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REVIEW

Factors Associated with Healthy Behavior for Preventing Non-Communicable Diseases

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Background: The increasing burden of Non-Communicable Diseases (NCDs) in both low- and high-income ASEAN countries highlights an urgent need for effective management and prevention strategies. These strategies are critical for reducing premature deaths, alleviating the healthcare costs, and saving lives. Unhealthy lifestyle behaviors, such as poor dietary habits, lack of physical activity, alcohol consumption, and inadequate sleep, significantly elevate the risk of metabolic syndrome and other NCDs.

Purpose: Mapping the literature on factors related to healthy behaviors for preventing and managing NCDs among college students in ASEAN countries.

Methods: A Scoping Review with a PCC (Population–Concept–Context) framework and was referred to the Scoping Review Framework by Arksey and O'Malley. This article reviewed both qualitative and quantitative studies, restricted to full-text articles in English and Indonesian published from 2020 to 2024, focused on University Students, Healthy Behaviour, conducted in ASEAN countries.

Results: Of the 1166 articles, 7 studies, involving 71,923 participants, met the criteria. The findings indicate that internal (eg, dietary habits, sleep quality, and mental well-being) and external factors, (eg, student knowledge and perception, and the Health University Framework (HUF)) are significantly associated with health behaviors among university students. Several studies also demonstrate a relationship between healthy behavior and students' psychological conditions and susceptibility to cardiovascular disease.

Conclusion: This review found that internal factors, such as dietary habits, sleep quality, BMI, along with external factors, including HUF Implementation and students' knowledge and perceptions, significantly influence healthy behaviors among university students in ASEAN. These factors related with psychological well-being and cardiovascular disease risk. Therefore, effective interventions and implementation of the holistic AUN-HPN HUF framework in universities are essential for preventing and managing NCDs among young adults.

Keywords: non-communicable disease, NCDs, healthy behaviors, university student, Health university framework, ASEAN university network, Health Promotion Network, HUF AUN-HPN, prevention factors, Southeast Asia countries

Introduction

The morbidity and mortality rates of Non-Communicable Diseases (NCDs) continue to increase in both low and high-income countries in ASEAN. NCDs are the biggest cause of death in ASEAN countries, affecting global industries. The increase in morbidity and mortality rates across all age groups is attributed to factors like lifestyle changes, urbanization, and inadequate healthcare systems.[1] WHO (2019) revealed that 17 million or about 62% of people died at the age of less than 70 years old.[2] The Lancet Commission on Adolescent Health and Wellbeing reported that the greatest burden of disease among people aged 10–24 years was from NCDs, which accounted for 56% of global disability-adjusted life-years (DALYs) in 2016.[3,4] From 1990 to 2019, DALYs attributable to NCDs also increased by 13.1%.[3] Countries with limited health resources tend to have difficulties in effectively managing NCD cases. This rise is significant, indicating a

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pressing public health crisis that demands urgent interventions to reduce premature deaths and alleviate healthcare burdens. Interventions to prevent non-communicable diseases are very important because they can reduce 82% of premature deaths and save lives and reduce the burden of health financing.

Despite the fact that NCDs pose a global problem, University students' knowledge and prevention are still lacking. A report indicates that the prevalence of non-communicable disease (NCDs) continues to rise among university students, with more than half of the students having intermediate and high risk for type 2 Diabetes Mellitus.[4] Furthermore, research in Bangladesh has reported that adolescent participants' physical inactivity is linked to university students who have unhealthy lifestyles, such as missing breakfast or lacking social support.[5,6] This demonstrates how lifestyle plays a significant impact on students' cognitive and emotional development. If neglected, it can raise the risk of unhealthy behaviors, mental issues, and non-communicable diseases. Therefore, preventing non-communicable diseases (NCDs), such as implementing effective health promotion strategies, within universities is an essential investment to encourage healthier lifestyle choices and mitigate the potential burden of NCDs in the future.

Another study involving university students from 24 countries, including some in the ASEAN region, found that 15.9% of university students had three or more NCD-related behavioral risk factors, such as lack of physical activity, poor diet, and tobacco use.[7] This finding indicates that the majority of university students may not be fully aware of the behaviors that can increase the risk of NCDs. The low percentage highlights a gap in knowledge and awareness about health and the importance of prevention among University Students. University students often change their eating habits, experience increased stress levels, and reduce physical activity due to academic pressures. Along with a limited awareness of the importance of health, these changes can lead students to adopt unhealthy behaviors that may raise their risk of Non-Communicable Diseases (NCDs).

The transition into university life presents unique challenges for students, including lifestyle changes that can significantly influence their health and increase the risk of NCDs. These include academic, financial, social, and future-oriented pressures.[8] This period of transition at the university level necessitates that students reorganize their time to identify available periods of free time, activities, social relationships, and dietary patterns.[9] Students who are highly occupied and experiencing elevated stress levels tend to gravitate towards fast food establishments or purchase fast food items in the vicinity of their campus or residence, as it is a more cost-effective and convenient alternative to cooking.[10]

College students often experience increased stress due to academic load which impacts lifestyle changes. Stress experienced by students plays an important role in the health behaviors adopted. Studies show that there is a positive correlation between smoking behavior and stress levels.[11] Sedentary behavior in university students is also at a very alarming level worldwide and student activities also often increase sedentary time in the form of sitting.[12] Studies reveal that 65% of university students spend 9.75 hours on sedentary behavior.[13]

Unhealthy lifestyle behaviors such as following unhealthy dietary patterns, lack of exercise, alcohol consumption, and insufficient quantity and/or quality of sleep increase the risk of Metabolic syndrome.[14] The innovative Care for Chronic Conditions (ICCC) framework has been adopted by the WHO for health system transformation towards better care for chronic diseases. These guidelines are encouraging and supporting, but the situation within ASEAN countries greatly affects the ability to control Non-Communicable Diseases (NCDs).

Management of Non-Communicable Diseases (NCDs) includes massive education by health workers on healthy living practices.[15] Part of this education is the topic of smoke prevention, smoking cessation, and prevention of second-hand smoke. Proper nutrition and daily activity education are also essential topics. The involvement of multidisciplinary health workers greatly influences the effectiveness of interventions to prevent and manage Non-Communicable Diseases (NCDs).[16] If health workers and financing are not evenly distributed throughout the region including rural and remote areas, then the challenge of disparities must still be faced.[17]

Reviewing strategies and implementing Non-Communicable Disease (NCD) prevention in various Indonesian regions is beneficial for implementation in other areas. However, a review with ASEAN coverage would provide greater insight into regional and country policies. The implementation of strategies in ASEAN countries that share close geographical and cultural characteristics allows for the repetition and modification of programs and policies to prevent non-communicable diseases (NCDs) in a manner that is accurate, effective, and efficient.

