204]. University students living off campus receive more of their energy from protein, higher serum triacylglycerol levels, and greater ratios of total cholesterol to high-density lipoprotein. Furthermore, the influence of living arrangements should be explored. In Saudi Arabia and Syria, students who lived with their families tended to exhibit healthier dietary habits, since that appears to create a more favourable environment for the promotion of healthy eating behaviours[205,206] and seemed to be a protective environment against unhealthy eating habits[188]. However, the impact of sociodemographic factors on dietary habits can vary significantly across regions. For example, in an Australian university, students living in their parents' homes consumed energy-dense, nutrient-poor snack foods, meat, takeaway foods and sugary drinks more frequently than students living in rental housing, their own homes or on campus[207]. While the explanation for this finding suggests that disposable income and socialisation may be contributing factors, it is crucial to acknowledge the complexity of dietary habits, which can be influenced by a multitude of factors, including cultural and individual preferences[127]. The interplay of variables such as gender, income and living arrangements is also a potential factor in shaping the dietary choices of students. In a broader context, certain findings related to gender disparities suggest that men, more so than women, may experience the impact of other sociodemographic conditions on their dietary habits[208,209]. For instance, a study conducted among British adults aged over 19 years illustrated that females living alone were more inclined to adopt diets rich in fruits and vegetables and low in fatty foods[210]. Similarly, research encompassing both single- and multiple-member households revealed that college-educated men and women residing in multiple-member living arrangements exhibited a higher propensity to consume fruits and vegetables compared with those less educated[211]. Conversely, the dynamics of the relationship between living arrangements and gender and their influence on students' dietary habits may be influenced by various factors, particularly in cases of solitary living[53,212].

In summary, female students generally exhibit healthier dietary choices, while male students have a tendency towards increased consumption of fast food. Income emerges as a pivotal factor, impacting food preferences and nutritional behaviours. Residential choices also contribute to divergent dietary patterns among students. The nuanced interplay of gender, income and living arrangements emphasises the multifaceted nature of dietary habits, underscoring the need for targeted interventions to promote healthier eating behaviours in the university student population.

Conclusion

Addressing the nutritional issues and eating behaviours among university students is crucial for promoting good health and academic performance. University students are a target group for public health initiatives as they are at risk of developing poor eating habits due to various factors, including economic conditions, time constraints, and lack of information about nutritional concepts. These behaviours can lead to malnutrition or overnutrition, increasing the risk of preventable diseases. Studies have shown that university students tend to consume energy-dense foods, skip meals, eat junk and fast-cooked foods, and engage in low physical activity and prolonged computer and TV use. Cultural and socioeconomic factors also influence food intake in different countries. Poor diet quality is linked to many chronic diseases, such as cardiovascular disease and type 2 diabetes.

Although there are similarities across different countries, the discrepancies identified highlight the need for tailored interventions that consider regional nuances. Therefore, preventive action that can lead to changes in the eating habits of university students should be taken to ensure that they maintain a healthy and balanced diet. Long-lasting dietary changes that can improve health and prevent the onset of chronic diseases can thus be made. However, university campuses pose challenges in promoting healthy and adequate diets. These environments often offer nutrient-poor, energy-dense and processed foods, which contribute to unhealthy eating habits and potential weight gain among students. To improve food environments on campus and positively influence food choices and behaviours among college students, institutions can take proactive measures. Collaborating with local farmers' markets and grocery stores can enhance the accessibility of affordable and nutritious food choices in campus dining halls. Moreover, universities may

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consider implementing education and awareness campaigns to disseminate knowledge about nutrition, promote the advantages of a balanced diet, and highlight the risks of inadequate nutrition.

University students are susceptible to developing disordered eating attitudes and body dissatisfaction issues due to various sociocultural, biological, genetic and psychological factors. These attitudes can lead to the development of eating disorders, which are a range of food-related behaviours and attitudes that can cause bodily self-destruction. The prevalence of disordered eating attitudes appears to be rising in young adults, particularly in young women, and in Middle Eastern countries because of Westernisation. Universities can provide additional support in managing student stress, body image concerns and preventing the risk of eating disorders. Implementing reward systems for students who prioritise smart food choices and redesigning menus to highlight healthier options are practical strategies to positively influence eating habits on campus. Eating habits and attitudes may also be influenced by gender, income, living arrangements and other environmental factors. It is essential to cultivate healthy dietary habits and attitudes during adolescence to prevent young adults from developing lifestyle-related diseases. By understanding the factors that contribute to disordered eating attitudes and body dissatisfaction, interventions can be developed to promote healthy eating habits and attitudes among university students. These interventions should consider the different factors that influence eating habits and attitudes, including gender, income and living arrangements.

Universities can implement strategies such as education and awareness campaigns in which they might encourage their students to eat well. These efforts can be helpful in disseminating knowledge on the value of nutrition, the advantages of a balanced diet and the effects of inadequate nutrition. Universities may also offer students access to affordable and nutritious food choices, including fresh produce, whole grains, and lean meats, in campus dining halls by collaborating with neighbourhood farmers' markets and grocery stores. Interventions can be implemented by universities to encourage the building of a healthy diet students. They may include the provision of nutritional counselling services, host cooking courses or lectures on healthy eating or reward for students who make smart food choices. To encourage students to make better eating choices, universities can redesign their menus and emphasise healthier selections or use colour-coded labelling to distinguish between healthy and unhealthy food options. Universities may encourage students to eat well by using the social media including social media campaigns that offer healthy recipe ideas and information about eating well. Using these strategies, universities can help to improve the overall health and wellbeing of their student population.

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The authors have no conflicts of interest to declare.

Authorship

N. Almoraie conceptualised the study. All authors wrote the first and revised versions and edited the paper.

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