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THE IMPACT OF BREAKFAST AND DIETARY PATTERNS ON MENTAL AND PHYSICAL HEALTH AMONG UNIVERSITY STUDENTS: A COMPREHENSIVE REVIEW

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Article Info

Abstract

University life presents unique challenges that significantly impact students' dietary habits, often leading to unhealthy eating patterns due to academic stress, irregular schedules, limited budgets, and social pressures. This review examines the critical role of nutrition, particularly breakfast consumption, in supporting the physical, mental, and academic well-being of university students. Proper nutrition is essential for cognitive function, energy levels, and immune health, all of which are vital for academic success. Breakfast, recognized as a key meal, restores glucose levels, enhances cognitive processes like memory and attention, and contributes to overall diet quality. Skipping breakfast is linked to impaired cognitive performance, reduced attention, and increased fatigue, negatively affecting academic outcomes. Additionally, poor dietary habits are associated with heightened risks of mental health issues, such as depression and anxiety, and chronic diseases like obesity and type 2 diabetes. Socioeconomic factors, cultural backgrounds, and the university environment further shape eating behaviors, with food insecurity and peer influences playing significant roles. This review synthesizes evidence from diverse studies to highlight the interplay between diet and student well-being, emphasizing the need for targeted interventions. Educational programs, campus food environment modifications, policy changes, and digital tools are proposed to promote healthier eating habits. By fostering a supportive environment, universities can empower students to make informed food choices, enhancing their health and academic performance.

Keywords:

Breakfast consumption, Dietary habits, University students, Mental health, Cognitive performance, Nutrition interventions.

1. Introduction

University life is defined by a unique set of issues that have a significant impact on dietary behaviors [1]. Stress associated with academic work, non-traditional schedules, low budgets, and social challenges of university life have a tendency to lead to poor dietary habits. Students can end up relying on easily accessible but unhealthy foods such as fast food, snack foods, and sweetened drinks, while neglecting nutrient-dense foods such as fruits, vegetables, and whole grains. These are also compounded by exam pressures, deadlines, and social changes, which can result in emotional eating and further compromise the quality of diets. Understanding these challenges is the first step towards meeting the nutritional requirements of university students and encouraging healthier eating patterns. Adequate nutrition is important for maintaining both physical and mental well-being, which are essential for good academic achievement [1].

An equalized diet delivers the proper amount of energy, vitamins, and minerals necessary for fueling thinking, maintaining focus, and stimulating memory. Food components such as omega-3 fatty acids, B vitamins, and antioxidants play important roles in brain processes by enabling the creation of neurotransmitters, in addition to protection from the effects of oxidative stress damage. Good diet also develops a strong immune system, protecting against illness and absence, and improving overall physical health to allow the student to participate wholeheartedly in their studies and extra-mural pursuits. Adequate nutrition can be neglected, and a chain of undesirable effects can ensue so that academic performance is impaired and overall wellbeing is compromised.

Poor nutrition contributes to undesirable health consequences and lower academic achievement [2]. Proper diet deprivation of basic nutrients causes fatigue, lower concentration, low memory, and lower problem-solving capacity, all of which fall directly under the category of academic performance.

In addition to this, unhealthy dietary habits will also raise the risk of the development of non-communicable diseases like obesity, type 2 diabetes, cardiovascular disease, and some forms of cancer. These diseases are not only hazardous to physical well-being but are also responsible for mental health concerns like depression and anxiety, and hence add further problems to university students. Improved dietary habits are thus essential in order to achieve academic success, as well as overall health and well-being over the long term. 1.2. Breakfast as an integral part of a healthy diet. Breakfast has been described as the most important meal of the day [3]. This saying is based on the fact that breakfast gives the body and brain the fuel they need to begin the day after a night of fasting.A healthy breakfast replenishes glucose levels, which are vital for mental function and provides sustained energy throughout the morning.

A combination of nutrient-dense foods, whole grains, fruit, dairy, and protein, offers sustained energy release and peak physical and mental functioning. Inclusion of a healthy breakfast is a simple yet powerful method for improving overall diet quality and well-being. Forgetting breakfast has been associated with negative outcomes on cognitive functioning, including interference [4]. Interference here refers to the ability to modulate automatic responses and focus on the task-relevant information and ignore distractions. Studies have shown that not eating breakfast is associated with poorer performance on cognitive tasks requiring sustained attention and the ability to screen out irrelevant stimuli. This can be explained by the lack of glucose and other nutrients that are required for good brain function.