The purpose of this study is to map the existing literature on the factors associated with healthy behavior in the context of the prevention and management of non-communicable diseases (NCDs) among university students in ASEAN countries.

Materials and Methods

Design

The design of this article was written in the scoping review with a PCC framework. We created a data extraction form to help collect and organize important data from the selected articles. The purpose of the mapping procedure or scoping mapping using the draft table that the authors conducted was to produce a descriptive overview of the findings that answered the research questions. Prisma Extension for Scoping Review (PRISMA-ScR) was also used to present methods to optimize the reporting of the review results. The PRISMA-ScR was established to improve the reporting quality of scoping reviews. It includes a checklist of 20 essential items and 2 optional items that guide researchers in clearly articulating their review processes and findings.[18] By adhering to these guidelines, researchers can ensure that their scoping reviews are comprehensive, transparent, and reproducible, which is crucial for advancing knowledge in a given field.

Search Methods

The keywords used included "Adult" AND "Healthy lifestyle" AND "Intervention" AND "University" OR "College" AND "ASEAN countries" in several databases, namely EBSCOhost, PubMed, ScienceDirect, Scopus, and Sage Journal. All keywords of databases are written in Table 1 below.

This article uses the PCC (*Population, Concept*, and *Context*) framework and is presented in Table 2.

Eligibility Criteria

To determine the articles reviewed, the authors determined the inclusion and exclusion criteria based on the PCC format. This article reviews both qualitative and quantitative studies. The search is restricted to full-text articles in English and Bahasa Indonesia published from 2020 to 2024. Restricting the scope of data from the past 5 years may be more advantageous as it can capture the latest trends, research developments, and current health policies, ensuring that the

Table 1 Keywords of Databases

No	Database	Keywords	Articles	Access Date
1	EBSCOhost	"Adult" AND "Healthy lifestyle" AND "Intervention" AND "University" OR "College" AND "ASEAN Countries"	620	July 2, 2024
2	Scopus	Adult* AND healthy AND lifestyle AND intervention AND university OR college AND asean AND countries AND PUBYEAR > 2020 AND PUBYEAR < 2024	261	July 2, 2024
3	PubMed	((("adult*"[All Fields] AND ("healthy lifestyle"[MeSH Terms] OR ("healthy"[All Fields] AND "lifestyle"[All Fields]) OR "healthy lifestyle"[All Fields]) AND "intervention*"[All Fields] AND ("universiti"[All Fields] OR "universities"[MeSH Terms] OR "universities"[All Fields] OR "university"[All Fields] OR "university s"[All Fields])) OR ("college"[All Fields] OR "college s"[All Fields] OR "colleges"[All Fields])) AND ("ASEAN"[All Fields] AND ("countries"[All Fields] OR "country"[All Fields] OR "country s"[All Fields] OR "countries"[All Fields]))) AND (2020:2024 [pdat])	118	July 2, 2024
4	Science Direct	Adult AND Healthy lifestyle AND Intervention AND University OR College AND ASEAN Countries	49	July 2, 2024
5	SAGE Journals	"adult" AND "healthy lifestyle" AND "intervention" AND "university" OR "college" AND "ASEAN Countries"	118	July 2, 2024

Notes: This table lists the keywords used in the database search for the review process.

Table 2 PCC Framework

Population	**University Students in the Southeast Asia Region**
Concept	Factors linked to healthy behaviors for preventing non-communicable diseases
Context	Prevention of non-communicable diseases in the university setting within Southeast Asian countries

Notes: The table outlines the Population, Concept, and Context (PCC) framework applied to guide article selection.

findings are highly relevant and practical to address the current factors related to healthy behavior for preventing NCD in Southeast Asia. Given the diversity of languages in the region, including studies in both English and Bahasa Indonesia guarantees a wider representation of research relevant to the ASEAN context. Review, study protocols papers, articles published in other languages except English and Bahasa, and Non-Communicable diseases that do not focus on the University student population were not included. It is because this study focuses on university students as they represent a vulnerable group during a critical phase in life, high frequency of sedentary behavior or inactivity, high stress, and poor diet in students can endanger their health and put students have a high risk at NCDs.[19] The articles were reviewed by the four reviewers based on the Prisma Extension for Scoping Review (PRISMA-ScR) (see Figure 1).

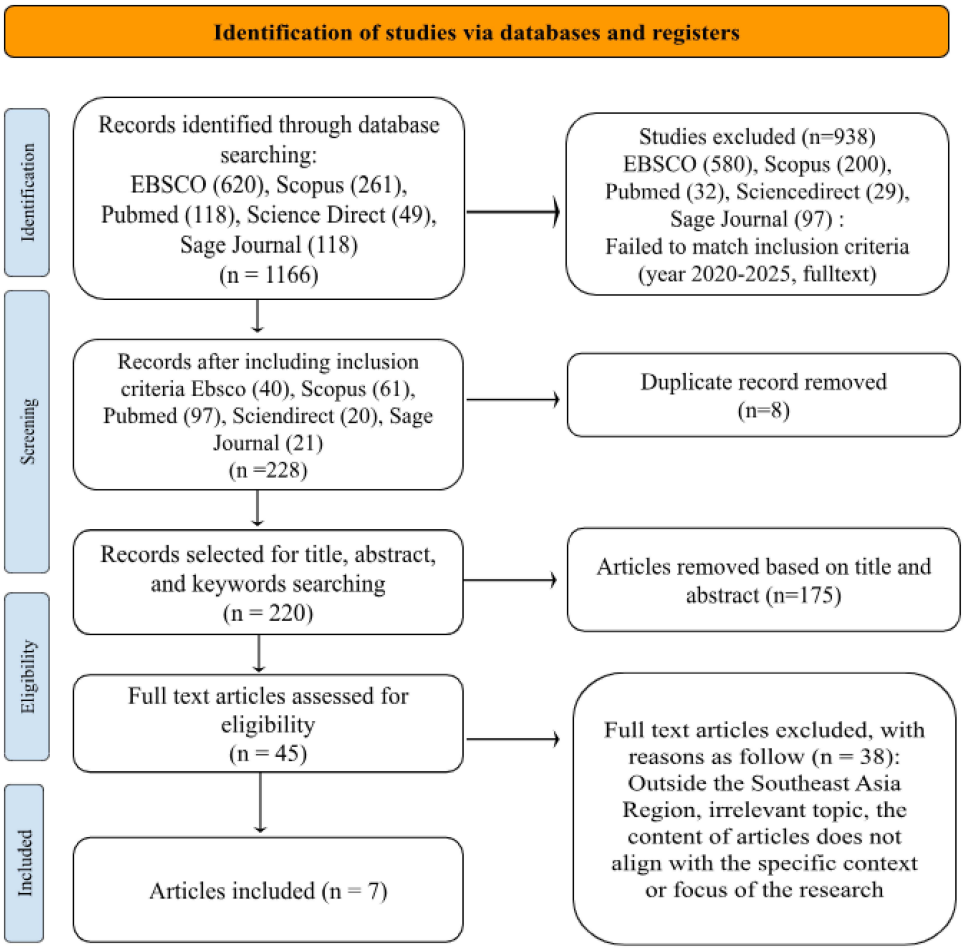

Figure 1 PRISMA-ScR.
Notes: This figure depicts the PRISMA-ScR flow diagram used to illustrate the process of article identification, screening, and inclusion in the review.

