

Health-promoting lifestyle and influencing factors among students from different types of universities in Taiwan

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Objectives: University sees the transition from adolescence to adulthood and the development of habits. A health-promoting lifestyle (HPL) developed during this period may help individuals avoid chronic diseases in adulthood. This study discussed HPL and its influencing factors among students from different types of universities. **Methods:** Two-stage sampling was adopted. Firstly, universities were stratified and randomly selected according to the region, ownership, and orientation in Taiwan. Students were then randomly selected according to their respective school ID numbers, and completed self-administered questionnaires that covered personal factors, health-promoting lifestyle profile (HPLP-S), perceived health status (PHS), and health conception (HC). A total of 1,062 valid questionnaires were collected from 37 universities. **Results:** The score for students' HPLP-S was 3.34, above the midpoint. However, the scores for nutrition, exercise, and health responsibility subscales of HPLP-S were relatively low. Additionally, female students, low PHS scores, and low scores for the functional/role performance, eudaimonistic, and clinical subscales of HC were each associated with a negative HPLP-S of students from all types of universities. Low disposable income and night-snacking were factors that could be considered by public universities. Inadequate physical activity was factor that could be considered by private universities. Night-snacking was factor that could be considered by general universities. And inadequate physical activity and excessive dining-out were factors that could be considered by vocational colleges. **Conclusions:** We believe that it is vital to provide plans featuring correct diet combined with regular exercise to students with poor health-promoting behaviours to promote responsibility for their own health. (*Taiwan J Public Health*. 2022;**41**(3):312-330)

Key Words: university types, health-promoting lifestyle, gender, perceived health status, health conception

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Received: Dec 24, 2021
Accepted: Jun 10, 2022
DOI:10.6288/TJPH.202206_41(3).110153



INTRODUCTIONS

With improvements in environmental health and medical standards, the global average life expectancy in 2019 reached 73.4 years, while the average healthy life expectancy (years without chronic diseases or disability) was only 63.7 years. The increase

in average healthy life expectancy during the past 10 years was less than that of the average life expectancy. Therefore, the World Health Organization (WHO) stated that while the death rate has declined, the incidence of chronic diseases and disability has increased [1]. In Taiwan, the Directorate General of Budget, Accounting and Statistics published that the average life expectancy and healthy life expectancy in 2018 were 80.7 years and 72.3 years, respectively, suggesting that people may spend approximately 8.4 years with unhealthy conditions during old age [2]. At the end of the 20th century, the disease types have changed from communicable diseases or malnutrition to noncommunicable chronic diseases, which accounted for eight of the top 10 causes of death in Taiwan [3]. Although chronic diseases are usually not immediately fatal upon diagnosis, they undoubtedly reduce quality of life and may lead to incapacity or become life threatening if not properly managed. Therefore, as life expectancy increases, reducing the incidence of chronic diseases and increasing healthy years have become more important.

Inappropriate, long-term habits and health behaviours are known causes of chronic diseases [4]. Research has shown that health risk behaviours such as smoking and alcohol consumption not only increase the incidence of chronic diseases and medication use, but also affect individuals' daily activities and perceived health status (PHS) [5]. Another study noted that dietary habits and a sedentary lifestyle easily lead to obesity and contribute to increased incidences and mortality of chronic diseases, while appropriate public health strategies could promote the health status of the public and reduce healthcare expenditure [6]. 'Health behaviour' is defined as activities taken by an individual who believe them to be healthy for disease prevention or early detection in order to stay healthy or avoid diseases [7].

Health behaviours could be categorised into 'disease prevention', which aims to reduce health risk behaviours, and 'health promotion', which establishes positive and beneficial health behaviours [8]. A health-promoting lifestyle (HPL) may be seen as a positive lifestyle, which consists of health-promoting behaviours such as self-actualisation, health responsibility, exercise, nutrition, interpersonal support, and stress management that helps individuals to become healthy through a positive attitude instead of negatively avoiding diseases or health issues [9,10]. Recent studies have shown that health status is positively correlated with lifestyle and that an HPL helps to improve suboptimal health status [11].

Health-promoting activities or lifestyles have been shown to be influenced by cognitive-perceptual factors and modifying factors, where cognitive-perceptual factors are the main motivations for adopting or maintaining health-promoting behaviours, including health definition, PHS, self-efficacy, perceived benefits, and perceived barriers, etc. Recent studies have shown that health conception (HC) is viewed as an individual's definition of health, with the higher the HC, the more positive the relative health-promoting behaviour [12,13]. Meanwhile, PHS is also considered to have a positive impact on health-promoting behaviours and lifestyle, and to be a predictor of whether an individual would adopt health-promoting behaviours or further develop an HPL [13-16]. In addition, modifying factors may contribute to health-promoting behaviours through cognitive-perception factors, including demographic characteristics, biological characteristics, and interpersonal influences. Studies have shown that demographic characteristics or health-related information, including gender, age, profession, residential status, work status, contact duration of health information, duration of physical activities, sleep problem, nutrition

style, and body mass index (BMI), may predict the development of an HPL along with cognitive-perception factors [13,14,16,17].