Maintaining a healthy breakfast habit on a daily basis may help with better cognitive control and overall cognitive function. Daily breakfast intake is associated with improved overall diet quality and nutrient adequacy [5]. People who habitually consume breakfast are more likely to eat a greater variety of nutrient-dense foods throughout the day. Breakfast consumers have increased intake of fiber, vitamins, and minerals, without which it is not possible to maintain good health. In addition, frequent consumption of breakfast is linked with better lifestyle habits in general, including exercise and not snacking between meals. By giving breakfast high priority, people establish a basis for a healthy day of eating and enhanced well-being.

Overview of the Review's Scope and Aims.

This review critically examines the influence of breakfast consumption and overall dietary habits on the cognitive performance, mental well-being, and physical health of university students. Drawing from a diverse body of literature including cross-sectional, longitudinal, and interventional studies it synthesizes evidence on the role of nutrition in shaping academic outcomes and student welfare. Particular emphasis is placed on the impact of breakfast as a determinant of cognitive function and mental clarity, as well as the broader relationship between diet quality and psychological resilience. The review aims to identify consistent patterns across studies and inform future policy, educational strategies, campus food environment modifications, and digital health interventions. Ultimately, it advocates for the creation of supportive university settings that empower students to adopt and maintain healthier eating behaviors.

2. Breakfast Consumption and Cognitive Function

2.1. The Association between Breakfast and Cognitive Function.

Forgetting to eat breakfast can result in attention-perception disorder and physical-mental fatigue [6]. When the body is starved of nutrients following an overnight fast, it has difficulty keeping glucose levels stable, which are essential for brain function.

This can lead to reduced alertness, concentration difficulties, and impaired cognitive performance. Students who do not eat breakfast might have difficulty concentrating in class, recalling information, and solving problems efficiently. The fusion of physical and mental fatigue also contributes to such problems, rendering an individual incapable of performing academic activities and producing optimal results. Intake of breakfast is associated with higher cognitive functions, i.e., memory, and attention [4]. Consumption of a nutritious breakfast provides the brain with the glucose and other nutrients that enable it to perform optimally. Studies have shown that breakfast-eating individuals possess better memory recall, improved attentional abilities, and quicker cognitive processing rates. These cognitive benefits are particularly important for university students, who utilize their cognitive abilities to perform well academically. Students who eat breakfast perform better on cognitive tasks [4].

Reyna Smano et al. (2019) found that students who did not consume breakfast performed slower on cognitive tasks compared to students who consumed breakfast on a regular basis.

The performance tasks were slower among students who had low breakfast nutritional quality (32.9 s ± 6 vs 29.3 s, $p < 0.050$).

This indicates that starting the day with a good meal can have an immense impact on intellectual functions and school performance. By paying attention to breakfast, students are able to optimize intellectual functions and performance in school. 2.2. Impact on attention, memory, and learning. In one study, it was found that students who skipped breakfast performed slowly on mental tasks [4]. The study, conducted by Reyna Smano et al. (2019), assessed cognitive performance using the Stroop Test, an indicator of inhibitory control of redundant information and selective attention to relevant stimuli. The results revealed that students who often skipped breakfast had longer reaction times and more errors on the Stroop Test compared to students who ate breakfast.

This suggests that eating breakfast is a critical function in aiding cognitive control and attention.

Lack of breakfast intake may impair inhibiting irrelevant information [4]. The results of the Stroop Test in Reyna Smano et al.'s (2019) study indicated that students who skipped breakfast had it more difficult to suppress irrelevant information when performing cognitive tasks. The risk of having trouble suppressing irrelevant information was 2.72 (95% CI: 1.25-4.80) for those with poor breakfast habits. This cognitive control impairment can have profound academic effects since students need to be able to focus on appropriate information and avoid distractions in order to learn optimally. Nutritious breakfast eating habits have the potential to induce capacity for learning and academic achievement [7]. Zabihollah Gharlipour et al. (2015) also found that breakfast intake is crucial for adolescents to remain healthy, in addition to promoting students' ability to learn and perform school homework.

Breakfast food intake regularly supplies the brain with a consistent glucose and other essential nutrients supply required for adequate functioning of the mind.

This can potentially lead to improved attention, memory, and problem-solving, which are all essential for academic success. Through the formation of good breakfast habits, students can establish enhanced learning ability and improved academic performance. 2.3. Neurobiological mechanisms underlying these effects.