Data Extraction and Analysis

The data analysis is conducted in accordance with the most recent Arksey & O'Malley guidelines on *scoping reviews*. The stages of this process are as follows: 1) determining the research question, 2) identifying appropriate literature relevant to the research question, and 3) selecting the results of literature studies that are appropriate to the research context, 4) conducting data mapping based on the literature that has been collected, 5) synthesizing, compiling, summarizing, and reporting the results, and 6) consulting with experts.[20] This framework provides a foundational approach that outlines essential steps for conducting scoping reviews, such as identifying research questions and mapping existing literature, which is particularly beneficial for complex topics where the evidence base is broad and varied.[21]

All articles were identified using the Mendeley software reference manager to determine suitability and eliminate duplicate articles. Further elimination was done by reviewing the title and abstract of each article. The authors then reviewed the full-text of all reviewed articles based on the specified criteria. Data were extracted to include important information, encompassing the study site, study design, aim, sample, instrument, and main findings. After collecting the data, all authors analyzed and interpreted each finding based on the research objectives and framework. Lastly, the authors conducted a thorough review of the included studies to ensure accuracy and minimize any errors during the data extraction process.

Results

In this *scoping review*, seven articles that focused on factors associated with healthy lifestyle among university students in Southeast Asia were identified and examined. These findings underscore the factors that influence a healthy lifestyle in reducing the risk of non-communicable diseases (NCDs) and improving overall well-being. The origin of articles from several countries in Southeast Asia are included in this study, except Cambodia and Timor Leste. All included articles are cross-sectional studies with total respondents of 71.923 university students. These included articles reported that the influence factors of healthy behavior exist. Five of the reviewed articles collected data online while two of them collected data offline. It was found that no interventions were used from the seven reviewed articles. Information extracted from the selected studies consists of standard data: title, author, year of publication, country of origin, study design, and research sample. Characteristic data of included articles is shown in Table 3.

Moreover, data extraction was carried out carefully related to the seven articles, such as the tools utilized in the studies and the health outcomes that were observed as a result. This systematic process is outlined in Table 4. By synthesizing these results, this review aims to contribute to a deeper understanding of how to foster healthier lifestyles among university students in Southeast Asia and to inform future research directions in this critical area of public health. Almost all included articles used physical activity, social support, food consumption, and mental well-being instruments. However, only a limited study reported that instrument related to perceptions of university support is useful (see Table 4).

Factor Related to Healthy Lifestyle Among University Students for Non-Communicable Disease Prevention

The crucial intervention is to conduct regular surveys to monitor behavioral changes in specific population groups, thereby providing more accurate information for making appropriate health promotion decisions. Research suggests that first-year students tend to exhibit lower levels of activity than their second-year counterparts. Moreover, the Healthy University Framework (HUF) of the ASEAN University Network – Health Promotion Network (AUN–HPN) has been demonstrated to influence physical activity among university students in Thailand.[25,29,30]

This present study revealed that there are three risk factors associated with an unhealthy lifestyle including sugar consumption, mental health challenges, and smoking. High consumption of sugary beverages was reported by over half of the respondents (n=8482; 55.2%); over 10% of respondents (n=2009; 13.1%) experienced poor mental well-being; and almost 10% of respondents (n=1364; 8.9%) were smokers.[24] Moreover, the dissemination of knowledge, particularly regarding the benefits and adoption of a positive perception of cardiovascular health, will enhance students' awareness of this critical area. The perceived benefits and acquired knowledge represent an indirect impact of health-enhancing behaviors.[22]

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Table 3 Characteristic Data of Included Articles

No	Author	Title	Country	Research Design	Participants
1	Amornsriwatanakul, A., Rahman, H. A., Katewongsa, P., Chaiyasong, S., Charoenwattana, S., Chupradit, S., Ivanovitch, K., Rodjarkpai, Y., Sriboonma, K., Sudnongbua, S., Wattanapisit, A., and Kasemsab, V. (2023).[22]	Multilevel factors associated with physical activity participation among Thai university students.	Thailand	Cross-sectional Online Survey	Secondary data from 3930 university students, 18 years old or higher studied in 9 universities member of AUN-HPN (ASEAN University Network-Health Promotion Network).
2	Wattanapisit, A., Rahman, H. A., Car, J., Haji Abdul-Mumin, K., de la Cruz, M. H. T. O., Chia, M., Rosenberg, M., Ho, M.-h. R., Chaiyasong, S., Mahmudiono, T., Rodjarkpai, Y., Dinov, I. D., Ottom, M., Amornsriwatanakul, A. (2022).[23]	The clusters of health-risk behaviours and mental wellbeing and their sociodemographic correlates: a study of 15,366 ASEAN university students.	Brunei Darussalam, Indonesia, Malaysia, Philipines, Singapore, Thailand, and Vietnam	A cross-sectional self-administered online survey	15.366 University students in ASEAN from 17 universities member of AUN-HPN in seven countries, namely Indonesia, Brunei Darussalam, Malaysia, Vietnam, Thailand, The Philipines, and Singapore.
3	Amornsriwatanakul, A., Rahman, H. A., Wattanapisit, A., Nurmala, I., Teresa O de la Cruz, M. H., Car, J., and Chia, M. (2022).[24]	University students' overall and domain-specific physical activity during COVID-19: A cross-sectional study in seven ASEAN countries	Brunei Darussalam, Indonesia, Malaysia, The Philipines, Singapore, Thailand, and Vietnam.	A cross-sectional study online survey	A total of 15,366 undergraduate students aged 18 to 22 years from seven ASEAN countries.
4	Lim, B. C., Kueh, Y. C., Arifin, W. N., and Ng, K. H. (2021).[25]	Modelling knowledge, health beliefs, and health-promoting behaviors related to cardiovascular disease prevention among Malaysian university students.	Malaysia	A cross-sectional design study with a survey questionnaire	This study involved 788 students at Universiti Sains Malaysia (USM) aged 19–27 years.
5	Pengpid, S., and Peltzer, K. (2020).[26]	Fruit and Vegetable Consumption is Protective from Short Sleep and Poor Sleep Quality Among University Students from 28 Countries.	28 negara (Asia: Bangladesh, China, India, Indonesia, Kirgistan, Laos, Malaysia, Myanmar, Pakistan, Philipines, Russia, Singapore, Thailand, Turki, and Vietnam; Afrika: Cameroon, Egypt, Ivory Coast, Madagaskar, Mauritius, Namibia, Nigeria, South Africa, and Tunisia; America: Barbados, Colombia, Grenada, Jamaika, and Venezuela)	A cross-sectional design	Included 21.027 university students from 28 countries with the median age of 20 years (range interquartile is 3 years).