Universities see the transition from adolescence to adulthood. The age of 18–25 years is considered as ‘emerging adulthood’, a critical period for behavioural development [18]. A healthy lifestyle developed during this period may reduce the incidence of suboptimal health status and delay the onset of chronic diseases [19]. Currently, it is believed that health-promoting universities are of great importance in improving the health and wellness of the population [20]. However, universities are a critical turning point in the academic life of students. After entering university from high school, significant changes take place in terms of study and general environment, leading to not only a higher degree of autonomy and freedom in students’ lives and behaviours, but also a more diverse interpersonal and objective environment, which makes the development of healthy behaviours even more difficult. Research has shown that dietary habits and drug use among university students in Taiwan is worse than that of high school students [21]. Students might feel stressed during the transitional period from high school to university, and students with higher perceived pressure levels exhibit more unhealthy dietary behaviours [22]. In summary, with the increase in age and pressure levels, if students are unable to modify their health-promoting behaviours and form an HPL during university, health issues may arise earlier than expected during adulthood.

Multiple current large-scale studies on HPL in different countries have shown that university students generally behave positively towards self-actualisation and interpersonal support, while behaviours regarding stress management, nutrition, exercise, and health responsibility require further improvement

[11,17,23,24]. Surveys on HPL among university students in Taiwan also suggested similar results [15,25,26]. The study showed that in terms of influencing factors, the HPL of nursing students in three universities in South Korea might be affected by their gender, PHS, and HC [16]. Whereas another study reported that the HPL of first-year students at a psychology school in Mexico was predicted by gender, socioeconomic level, and parents’ education [24]. Research has also found that different schools of university, grades, exercise habits, residential places, receiving health education lessons, and PHS might predict the HPL of students in a university in Turkey [14]. Taiwanese scholars have conducted research on six universities in Taichung, finding that students who had taken healthcare courses, had lesser psychological distress, had better PHS, and often attended morning courses, tended to reflect better HPL [15]. Most of the above studies only focused on a single university or a few universities in a specific area of research, and the current status and influencing factors of university students’ HPL varied with the research design and included variables; hence, their inference is limited, and there is a lack of comparability among the research results.

In addition, the Ministry of Education in Taiwan has classified universities and colleges into public and private institutions based on the ownership [27]. Both the number of students and tuition fees at private universities are more than twice that of public universities [28]. Research has also shown that the socio-economic status of private university students in Taiwan is lower than that of public university students, which is largely different from that of European countries and America [29]. On the other hand, universities and colleges in Taiwan could be divided into general universities and vocational colleges based on their educational goals [27]. General

university education is commonly believed to emphasise scientific logic and advocate education before employment, while vocational college education emphasises the application of technology, and advocates employment before continuing education [30]. Accordingly, students from different types of universities and colleges have differences in their daily routines, financial burdens, and learning methods. However, few studies have investigated whether this difference also leads to different current status and predictors of HPL.

Therefore, this study focused on the main island of Taiwan, and firstly stratified its universities and colleges according to the school ownership or educational orientation, and then investigated the status of the HPL of students from different types of universities. This study discussed how the PHS and HC among the cognitive-perceptual factors as well as the personal factors (including socio-demographics and health-related information) among the modifying factors vary in their HPL, which might elucidate the predictors of HPL among students from different types of universities. In this way, it provides a detailed understanding of the target and the direction of health education for those who have poor health behaviours and urgently require priority intervention, in order to propose university hygiene and health-promoting education suggestions suited to the times that are customised to meet the needs of different universities.

MATERIALS AND METHODS

Design and Participants

This quantitative study adopted cross-sectional questionnaires to discuss the association between personal factors, HPL, PHS, and HC to further elucidate the possible predictors of HPL among university students. The participants included students from

different universities and colleges on the main island of Taiwan. In this study, a pre-test and a formal survey were conducted, with unrepeated participants in the two surveys. A pre-test was conducted to validate the reliability and validity of the study instrument. A total of 403 participants were selected by convenience sampling from August 2020 to September 2020 to complete the pre-test self-administered questionnaire, and 400 valid responses were collected with an effective rate of 99.3%. To explore whether HPL varied among different regions or institution types, this study firstly stratified the universities in Taiwan by ratio of the region and institution types. Taiwan is divided into northern, central, southern, and eastern regions according to the urban and regional development by the National Development Council [31]. In addition, the Ministry of Education in Taiwan has classified universities and colleges into public and private institutions, and divided them into general universities and vocational colleges based on their educational goals [27]. The formal survey adopted a two-stage sampling, where 37 out of 140 universities/colleges were selected by stratified random sampling first, followed by a random sampling based on the student ID number in each university or college to find participants to complete the paper-and-pencil self-administered questionnaire from November 2020 to March 2021. If the selected students did not attend school or did not consent to be tested, the students were sampled again as substitute samples, with a target of collecting 25 to 30 samples from each university. A total of 1,076 formal questionnaires were collected, and 1,062 valid responses were recovered, giving an effective rate of 98.7%.