Food affects the way the body regulates mood by having an impact on release of neurotransmitters [8]. Neurotransmitters are chemical messengers that transmit messages between brain nerve cells and play a central role in mood, attention, and mental functions.

Certain nutrients such as amino acids, vitamins, and minerals are essential to the production and functioning of neurotransmitters. For example, tryptophan is one of the amino acids employed in the synthesis of serotonin, which regulates mood and sleep. When the diet lacks adequate amounts of these fundamental nutrients, synthesis of neurotransmitters will be disrupted, leading to disruptions in mood and cognition imbalances. Breakfast consumption has essential nutrients crucial in brain functions as well as neurotransmitter synthesis. A healthy breakfast typically includes a combination of nutrient-rich foods, such as whole grains, fruits, dairy, and protein.

These foods are rich in key vitamins, minerals, and amino acids, which are needed to maximize brain function and neurotransmitter production. For example, whole grains have B vitamins, which are essential for energy metabolism and nerve function, while dairy foods have calcium, which is essential for nerve transmission. By a proper breakfast, the brain can be supplied with the material it requires to function

optimally. Skipping breakfast can lead to disruptive glucose control and brain energy supply effects. The brain requires glucose as the final fuel, and normal glucose levels must exist for maximal brain function. When breakfast is missed, the body loses glucose following an overnight fasting period, which causes a lowering of blood sugar levels.

This can lead to tiredness, reduced concentration, and compromised intellectual performance.

Moreover, the body may respond by releasing stress hormones, such as cortisol, which can further disrupt brain function and negatively impact mood. Eating breakfast regularly stabilizes blood sugar and delivers a steady supply of energy to the brain.

3. Dietary Patterns and Mental Health

3.1. The Association between General Diet Quality and Mental Health.

Lifestyle variables like nutrition can influence the mental health of university students [9]. University students are exposed to a considerable amount of stressors in the form of academic pressures, financial issues, and social transitions. Such stressors can exacerbate mental health, contributing to higher levels of anxiety, depression, and other mental health conditions. Nevertheless, embracing healthy lifestyle habits like having a healthy diet is likely to counteract the adverse effects of stress and foster optimal mental health. Poor dietary habits are linked with increased risk of depression and anxiety [9].

Ali Rahimi et al. (2024) explored the relationships between lifestyle health in students at Herat University in Afghanistan. Low perceived health and non-regular breakfast consumption were linked with increased risk of depression and anxiety. An essential nutrient-deficient diet can cause disruption in the synthesis of neurotransmitters, impede brain functioning, and heighten inflammation, all of which can lead to the onset of mental health disorders. Unhealthy eating habits are associated with depression, anxiety, and stress [10]. Enrique Ramn-Arbus et al. (2019) found that unhealthy eating habits are common among university students and are associated with anxiety, depression, and stress. The unhealthy eating habits typically include excessive consumption of processed foods, sugary drinks, and saturated fats while lacking fruits, vegetables, and whole grains.

Educational interventions aimed at reducing the consumption of unhealthy food among university students can also translate into psychological health benefits and vice versa. 3.2. Specific nutrients and food groups that affect mood and levels of stress. Poor vegetable consumption increases the risk of depression and anxiety [9]. Vegetables contain a lot of vitamins, minerals, and antioxidants, which are essential for brain function and mental health. These nutrients prevent oxidative stress, reduce inflammation, and help synthesize neurotransmitters. Insufficient vegetable intake will starve the brain of these essential nutrients and increase the possibility of developing depression and anxiety. Overindulgence in sweets is associated with higher frequency of psychological disturbances [10]. Though sweets have the ability to bring a temporary boost in mood, long-term consequences on mental processing can be harmful. Overconsumption of sugar has the potential to induce blood sugar fluctuations, which in turn may induce mood swings, irritability, and drowsiness. Excessive sugar has also the potential to induce inflammation and oxidative stress in the brain, thereby raising the risk of depression and anxiety. Omega-3 fatty acids found in fish have the potential to improve mental health [11]. Sdka Ouz et al. (2017) confirmed that the

higher number of male participants consumed more omega-3 than women (p=.019). Omega-3 fatty acids have essential functions in brain activity and development, such as cell membrane composition, neurotransmitter synthesis, and inflammation control.