6	Abdul Rahman, H., Amornsriwatanakul, A., Abdul-Mumin, K. H., Agustiningsih, D., Chaiyasong, S., Chia, M., Chupradit, S., Huy, L. Q., Ivanovitch, K., Nurmala, I., Abdul Majid, H. B., Mohd Nazan, A. I. N., Rodjarkpai, Y., de la Cruz, M. H. T. O., Mahmudiono, T., Sriboonma, K., Sudnongbua, S., Vidiawati, D., Wattanapisit, A., Charoenwattana, S., Cahyani, N., Car, J., Ho, M.-H. R., Rosenberg, M. (2022).[27]	Prevalence of Health-Risk Behaviors and Mental Well-Being of ASEAN University Students in COVID-19 Pandemic.	Brunei Darussalam, Indonesia, Malaysia, Philipines, Singapore, Thailand, and Vietnam.	A Cross-sectional online self-administered student survey.	15.366 University students in ASEAN from 17 universities member of AUN-HPN in seven countries, namely Indonesia, Brunei Darussalam, Malaysia, Vietnam, Thailand, The Philippines, and Singapore.
7	Yap, S. Y., Foo, C. N., Lim, Y. M., Ng, F. L., Mohd-Sidik, S., Tang, P. Y., Najar Singh, J. K., and Pheh, K. S. (2021).[28]	Traditional Chinese Medicine Body Constitutions and Psychological Determinants of Depression among University Students in Malaysia: A Pilot Study.	Malaysia	A cross-sectional pilot study online survey	The sample are University students aged between 18 and 30 years, who are Malaysian citizens and studying in Malaysia. For each variable—depression, Traditional Chinese Medicine body constitution, dysfunctional attitude, stress, perceived stress, and self-esteem—ten samples were recruited, resulting in a dropout rate of 25.0%. The sample size was calculated using the formula: (10 × number of variables) ÷ (1–0.25). Consequently, the final estimated sample size for this pilot study was 80.

Notes: This table summarizes the key characteristics (eg, country, study design, sample size) of the articles included in the review.

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Table 4 Data Extraction

No	Title	Instrument	Result
1	Multilevel factors associated with physical activity participation among Thai university students.	The online survey used was of the type developed based on a pre-tested instrument. It consisted of seven sections: 1) Physical Activity (PA); 2) Social support for PA; 3) University environment; 4) Health-related behaviors; 5) Mental well-being; 6) Opinions on university support; and 7) Sociodemographic information. The survey was initially developed in English, and translated into the national languages of the participating countries. The Thai version was used on the Qualtrics platform (Qualtrics International Inc., WA, USA).	Several key factors influencing adequate physical activity (PA) among university students in Thailand: 1. Gender: Women have 13% lower odds of achieving sufficient PA compared to men. 2. Academic Year: Students in their second academic year are 22% more likely to engage in adequate PA compared to first-year students. 3. BMI Status: Underweight and overweight students are less likely to have sufficient PA, with decreased probabilities of 19% and 26%, respectively, compared to students with a normal weight. 4. Sport participation: University student participated into sport 1–3 and 4–6 days/week had 3 and almost 4 times higher odds of having sufficient PA respectively. 5. Sedentary Time: Students sedentary for more than eight hours are 70% more likely to have adequate PA than those sedentary for less than four hours. 6. Adequate consumption of fruits and vegetables increased the likelihood of an individual performing sufficient physical activity (PA) by 59%. This suggests that a healthy diet can contribute to increased physical activity. 7. Taking a sedentary route (eg, walking or cycling) to campus is associated with a 70% increased likelihood of doing sufficient physical activity (PA). 8. Recreational Facilities: having access to exclusive sports or recreational facilities can 40% encourage people to be more physically active. 9. Healthy University Framework (HUF): Universities that adopt the HUF framework provide their students with a greater likelihood of participating in sufficient physical activity, compared to universities that do not implement HUF. In summary, PA among university students is influenced by factors such as gender, academic year, BMI, sports participation, sedentary behavior, diet, route to campus, recreational facilities, and the presence of a Healthy University Framework.
2	The clusters of health-risk behaviors and mental wellbeing and their sociodemographic correlates: a study of 15,366 ASEAN university students.	The online survey is comprised of seven sections. The survey comprises seven sections, as follows: 1) Physical activity, 2) Social support for physical activity, 3) University environment, 4) Health-related behaviors, 5) Mental well-being, 6) Opinions on university support, and 7) Sociodemographic information. The survey, which was originally conducted in English, was subsequently translated into four languages: The survey was translated into four languages: Indonesian, Malaysian, Thai, and Vietnamese. An online survey was conducted using the Qualtrics platform and administered to a small group of university students (sub-sample) for the purpose of gathering feedback on how they understood and used the survey. The objective of the pilot test was to ascertain the functionality and comprehensibility of the online survey for respondents before its broader dissemination.	This study identified several patterns related to the consumption of sugary beverages and mental well-being among students. 1. High Consumption of Sugary Beverages: Female second- and third-year students residing in Thailand who are less active are more likely to be classified in the "High Sugar Intake" group than in the "Healthy" group. Conversely, students residing in the Philippines, those with a lower body mass index (BMI) or higher BMI, and those residing in townhouses were less likely to consume high amounts of sugar-sweetened beverages. These findings indicate that geographical location, body mass index, and residential type may influence the consumption patterns of sweetened beverages among university students. 2. Mental Well-Being: Students with lower body weight who reside in countries such as Indonesia, Malaysia, the Philippines, or Vietnam tend to exhibit poorer mental well-being than students from Brunei. 3. Alcohol Consumption: Students with higher cumulative grade point averages (CGPA) were less likely to be alcohol drinkers than those in the "Healthy" group. 4. The likelihood of students who are not members of sports clubs being included in the alcohol-drinking group is 30% lower than that of students who are members of sports clubs.