Instruments

The personal factors in this study referred

to related research [13, 14, 16, 17] and included socio-demographics such as gender, institution region, institution ownership, institution orientation, grade, residential status, and monthly disposable income, as well as health-related information such as BMI, daily duration of sleep, daily duration of 3C (computer, communication, and consumer electronics) usage, weekly duration of physical activity, weekly number of dine-outs, and weekly number of night snacks.

The original health-promoting lifestyle profile (HPLP) [9] was translated into Chinese [32] and simplified to 24 questions [33]. In this study, HPL was assessed using the simplified version of the HPLP (HPLP-S), which included six subscales: self-actualisation which measures attitudes and expectations from life; health responsibility which assesses paying attention to one's own health and seeking professional assistance when necessary; exercise which is concerned with patterns of sport and leisure activity; nutrition which measures food choices and diet patterns; interpersonal support which assesses development of social support systems and relationship with others; and stress management which is concerned with ways to relax and cope stress [33]. A five-point Likert scale was used for scoring, ranging from 'never' to 'always'. A higher average score indicated a lifestyle closer to the ideal condition for health promotion. The Cronbach's alpha of this scale was 0.93 in this study, indicating high reliability. In addition, factor analysis was used to validate that this scale contained these six factors: self-actualization, health responsibility, exercise, nutrition, interpersonal support, and stress management. The factor loadings were 0.799-0.837, 0.710-0.826, 0.657-0.850, 0.762-0.884, 0.807-0.846, 0.741-0.809, which cumulatively explained 77.281% of the total variance, and demonstrated good scale validity.

PHS refers to an individual's subjective assessment of their overall health. In this study, PHS was measured using a scale that included four items (i.e., "How do you rate your overall health status?", "How do you rate your health status compared with peers?", "How do you rate your health status compared with yourself half a year ago?", "How do you rate your health status compared with ideal well-being?") [13]. A five-point Likert scale was adopted to denote the scores, ranging from 'very bad' to 'very good'. A higher average score suggested a better subjective judgment of the individual's health status. Cronbach's alpha for this scale was 0.90, suggesting high reliability.

HC refers to individual perceptions of the meaning of health. In this study, HC was assessed using the scale developed by Laffrey [34]. The scale was translated into Chinese and simplified to 24 questions [32]. The scale consists of four subscales: functional/role performance which measures capacity to carry out social roles in a satisfactory manner; adaptive which assesses ability to adjust to life situations; clinical which is related to medical identification of disease, illness, or symptoms; and eudaimonistic which is concerned with exuberant well-being. The responses were scored using a five-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'. A higher average score indicated a more positive HC. The Cronbach's alpha of this scale was 0.94 in this study, demonstrating high reliability. Additionally, factor analysis was used to validate that this scale contained these four factors: functional/role performance, adaptive, clinical, and eudaimonistic. The factor loadings were 0.430-0.850, 0.667-0.846, 0.827-0.870, and 0.432-0.778, which cumulatively explained 70.982% of the total variance, and indicated good scale validity.

Ethics

This study complied with the Declaration of Helsinki and was reviewed and approved by the Behavioural and Social Science Research Ethics Committee of National Taiwan University (202004ES028). The interviewer explained to the participants the purpose, process, benefits, and potential risks of the study in detail so that they could decide whether to participate or withdraw from the research at any time. Participants signed informed consent forms before the survey was administered. Furthermore, the entire study process was conducted using an anonymous self-administered questionnaire. Interviewers could only explain the meaning of the questions when necessary and did not interfere with or guide the participants in completing their responses.

Data Analysis

Data were analysed using IBM SPSS 23.0. For descriptive statistics, percentages were used to present the distribution of personal factors, while the mean and standard values were calculated to present the HPLP-S, PHS, and HC. For inferential statistics, an independent *t*-test or one-way ANOVA combined with a Scheffé post-hoc test was conducted to explore the relationship between personal factors and HPLP-S, PHS, and HC. Pearson's correlation coefficient was used to analyse the correlation between HPLP-S, PHS, and HC. In addition, a multiple regression analysis was used to explore the possible influencing factors of HPLP-S among university students. For all samples, The HPLP-S score was used as the dependent variable, and 28 variables were used as the independent variables, which consisted of 13 personal variables that were transformed into 23 dummy variables and the PHS and

HC subscale scores. For the samples that were stratified by school ownership or educational orientation, institution-owned variable or institution-oriented variable were removed from the independent variables, respectively. A stepwise regression analysis was performed using an inclusion criterion of 0.05 and an exclusion criterion of 0.10. Differences were considered significant at $p < 0.05$.