Studies have shown that omega-3 fatty acids have been able to cure depression, reduce anxiety, and improve cognitive function. The inclusion of fish in the diet can provide a vital element of the healthy fats.

3.3. Dietary Intervention Contribution to Improved Mental Health Outcomes.

Aggressive promotion and specific interventions on diet can improve well-being in students [9]. Multifaceted intervention is essential to encourage a healthy campus culture. Interventions may include educational programs, university environment changes, and policy recommendations for universities and public health organizations. Through targeting the various factors influencing dietary habits, such interventions can help support healthier food choices and better mental health in university students. Interventions for reducing consumption of unhealthy food can result in improved psychological well-being [10]. Through the provision of education regarding nutrition and healthy eating, such interventions can empower students to make informed food choices. Educational interventions also address common barriers to healthy eating, such as time constraints, cost, and lack of cooking skills. By equipping students with the necessary knowledge and skills, these interventions are likely to reduce intake of unhealthy foods and improve psychological health.

A multi-factorial approach must be employed to develop a healthy campus culture [9]. This approach involves the intervention of several factors influencing eating behaviors, including individual behavior, social norms, and environmental influences. Healthy campus life would offer an availability of healthy food, encourage healthy dietary habits through education and health awareness, and foster healthy social norms that favor healthy choices. By doing so, a university can establish a culture of health that supports all students' well-being.

4. Physical Health Consequences of Dietary Decisions

4.1. Relationship between Dietary Habits and Body Weight.

Unhealthy eating patterns have been associated with unwanted weight gain [12]. The interconnection between pattern of eating, weight status, and academic function has been accorded much lesser attention in young adults. Overconsumption of energy-dense, low-nutrient diets, which involve processed foods, sweetened beverages, and detrimental fats, account for energy excess and weight gain. Such diet patterns tend to be deficient in key nutrients and thus result in heightened hunger and cravings, fuelling the cycle of unhealthy intake and weight gain.

Increased snacking and energy-dense snack consumption were noted during isolation periods [13].

L. Gallo et al. (2020) revealed that among females, energy intake was ~20% higher in 2020 than in 2018 and 2019, and snacking frequency and energy density of snacks consumed were also increased. Physical isolation measures owing to the pandemic caused by coronavirus disease 2019 (COVID-19) occurred in most regions of the globe. In Australia, country-wide restrictions covered staying at home, except to get

medical care, to care for someone, to buy food, to do exercise, or to go to work in an essential service. These foods are typically high in calories, added sugars, and unhealthy fats, which can lead to weight gain and other issues. Dietary lifestyle is an important factor in the control of body mass index (BMI) [14]. A healthy diet with a high intake of fruits, vegetables, whole grains, and lean protein can facilitate a healthy weight by enhancing satiety, maintaining normal blood sugar levels, and delivering necessary nutrients. A diet with high consumption of processed foods, sweets, and saturated fats, on the other hand, can cause weight gain and higher BMI and can predispose to obesity and associated disease.

4.2. Impact on Energy levels and Physical Activity.

Proper nutrition is crucial for maintaining energy levels necessary for physical activity [1]. The university experience can cause academic stress that, in turn, can lead to comorbidities. Students increasingly face demands and challenges that require a large amount of physical and psychological resources. A well-balanced diet provides the body with the necessary fuel to perform physical activities, whether it's walking to class, participating in sports, or engaging in structured exercise. Complex carbohydrates, found in whole grains, fruits, and vegetables, provide a sustained release of energy, while protein helps to repair and rebuild muscle tissue.

Students with unhealthy dietary patterns tend to engage in low physical activity levels [15]. L. Lee and Shi-Hui Cheng (2023) found that unhealthy dietary pattern was significantly associated with a lower IPAQ category ($p=0.013$), and increased time spent sitting ($p=0.027$) during the pandemic. Unhealthy dietary patterns often lead to fatigue and decreased motivation, making it difficult to engage in physical activity. Moreover, a diet high in processed foods and sugary drinks can lead to energy crashes, further reducing the desire to be physically active.

Physical activity and diet are variables that are related to psychological well-being [1]. Montserrat Monserrat-Hernndez et al. (2023) found that there is a relationship between academic stress and physical exercise, but not with adherence to the Mediterranean Diet. However, there is a relationship between the consumption of unhealthy foods exceeding the recommendations for the Spanish population and academic stress. Regular physical activity can help to improve mood, reduce stress, and enhance cognitive function, while a healthy diet provides the necessary nutrients to support these benefits.