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3	University students' overall and domain-specific physical activity during COVID-19: A cross-sectional study in seven ASEAN countries	**AUN–HPN health behavioral survey** The variables under investigation are as follows: 1) Physical activity (PA), 2) Social support for PA, 3) The university environment, 4) Health-related behaviors, 5) Mental well-being, 6) Perceptions of university support, and 7) Sociodemographic information. The online survey provides data on physical activity and sociodemographic characteristics of students. The survey instrument has been previously tested and modified in accordance with the WHO guidelines. The initial recruitment materials and survey were originally drafted in English and subsequently translated to ensure accuracy and comprehension. Furthermore, the survey was pilot tested on the Qualtrics platform to enhance student comprehension of the platform's functionality and to facilitate revisions based on student feedback. **Measurement**: The Global Physical Activity Questionnaire (GPAQ) version 2.0, developed by the World Health Organization (WHO), comprises 16 items for measuring physical activity. The instrument employed was a 16-item version of the Global Physical Activity Questionnaire (GPAQ) developed by the World Health Organization (WHO). Students were classified as "meeting the PA guidelines" if they engaged in 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity per week, or a combination of both, resulting in a total of 600 MET minutes per week (with 1 MET equating to 1 kcal/kg/hour). Students were classified as "not meeting the PA guidelines" if they did not meet the aforementioned criteria.	The present study demonstrates that a range of sociodemographic factors influence university students' ability to adhere to the Physical Activity (PA) Guidelines during the ongoing pandemic. The following section presents the key findings of the study. 1. Body mass index (BMI) was found to be a significant predictor of meeting the physical activity guidelines. Students with a body mass index (BMI) classified as underweight, overweight, or obese exhibited a 14% to 25% increased likelihood of meeting the PA guidelines compared to students with a normal BMI. 2. The country of residence was also identified as a factor. The likelihood of students from the Philippines and Vietnam meeting the PA guidelines was 32% to 70% higher than that of students from Brunei. Conversely, students from Indonesia and Singapore exhibited a lower likelihood of meeting the aforementioned guidelines. 3. The type of travel undertaken to and from the university was also examined. Students who engage in active transportation to and from university, as well as those who utilize inactive transportation but are members of a sports club, are 42% less likely to meet PA guidelines. 4. Sports Activities Students who engaged in one to three sports activities per week were more than four times as likely to meet PA guidelines. 5. The term "sedentary time" (ST) refers to periods of low to moderate intensity physical activity, such as sitting, reclining, or lying down. The likelihood of college students meeting PA guidelines was 32% lower for those who spent more than eight hours per day in sedentary activities. In aggregate, 60.3% of university students across the seven ASEAN countries were found to meet the global PA guidelines. **The Lifestyle Habits and Physical Activity of University Students**: 1. Leisure and study activities constitute the predominant aspect of the lifestyle habits of university students. 2. Male students engage in more recreational activities but demonstrate less engagement in learning activities. 3. The following factors have been identified as influencing physical activity (PA): The achievement of recommended physical activity levels is influenced by factors such as BMI, type of travel, and sports club membership. 4. The relationship between physical activity (PA) and lifestyle is a complex one. Students who are underweight, overweight, or obese are more likely to adhere to the recommended physical activity guidelines. 5. There is a robust positive correlation between participation in sports and adherence to physical activity guidelines. 6. The influence of country of residence on the likelihood of meeting PA guidelines is a significant factor. The country of residence exerts a significant influence on the ability of ASEAN students to meet the recommended physical activity guidelines.

(*Continued*)

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Table 4 (Continued).

No	Title	Instrument	Result
4	Modelling knowledge, health beliefs, and health-promoting behaviours related to cardiovascular disease prevention among Malaysian university students.	**Research Instruments**: 1. Knowledge of Heart Disease: Measured using a 30-item scale with true/false/do not know response options. The validity of this scale was evaluated in a previous study through confirmatory factor analysis (CFA), which resulted in a model with 23 items. Participants' answers were coded "0" for incorrect or "don't know" answers and "1" for correct answers. The participant's total score was then calculated by summing all correct answers, and this score was converted into a percentage. A higher score indicates a higher level of knowledge about heart disease. 2. Health Beliefs: Measured using a 25-item test of Health Beliefs related to Cardiovascular Disease (HBCVD). 3. Health-Promoting Lifestyle Profile II (HPLP-II) is a 52-item scale that focuses on self-initiated actions and perceptions by individuals to maintain or increase levels of well-being, self-actualization, and personal fulfillment. In previous research, this scale was simplified into three subscales consisting of 26 items. The subscales selected include behaviors that support health and have a direct effect on cardiovascular disease (CVD) prevention: nutrition (9 items), physical activity (8 items), and health responsibility (9 items). 4. Self-efficacy was evaluated using the statement, "There is nothing I can do to prevent myself from getting heart disease". Participants' responses were measured with a 4-point Likert scale, where answer options ranged from 1 = "strongly disagree" to 4 = "strongly agree".	The results of this study are consistent with the theoretical tenets of the health behavior model and support other empirical research findings related to physical activity, weight management, and nutrition behaviors in young adults. Key findings from this study include: 1. Demographic Variables: The study found that age as a demographic variable has a significant effect on health beliefs, ie perceived susceptibility and severity to cardiovascular disease (CVD). 2. BMI and Perceived Susceptibility: Findings showed that individuals with higher BMI had greater perceived susceptibility to CVD. 3. Individuals who perceive the benefits of diet and exercise to reduce heart disease risk are expected to have more confidence to engage in certain activities to prevent themselves from developing heart disease (ie, self-efficacy). 4. There was a significant association between perceived benefits and intention to screen for heart disease ($\beta = 0.15$, $p < 0.001$). 5. The study found that family history had a negative effect on health-promoting behaviors ($\beta = -0.12$, $P = 0.003$), suggesting that those with a family history of CVD may be less engaged in preventive behaviors.
5	Fruit and Vegetable Consumption is Protective from Short Sleep and Poor Sleep Quality Among University Students from 28 Countries.	Measurement in this study was done through several specific questions covering various aspects of the participants' lifestyle and health:: 1. Fruit and Vegetable Consumption: Participants were asked to answer questions such as, "How many servings [80 grams] of fruit do you eat each day?" and "How many servings [80 grams] of vegetables do you eat each day?" 2. Sleep Duration: Sleep duration was measured by the question, "On average, how many hours of sleep do you get in a 24-hour period?" Answers were categorized into three groups: short sleep (≤6 hours), reference category (7–8 hours), and long sleep (≥9 hours). 3. Sleep Quality: Sleep quality was evaluated through the question, "Overall in the past 30 days, how much of a sleep problem have you had, such as difficulty falling asleep, waking up frequently at night, or waking up too early in the morning?" Answers were given on a scale from 1 (none) to 5 (very/unable). 4. Restless Sleep: Restless sleep is measured by the question, "Most of the time in the past week, was your sleep restless?" Answers ranged from "1 = rarely (<1 day)" to "4 = most often (5–7 days)". Restless sleep was defined as "a lot (3–4 days) or most often (5–7 days)". 5. Physical Activity: Physical activity was measured using the short form of the "International Physical Activity Questionnaire (IPAQ)". 6. Tobacco Use: Defined as the current use of tobacco products such as cigarettes, snuff, chewing tobacco, cigars, and others. 7. Excessive Drinking (Last Month): Measured by the question, "How often did you drink (for men) five or more and (for women) four or more drinks on one occasion?" 8. Eating Habits: Includes two main aspects:. 1. Avoidance of foods containing fat and cholesterol (with a "yes" or "no" answer). 2. Frequency of eating red meat (with answer options: every day, 2–3 times a week, once a week, less than once a week, never).	The findings of this study indicate a linear decrease in the prevalence of sleep deprivation as fruit and vegetable (FV) consumption increased by more than two servings per day. 1. The consumption of two servings of fruit and vegetables per day was found to be associated with a 21% reduction in the risk of poor sleep. 2. Consuming seven or more servings per day was associated with a 33% reduction in risk. 3. Consuming five servings of fruits and vegetables per day was also associated with a 34% decreased risk of prolonged sleep, which was comparable to the 34% decreased risk observed in individuals who consumed seven or more servings per day. This study also revealed some important findings related to students' health behaviors: 1. Almost two in five students (38.5%) reported low levels of physical activity, 11.8% used tobacco, and 10.6% drank alcohol excessively. 2. 39.2% of students avoided consuming fat and cholesterol, while 48.1% consumed red meat daily. 3. The prevalence of short sleep (lack of sleep) and long sleep were 38.9% and 12.8% respectively, while 9.6% of college students reported poor sleep quality, and 19.7% experienced restless sleep. 4. Sleep Duration: There was an inconsistent relationship (inverse curvilinear) between long sleep duration and fruit and vegetable (FV) consumption, with higher prevalence in low (0–1 servings) and high (5–7 servings) FV consumption, and lower prevalence in two to four servings FV consumption. In addition, poor sleep quality and restless sleep decreased with increasing FV consumption.