4.3. Long-Term Health Hazards due to Unhealthy Eating.

Unhealthy dietary choices adopted in early adulthood can result in chronic diseases [14]. Unhealthy eating habits at this pivotal time can lead to a lifetime of poor health conditions. Young adults' diet intake and lifestyle habits in Lebanon must be improved to prevent obesity and other related comorbidities. These conditions not only impair quality of life but also raise healthcare expenditures and lower productivity.

Regular intake of foods that are high in unhealthy items elevates the risk of developing obesity and their comorbidities. Obesity is a chief risk factor for a variety of chronic conditions like type 2 diabetes, cardiovascular disease, cancer, and musculoskeletal disease. A diet of processed food with high levels of sugary beverages and unwholesome fat increases body weight and accelerates the likelihood of developing them. Furthermore, obesity generates psychological problems such as depression and anxiety, which

contribute to the challenges students face in universities. Poor nutrition can impair overall health and well-being. A diet that lacks essential vitamins, minerals, and antioxidants may leave the body more susceptible to infection, more prone to infections, and decrease mental function. Tiredness, loss of energy, and failure to cope with stress can result from deficiencies. Subclinical deficiencies over a long period may be an underlying cause of chronic disease and decline in general health and well-being.

5. Socioeconomic and Cultural Determinants of Food Choices

5.1. The role of socioeconomic status in shaping dietary choices.

High-income students were more likely to eat vegetarian/low calorie diets [14]. P. Salameh et al. (2014) reported that high-income students and obese students (BMI30kg/m2) were more likely to eat vegetarian/low calorie diets ($p<0.05$). This is because healthy foods such as fresh fruits and vegetables, lean protein sources, and whole grains tend to be more expensive compared to processed foods and sugary drinks. Children with higher incomes have greater access to these healthier food options, while those with fewer resources have no choice but to settle for the less healthy and less expensive food choices. Family dynamics and socioeconomic context determine, while considering food habits and nutrition status, students [16]. Susana Gotthelf and Claudia Tempestti (2017) found that socioeconomic status and family influence have deciding roles taking into account eating behaviors nutritional status in students. Disadvantaged students might have issues with food insecurity, the unavailability of healthy foods, and weak parental support for eating healthily. These determinants can strongly influence their food options and nutritional status. Food insecurity has a negative impact on the ability to follow healthy eating patterns [17]. Alejandra Betancourt-Nez et al. (2023) discovered that food insecurity weakens the capacity to eat a healthy eating pattern (fruits/vegetables and foods high in animal protein). Besides, the consumption of foods that are characteristic of the Mexican cuisine that mirrors the local Western food pattern is inhibited in families suffering from severe-FI.

The main hindrance to healthy dietary habits is food insecurity, causing students to face challenges in access and affordability in acquiring healthy diets. 5.2. Cultural backgrounds and their influence on food preferences.

Culture and traditional family practices drive food intake and eating habits [2]. Tanya Horacek and Nancy M. Betts (1998) discovered that cultural and heritage family traditions affect food choice and eating habits. Cultural traditions and norms tend to determine what foods are acceptable or desirable, affecting personal food preferences and eating patterns.

Family traditions also significantly affect eating habits since children tend to acquire their eating habits from their parents and other family members.

Dietary habits differ between countries and regions [18]. H. Cena et al. (2021) identified that dietary habits, sleep habits, physical activity and perceived stress in students varied across countries. The highest Mediterranean diet score was observed in Spain and Italy, and the lowest in Turkey, followed by Croatian, Lebanese, Polish and Romanian students. These differences are due to differences in food availability, cultural beliefs, and socioeconomic status. Acculturation and new food environments have the potential to change traditional eating habits [2]. College students who move out of home could be exposed to novel

food settings and consumption practices. This can lead to the transformation of their accustomed foodways as they get adapted to the new environment and learn new food ways. Acculturation, or the adoption of the cultural customs of a new environment, can also enter the picture in terms of diet changes, as students also begin to adopt the new foods and food customs of their new environment.

5.2. The Effect of University Environment and Peer Culture.

The university environment can influence food habits due to time pressures and stress [1]. The students can experience more time pressure due to study requirements, social events, and extracurricular activities. This can lead them to consume convenience foods but unhealthy ones, such as junk foods and packaged snacks. Academic stress can also be an influence on eating habits because students might skip meals or consume comfort foods during times of stress. Peer pressure and social norms influence food consumption greatly in students [2]. Students are influenced by the dining habits of their peers, particularly in social settings such as campus events and dining halls. Social norms, or the perceived acceptable eating habits within a group, also have an impact on food choices, as students will conform to the eating habits of their peers to fit in. Campus culture and food availability influence food intake [19]. Ashraful Kabir et al. (2018) discovered that campus culture at the university and examination frequency shape students' intake. The presence of healthy foods on campus, including salad bars and fresh fruit stands, may encourage healthier food habits. The prevalence of unhealthy foods, including fast food chains and vending machines, may result in poor food intake.

6. Lifestyle Factors and Eating Behaviors

6.1. The Influence of Sleep Habits on Food Intake.

Unhealthy sleep is linked to unhealthy eating practices [20]. M. Khan et al. (2024) identified that poorly sleeping students were three times as likely as their peers not to eat breakfast (AOR=2.95, 95% CI: 1.934.51). Destructive eating habits can target hunger-regulating hormones, enhance hunger for food that is rich in calories yet poor in nutrients. Additionally, deprivation of sleep results in low motivation and weakness, making choosing a healthy option more challenging.

Irregular sleep patterns can disrupt appetite regulation and increase cravings for unhealthy foods. Sleep deprivation can disrupt the balance of hormones that regulate appetite, such as ghrelin and leptin. Ghrelin, known as the "hunger hormone," stimulates appetite, while leptin, known as the "satiety hormone," suppresses appetite. When sleep is disrupted, ghrelin levels increase, while leptin levels decrease, leading to increased hunger and cravings for unhealthy foods.

Poor sleep quality students are more likely to miss breakfast [20]. M. Khan et al. (2024) reported that poor sleep quality students were three times more likely to miss breakfast compared to their peers (AOR=2.95, 95% CI: 1.934.51). Sleep-deprived students might have less time or energy to prepare and eat a healthy breakfast. Additionally, sleep deprivation can weaken cognitive function, which makes it hard to make healthy food choices.

6.2. Stress and Its Impact on Food Selection.

Academic stress has the potential to cause changes in eating habits [1]. Montserrat Monserrat-Hernndez et al. (2023) concluded that academic stress is related to physical exercise, but not with compliance with the Mediterranean Diet. There is a relationship between consuming unhealthy foods more than recommended for the Spanish population and academic stress. Academic stress has the potential to induce emotional eating, increasing the intake of comfort foods or the avoidance of meals.

Stressed students are more likely to consume junk foods like fast foods, snacks and drinks [21].

Ebtehal Almogbel et al. (2019) reported that stressed participants were more likely to eat junk foods like fast foods, snacks and drinks compared to unstressed ($p < 0.05$) food preference increased increase levels. These foods create a temporary feeling of comfort and satisfaction but are usually rich in calories, sugar, and unsaturated fats, leading to weight gain and other health issues.

Stress can also affect food selection, causing comfort foods to be consumed more frequently [22]. Germn Daz et al. (2023) identified that emotional eaters manage their emotions by consuming more comfort foods. Comfort foods tend to contain high amounts of sugar, fat, and salt, and their consumption results in a momentary feeling of satisfaction and stress relief. Nonetheless, these foods have the potential to lead to weight gain and other health issues.

6.3. Physical Activity Levels and Dietary Habits.

Students who engage in regular physical activity tend to have healthier dietary habits [23]. P. T. Trraga Lpez et al. (2022) found that greater association was seen between intake of fruits (OR = 1.95; 95 % CI, 1.25-3.04), pulses (OR = 1.51; 95 % CI, 1.00-3.20), and nuts (OR = 1.99; 95 % CI, 1.33-2.99) in those considered sufficiently active. Regular physical activity can increase awareness of healthy eating and promote a desire to fuel the body with nutritious foods. Moreover, physical activity can help to regulate appetite and reduce cravings for unhealthy foods.

Physical activity is positively associated with the intake of fruits, vegetables, and nuts [23]. P. T. Trraga Lpez et al. (2022) also found that a significant relationship between the intake of fruits (OR = 2.28; 95 % CI, 1.49-3.47), pulses (OR = 1.41; 95 % CI, 1.00-2.08), nuts (OR = 1.96; 95 % CI, 1.34-2.86), and fish/seafood (OR = 1.67; 95 % CI, 1.15-2.43) in those who engaged in both strength and flexibility activities. These foods are rich in vitamins, minerals, antioxidants, and fiber, which are essential for maintaining good health. Engaging in regular physical activity can increase the desire to consume these nutrient-rich foods.