6	Prevalence of Health-Risk Behaviors and Mental Well-Being of ASEAN University Students in COVID-19 Pandemic - ASEAN	1. Online Survey: AUN-HPN Health Behavioral SurveyThis survey includes measurements on various aspects of student health behavior, including: a. Physical Activity (PA) b. Social Support for PA c. University Environment d. Health Related Behavior e. Mental Wellbeing f. Opinions on University Support g. Sociodemographic Information 2. Demographics: Participants were asked to provide the following information a. Age b. Gender c. Country d. Height e. Weight f. Grade point average (GPA) g. Year of study h. Living arrangements 3. Height and weight are used to calculate the Body Mass Index (BMI), which is classified into four groups: ● Underweight: <18.5 kg/m² ● Normal: 18.5 to 22.9 kg/m² ● Overweight: 23.0 to 24.9 kg/m² ● Obese: ≥25 kg/m² 4. Health-Risk Behaviors: Physical activity was measured using the Global Physical Activity Questionnaire (GPAQ) version 2.0. 5. Mental Well-Being: Mental well-being was measured using the Global Physical Activity Questionnaire (GPAQ) version 2.0. Scores were assessed based on responses on a Likert scale of 1 to 5 (1 = not always, 5 = all the time), with a minimum score of 7 and a maximum of 35. The mental well-being categories are as follows: Low: 7.0 to 17.99 Moderate: 18.0 to 24.99	The study found several important findings related to the health behaviors of university students in different countries: 1. The study found that university students in Indonesia and Singapore were more likely to be physically inactive and have a high salt intake compared to students in Brunei. 2. Students from Indonesia, Malaysia, Thailand, Singapore and Vietnam had significantly lower levels of mental well-being compared to students from Brunei. 3. Underweight and obese students were 25% more likely to be physically inactive. 4. Students living off-campus were 28% more likely to be physically inactive and 26% more likely to have a high salt intake. 5. Students with higher GPA are less likely to consume alcohol. 6. Female students are less likely to have a poor diet but more likely to consume sugary drinks. 7. Older students are less likely to consume snacks or fast food. 8. Students in their second year and fourth year or more were 17% and 30% more likely to have a poor diet.
7	Traditional Chinese Medicine Body Constitutions and Psychological Determinants of Depression among University Students in Malaysia: A Pilot Study.	Instruments to assess depression, body constitution, dysfunctional attitudes, stress, perceived stress, and self-esteem:: 1. The pre-tested and validated Patient Health Questionnaire (PHQ-9) 2. Constitution in Chinese Medicine Questionnaire (CMCQ) 3. Dysfunctional Attitude Scale (DAS) 4. Depression Anxiety Stress Scale (DASS-21) 5. 5. Stress Subscale 6. Perceived Stress Scale (PSS-10). 7. Rosenberg Self-Esteem Scale (RSES). 8. Depression was measured using the PHQ-9, as it has equivalent validity to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5), and showed a high sensitivity of 88% and high specificity of 85%. 9. Participants' socio-demographic characteristics and health status were recorded.	The results of the study are as follows: 1. The prevalence of depression among students is 33.8%, with women exhibiting a higher risk of depression (26.3%) compared to men (7.5%). These figures are higher than those reported in similar studies conducted at public and private universities in the Klang Valley. 2. **Body Constitution**: A total of 14 subjects (17.5%) exhibited a balanced constitution. ○ A total of 66 subjects (82.5%) exhibited an imbalanced or mixed constitution. 3. **Dysfunctional Attitudes**: Approximately 17.5% of the subjects exhibited dysfunctional attitudes. 4. **Stress**: ○ A total of 23.8% (n = 19) of the subjects reported experiencing high levels of stress. ○ The majority of subjects (87.5%) reported experiencing stress. 5. **Self Esteem**: 50.0% of the subjects reported low self-esteem. **Significant Correlation with Depression**: 1. A significant correlation was observed between depression and Traditional Chinese Medicine (TCM) constitutional types ($p = 0.03$). 2. A significant correlation was identified between depression and dysfunctional attitudes ($p < 0.001$). 3. Depression was found to be significantly correlated with stress levels ($p < 0.001$). 4. A significant correlation was observed between depression and perceived stress ($p = 0.01$). 5. Additionally, self-esteem demonstrated a significant correlation with depression ($p < 0.001$). According to traditional Chinese medicine, body constitution and self-esteem represent significant risk factors for depression among students. Identifying these risk factors is crucial for facilitating the early detection and intervention of depression among students.

Notes: This table provides an overview of the extracted data, including main findings, and research instruments.

Furthermore, the consumption of fruits and vegetables has been identified as a contributing factor. This study expands upon previous findings regarding the relationship between inadequate fruit and vegetable consumption and shorter sleep duration. This scoping revealed the inverse relationship between fruit and vegetable consumption and poor sleep quality and restlessness.[26,28,31] An increase in fruit and vegetable consumption has been linked to a reduction in both poor sleep quality and sleep disturbances.