A sedentary lifestyle is associated with poor dietary habits [13]. L. Gallo et al. (2020) reported that higher energy consumption among females and lower physical activity among males and females indicate effects of isolation measures that could have harmful effects on physical and mental health, with the potential to have an influence on long-term activity and nutrition habits. A sedentary lifestyle may reduce awareness of healthy eating and encourage dependence on convenient but unhealthy foodstuffs. Additionally, a sedentary lifestyle can result in tiredness and low motivation, making it challenging to take part in physical activity and make healthy food choices.

7. Interventions and Strategies for Encouraging Healthy Eating

7.1. Educational Programs And Workshops.

Nutrition education programs have been shown to enhance knowledge and awareness of healthy eating among students [24].

Kingsley Omage and Vivian Omuemu (2018) opined that skipping meal between meals is a common practice and regular practice is routine nutrition education program institution priority on sound practice is encouraged. Such programs can include several aspects such as general nutrition information, healthy eating planning, label reading, and eating mindfully. By heightening students' nutrition knowledge, these programs may encourage them to make wise choices when it comes to food. Workshops and seminars can offer hands-on skills in planning and preparing meals. The workshops can instruct students on how to prepare easy, fast, and healthy meals with affordable foods. They can also offer suggestions on meal planning, budget grocery shopping, and cooking. By offering these hands-on skills, workshops and seminars can assist students in overcoming potential obstacles to healthy eating. Educational interventions can assist students in making informed food choices [10].

Enrique Ramn-Arbus et al. (2019) determined that educational interventions to lower unhealthy food intake in university students can also lead to psychological health outcomes and/or vice versa.

By equipping students with the knowledge and skills to make informed food choices, these interventions can assist in enhancing their dietary habits and general well-being. These interventions ought to be formulated to the distinct needs and interest of university students, considering their individual challenges and situations. 7.2. Environmental alterations in university life. Modification of the campus food environment will support healthier diets [2]. Tanya Horacek and Nancy M. Betts (1998) discovered that influences on diet: analysis, averages, cluster averages impact dietary intake. The university setting has a great influence on students' diets. By ensuring healthy foods are convenient, inexpensive, and appealing, universities will promote healthier student choices. Expanding the quantity of healthy food choices in dining halls and cafeterias. This may be done by increasing the diversity of fruits, vegetables, whole grains, lean proteins, and low-fat dairy foods. It can also include limiting the supply of unhealthy food choices, like processed foods, sugary beverages, and fried foods. By making healthy choices more convenient and appealing, universities can promote students' frequent use of these options.

Instituting policies that limit the sale of unhealthy foods on campus.

Policies can be placed on limiting the sale of sweetened beverages, processed snacks, and fast food in vending machines, campus stores, and dining halls.

Limiting the availability of unhealthy food makes it harder for students to have unhealthy options.

These policies must be used in combination with other interventions to encourage healthy eating, including nutrition education programs and environmental changes.

7.2. Policy Recommendations for Universities and Public Health Organizations.

Universities ought to give main emphasis to promoting healthy eating habits among students [9]. Ali Rahimi et al. (2024) identified that lifestyle behaviors like diet have the ability to influence university students' mental well-being. Tailored promotion focused interventions on sleep, discipline-specific requirements might enhance well-being students. It is the responsibility of universities to establish a conducive environment facilitating the health and well-being of the students. This includes giving main emphasis to promoting healthy eating habits through several strategies. Public health agencies can work with universities to create and implement effective interventions. Public health agencies can share expertise and resources to assist universities in promoting healthy eating. This can include creating and implementing nutrition education programs, researching dietary habits and health outcomes, and advocating for policies to promote healthy eating. Policies must tackle socioeconomic differences in healthy food access [16]. Susana Gotthelf and Claudia Tempestti (2017) identified that a higher socioeconomic vulnerability higher percentage school without schools. Socioeconomic differences in healthy food access can lead to differences in dietary patterns and health status. Policies must seek to minimize these differences by maximizing access to low-cost, nutritious foods for all students, irrespective of their socioeconomic status.