Among the seven articles included in this study, four articles emphasize that adopting a healthy lifestyle is crucial for university students in Southeast Asia. This lifestyle encompasses various internal factors such as dietary habits, academic performance (GPA), gender, sleep quality, and body mass index (BMI).[22–24,27] Each of these factors significantly contributes to overall health and well-being. These factors are essential for fostering habits that not only enhance students' daily lives but also lower the risk of developing non-communicable diseases (NCDs) in the long term.

Conversely, three other articles reveal that although internal factors are crucial, external factors including social environments and available resources, also play a role in shaping students' health behaviors.[25,29,30] However, it is evident that students who actively engage in a healthy lifestyle, characterized by balanced nutrition, regular physical activity, and adequate sleep, are more likely to experience improved health outcomes. Importantly, no articles were found that attribute health outcomes solely to external factors without considering the impact of individual lifestyle choices. This observation underscores the premise that while external influences can impact individual health, it is primarily the commitment to a healthy lifestyle that serves as a foundation for reducing the risk of NCDs among university students.

Discussions

An understanding of the benefits derived from disease prevention has a positive effect on cognition and perception. This study's results align with the theoretical principles of the health behavior model and other empirical research findings on physical activity, weight management, and nutritional behaviors among young adults. The study revealed that demographic variables (specifically, age) significantly influenced health beliefs (ie, perceptions of vulnerability and severity). Age is a factor that contributes to people's perception of disease prevention. Increasing age is associated with an increased risk of disease occurrence and thus increased vigilance in disease prevention.[32,33] This is in accordance with the study findings that first-year students have low levels of physical activity when compared to second-year students.

Gender also plays a crucial role in influencing students' healthy lifestyles. Studies have shown that women are more likely than men to take steps to prevent disease. However, female students have lower activity levels and poorer diets. Based on research conducted in Singapore, female students have low levels of physical activity compared to men, with most of these women (73%) exercising less than three times per week.[34] Female students tend to consume salty foods such as chips and fatty foods compared to male students. This is influenced by fear of judgment, stereotypes, environment and feelings of inadequacy that women tend to have.[35] The student's country of origin is also related to healthy lifestyles. This is influenced by urbanization, gross domestic product per capita, human development index, culture related to eating behavior, health promotion policies, and advocacy in a country that contributes to the lifestyle of people in it.[36]

Other factors found in this present study are the mental well-being and sleep patterns of the university students. These factors are important to avoid stress and depression. A similar study conducted outside the ASEAN region at a university in the United Arab Emirates that employed the Systematic Assessment of Resilience (SAR) tool, which proved to be highly beneficial. The implementation of the Systematic Assessment of Resilience (SAR) has been demonstrated to enhance resilience and mitigate the incidence of depression. The SAR framework provides comprehensive guidance for fostering resilience and enhancing four key interventions: (1) self-regulation, which entails the ability to regulate one's behavior and cope with challenges; (2) Management, which describes the capacity of students to utilize available resources in an efficacious manner to overcome obstacles. (3) Engagement, which highlights the capacity of students to engage and commit to pursuing challenges with persistence; and (4) Growth, which reflects the sustained development of students to meet future challenges. Training sessions were conducted to familiarise participants with the utilization and implementation of the SAR framework. These sessions were completed before the commencement of the rotation as a pre-requisite for the online workshop, which lasted five hours.[37]

Despite these positive outcomes from specific interventions like SAR, a significant limitation in this review is the absence of interventions altogether. This is a significant limitation that warrants careful consideration. This gap may stem

from several underlying factors, including the nature of the research designs employed and the prevailing focus within the academic community. Many studies tend to prioritize descriptive or correlational research methods, which are essential for understanding phenomena but do not involve direct interventions. For instance, non-experimental designs, such as qualitative and descriptive studies, are often utilized to explore relationships among variables rather than to test specific interventions. However, this present study indicated that modelling knowledge, health beliefs, and health-promoting based on university policy implementation will benefit non communicable prevention among university students.

HUF AUN-HPN

The framework within the university environment about health is the Healthy University Framework (HUF). HUF represents a collaborative framework for promoting health within the university environment across the ASEAN region. HUF is divided into three principal categories of framework. Firstly, the systems and infrastructure are designed to create a healthy university. There are suggested elements for establish a healthy university framework, including: 1) University policies to promote health; 2) A healthy working environment, clean, and green environment; 3) Health promotion services, counselling, and advisory support; 4) Equal opportunities including disability friendly; 5) Health promotion curriculum and co-curriculum; 6) Capacity building on health promotion; 7) Health promotion research; 8) University Volunteerism; 9) Budgetary support for healthy university programs.[38]

Building upon this foundation, the second category encompasses thematic areas that include a zero-tolerance policy to address behaviors that detrimental to health. This thematic focus serves as a strategy to fulfill the criteria of a healthy university by promoting various health activities across universities in the ASEAN region.[38] The HUF employs a comprehensive approach encouraging all stakeholders within the university environment to share knowledge and expertise while ensuring equal rights in developing innovative solutions to regional health issues.

In addition to HUF, the ASEAN University Network (AUN) plays a critical role in facilitating knowledge sharing and collaboration among academic institutions in Southeast Asia. Higher Education Institutions (HEIs) will enable in creation of a place health promotion program that will help develop and build effectiveness and efficiency in three interrelated functions, namely education, research, and public service. Through AUN, University staff can review and maintain the condition of all individuals in university settings, including Pre-Recruitment Health Screening, Outreach Program, Fitness Program, NCD Monitoring and Risk Reduction, Promoting Non-Smoking, and Health/Social Counselling.[38] Campus health promotion initiatives are essential to building healthy universities with members who are effective in finding, sharing, and applying knowledge and skills for the benefit of people and society.

Moreover, the Health Promotion Network (HPN) is an integral component of AUN that focuses specifically on networking for health promotion in Southeast Asia. Consequently, the AUN-HPN represents a collaborative policy initiative between academic institutions and healthcare professionals to promote health and well-being to enhance the quality of life in the ASEAN region. This policy encompasses a range of activities, including research, health programs, health promotion strategies, and regional meetings that address the specific health needs and challenges within the region.

Implementing the Healthy University Framework involves several strategic steps that aim to create a healthy campus environment and support the well-being of students and staff. First, policy creation is an important first step, where commitment from university leaders is needed to agree and integrate health policies into the organizational culture. Once the policy is in place, various programs and activities can be launched, such as anti-smoking programs, alcohol-free initiatives, and health promotion that includes mental health education and physical activity.[38] The active involvement of students and staff in the planning and implementation of these programs is highly recommended to increase their effectiveness.