8. Technology and Digital Interventions

8.1. Mobile Apps and Digital Platforms in Support of Healthy Food Consumption.

Mobile apps are capable of offering customized nutrition advice and assistance [25].

L.Bjar (2022) discovered that dietary habits could be affected by everyday routines; though, variability of intake during weekdays and at weekends has seldom been investigated.

Repeated-measurement 28-day cross-sectional observational study with self-reported dietary consumption gathered through the e12HR app was employed.

These applications are able to monitor dietary consumption, give feedback on food selections, and make recommendations for bettering eating habits. By offering accessible and convenient support, mobile applications can assist students in making healthier food selections. Web sites can provide educational material and interactive tools for monitoring food intake. Web sites may include access to a wide range of information on nutrition, healthy meal planning, and food preparation. Web sites may also include interactive monitoring of food intake, goal setting, and tracking of progress. By providing an entire package of tools and resources, web sites can facilitate the ability of students to control eating habits. Technology can enhance the availability and interaction of nutrition interventions. Online websites and mobile phone apps are available at anytime, anywhere, and hence they are a reasonable option for students with a tight schedule. Additionally, technology can enable nutrition interventions to be more enjoyable and interactive, which will enhance participation and adherence among students. Through the application of the power of technology, institutions can reach more people and make more effective nutrition interventions.

8.2. Social Media and their Influence on Dietary Habits.

Social media can be used to disseminate health eating messages and promote healthy role models. Social media platforms can be used to make health eating announcements, health recipes, and health eating tips. They can also be used to promote healthy role models who eat healthily. By the use of social media's reach and influence, universities are able to promote healthy eating in a huge student population. However, social media also expose students to unhealthy food trends and unrealistic body images. Social media platforms are typically packed with images of unrealistic body ideals and unhealthy food trends advertisements. This can lead to body dissatisfaction and unhealthy eating behaviors, such as restrictive dieting and binge eating. Universities must be aware of the potential ill effects of social media and implement steps to overcome them.

Effective methods must be employed to harness social media for the promotion of healthy eating habits.

Universities may utilize social media to promote healthy body images, counteract unrealistic beauty ideals, and give correct information about nutrition and eating well.

Universities may also collaborate with social media influencers that endorse healthy living for a broader coverage of students.

Through effective and strategic use of social media, universities can promote healthy eating habits and combat the negative effect of social media.

8.3. Utilizing Digital Technologies for Individualized Diet Advice.

Digital tools can analyze individual dietary patterns and provide tailored recommendations. These tools can assess dietary intake, identify areas for improvement, and provide personalized recommendations for improving dietary habits. Personalized feedback can help students identify areas for improvement and track their progress. Individualized feedback may enable students to see where they need to improve and monitor progress. Individual feedback on dietary consumption can allow computer programs to notify students of their weaknesses and strengths. The information can be applied in setting realistic objectives and tracking development in the long run. Individualized feedback can also provide encouragement and motivation, allowing students to keep going with the goals of healthy eating. Machine learning and artificial intelligence can be applied to enhance digital interventions. AI and machine learning can be used to analyze large databases of nutritional data and identify trends and patterns. This information can be used to develop more effective interventions and provide more personalized advice. AI and machine learning can be used to personalize interventions to individual needs and preferences, making them even more impactful. 9. Special Groups and Special Requirements

9.1. Planning Meals for Students with Special Medical Conditions.

Individuals with diabetes, food allergies, or other medical conditions require special diet counseling. All these states are expected to change dietary needs, and food selection and meal planning must be done under careful consideration. Facilities and support for

There is a need for collaboration to provide an environment for healthy eating in universities' campuses with an emphasis on partnership. The partnership involves the public health agencies, food service operators, students, and the university to come up with an environment on campus that encourages healthy eating. Healthy food choices and nutrition education programs and healthy eating policies are some of the collaborative activities.

Conclusion

This review underscores the pivotal role of nutrition, particularly breakfast consumption, in enhancing university students' physical health, mental well-being, and academic performance. Healthy dietary habits, supported by regular breakfast intake, improve cognitive functions, reduce mental health risks, and mitigate chronic disease development. Socioeconomic, cultural, and environmental factors significantly influence eating behaviors, necessitating targeted interventions. Educational programs, campus food environment changes, policy initiatives, and digital tools can foster healthier eating practices. Universities must prioritize creating supportive environments to empower students to make informed food choices, ultimately promoting long-term health and academic success through comprehensive, collaborative strategies.

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