Finally, it is important to ensure that all such activities are outcome-based and regularly evaluated to achieve the key performance indicators set. The operational structure consists of several groups, including the Secretariat, Advisory Group, and Working Groups, each of which has a specific role in the implementation of this framework.[38] The Advisory Group serves to provide strategic direction, while the Working Groups are responsible for the implementation of particular programs in the health sector. This structured approach is expected to create a healthier campus environment that supports the well-being of the entire academic community (see Figure 2).

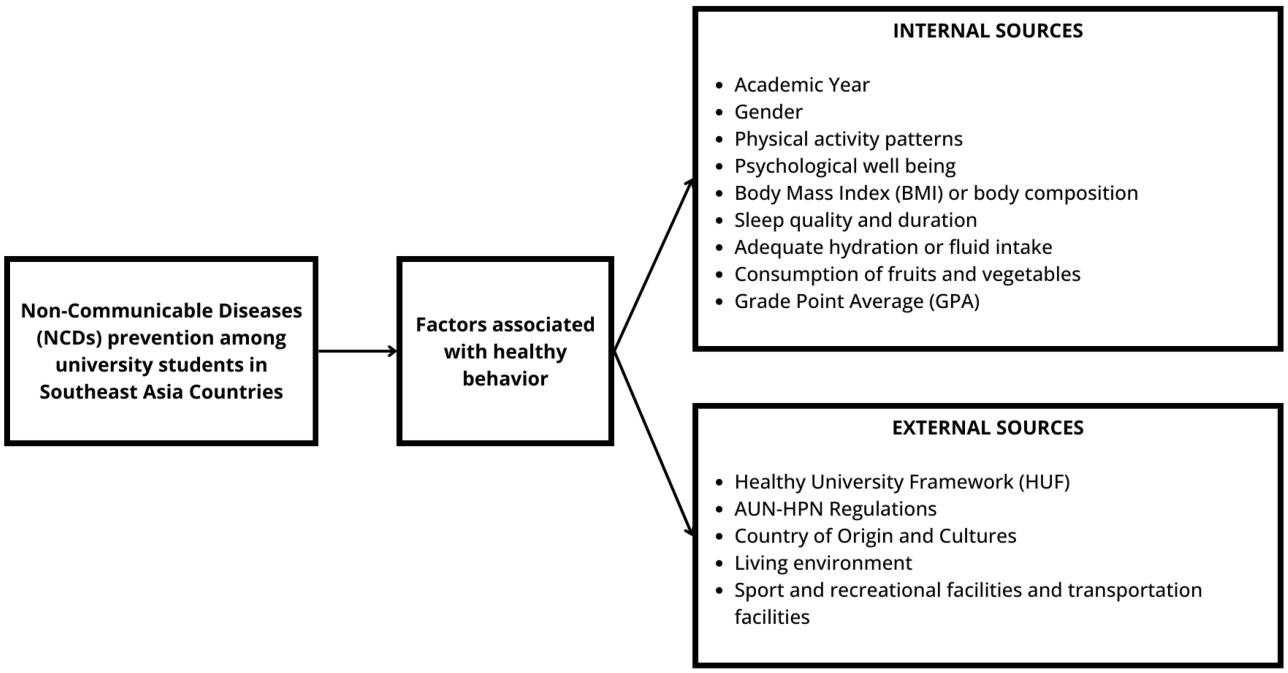

Figure 2 The framework of factors associated with NCDs in Southeast Asia Nation countries.
Notes: This figure presents the conceptual framework of factors influencing non-communicable diseases in Southeast Asian nations, including internal and external factors.

Strengths and Limitations

The article offers insights that may be pertinent to the Southeast Asian student population, which may exhibit distinctive characteristics compared to other regional student populations. By focusing on Southeast Asia, this article can examine the distinctive social, cultural, and economic factors present in each ASEAN member state. The findings of this study can be utilized by policymakers, educational institutions, and local organizations to develop policies that are more aligned with the needs of students in Southeast Asia.

However, it should be noted that the article is not without limitations. One significant limitation identified in this review is the absence of interventions across the studies analyzed. This lack of intervention-focused research restricts the understanding of practical applications and the potential effectiveness of various strategies in addressing the issues at hand. The absence of interventions means that while existing literature can be assessed for trends and outcomes, conclusions about actionable steps or best practices cannot be drawn based on this evidence. This gap highlights a critical area for future research, where studies incorporating specific interventions could provide valuable insights and contribute to a more comprehensive understanding of the topic.

As the review is limited to the Asian Southeast Asian region, the findings may not be applicable to other student populations in other regions. Readers from outside the region may therefore perceive the findings as less relevant. Moreover, the article does not examine studies that employ intervention, which may limit its ability to offer compelling evidence in support of proposed solutions.

Conclusions

This review examines the internal and external factors that influence healthy behavior among university students in ASEAN countries. A total 7 studies were included, highlighting key factors namely dietary habits, duration and quality of sleep, Body Mass Index (BMI), students' knowledge and perceptions, and the implementation of health frameworks within university environments. This illustrates the complexity of determinants of health behaviors. Four of the seven articles indicate that internal factors related to students' daily behavior significantly influence the risk of NCDs among university students. In contrast, three articles report that the risk of NCDs is influenced by a combination of internal and external factors. Moreover, this review revealed a significant correlation between healthy lifestyle practices and

psychological well-being among students, as well as their susceptibility to cardiovascular disease. Notably, one study identified three risk factors associated with an unhealthy lifestyle, which are sugar consumption, mental health challenges, and smoking. Specifically, 8482 respondents had high consumption of sugary beverages.

To effectively tackle these internal and external influences, it is imperative to implement efficacious interventions for the prevention and management of Non-communicable Diseases (NCDs) among university students. Universities should prioritize the integration of health education into their curricula, promote physical activity through campus initiatives, and enhance access to nutritious food options on campus. The implementation of a holistic health promotion strategy and the creation of a supportive environment at the university level hinges on the effective implementation of the HUF AUN-HPN. This framework also plays an important role in reducing the burden of noncommunicable diseases (NCDs) among young adults.

Building on the findings of this review, future studies could explore the combining interventions between increasing fruit and vegetable consumption with improving physical activity as part of an integrated NCD prevention program. Additionally, future studies might examine the feasibility, cultural adaptability, and long-term sustainability of such combination interventions, considering the diverse socio-economic and cultural settings in the region. In conclusion, ASEAN universities should take practical steps such as establishing partnerships with local health organizations, conducting regular health assessments for students, and fostering student-led health initiatives to effectively implement HUF and promote healthier lifestyle among students.

Ethical Approval

Not applicable. Although this study did not involve human or animal subjects, authors ensured that ethical standards were upheld throughout the research process. For instance, the literature review was conducted with integrity by accurately representing all data and ensuring proper citation of all sources to avoid plagiarism. Additionally, the selection of studies adhered strictly to the inclusion and exclusion criteria to maintain objectivity and transparency.

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Disclosure

The authors declare no conflicts of interest related to this work.

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