RESULTS

Personal factors

A total of 1,062 university students in Taiwan were enrolled in this study, and their personal factors are shown in Table 1. Of the students, 58.1% were women, and 59.3% were lower-division students (freshmen and sophomore). In terms of institution region and type, most students (42.3%) were from the northern region, approximately two-thirds of the students (68.7%) were from private universities, and over half (53.1%) were from vocational colleges. The ratios of the above-mentioned regions and types of institutions were similar to the distribution of university students in Taiwan. Over one-third of the students (36.2%) lived with their relatives. More than 80% of the students had a monthly disposable income of 15,000 TWD or less. With regards to health-related information, most students (61.2%) had a healthy body weight ($BMI = 18.5-23.9$), followed by overweight or obese students ($BMI \geq 24.0$) at 21.5%. Moreover, 46.0% of the students slept for less than seven hours every day, 54.0% of them used 3C for six hours or more daily, and 45.0% of them had a weekly physical activity duration of 75 min or less. In terms of eating behaviours, 50.3% of the students dined out 15 times or more per week, and 40.8% of them had night snacks four times or more weekly.

Table 1. Personal factors of university students (n = 1,062)

Socio-demographics	n	%	health-related information	n	%
Gender			BMI (Kg/m ²)		
Male	445	41.9	< 18.5	184	17.3
Female	617	58.1	18.5–23.9	650	61.2
Institution region			≥ 24.0	228	21.5
Northern	449	42.3	Daily duration of sleep		
Central	251	23.6	< 4 h	57	5.4
Southern	306	28.8	4–6.9 h	431	40.6
Eastern	56	5.3	≥ 7 h	574	54.0
Institution ownership			Daily duration of 3C usage		
Public	332	31.3	< 3 h	126	11.9
Private	730	68.7	3–5.9 h	362	34.1
Institution orientation			≥ 6 h	574	54.0
General universities	498	46.9	Weekly duration of physical activity		
Vocational colleges	564	53.1	≤ 75 min	478	45.0
Grade			76–150 min	344	32.4
Lower-division	630	59.3	≥ 151 min	240	22.6
Upper-division	432	40.7	Weekly number of dine-outs		
Residential status			None	20	1.9
With relatives	384	36.2	1–14 times	508	47.8
On-campus	337	31.7	≥ 15 times	534	50.3
Off-campus	341	32.1	Weekly number of night snacks		
Monthly disposable income			None	228	21.5
≤ 10,000 TWD	601	56.6	1–3 times	401	37.7
10,001–15,000 TWD	261	24.6	≥ 4 times	433	40.8
≥ 15,001 TWD	200	18.8			

Current Status of HPLP-S

The average score for overall HPLP-S was 3.34 ± 0.68 . The interpersonal support subscale had the highest score of 3.59, followed by 3.56 for the self-actualisation subscale, 3.48 for the stress management subscale, and 3.24 for the nutrition subscale. The exercise and health responsibility subscales had the lowest scores of 3.09 and 3.07, respectively.

Association Between personal factors and HPLP-S, PHS, and HC

The differences in the subjects' HPLP-S according to personal factors are shown in Table 2. The overall HPLP-S scores

significantly differed between genders ($p < 0.001$), monthly disposable income ($p = 0.005$), daily sleep duration ($p < 0.001$), and weekly physical activity duration ($p < 0.001$). Among them, males, those with a monthly income of more than 15,000 TWD, those who slept four hours or more per day, and those who exercised more than 75 min per week showed significantly higher overall HPLP-S scores.

In terms of the HPLP-S subscales, the self-actualisation scores were significantly higher in those from institutions in the eastern region ($p = 0.008$), those with a healthy weight ($p = 0.004$), those who slept four hours or more per day ($p = 0.001$), and those who exercised more than 75 min per week ($p < 0.001$).

Table 2. Comparing overall and subscales scores of HPLP-S by personal factors (n = 1,062)

Variables	overall HPLP-S	Self- actualisation	Health responsibility	Exercise	Nutrition	Interpersonal support	Stress management
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Gender							
Male	3.44 (0.73)	3.62 (0.83)	3.23 (0.94)	3.29 (0.92)	3.35 (0.84)	3.58 (0.82)	3.56 (0.82)
Female	3.27 (0.64)	3.53 (0.80)	2.96 (0.91)	2.95 (0.92)	3.16 (0.87)	3.59 (0.74)	3.43 (0.76)
p-value	<0.001	0.062	<0.001	<0.001	<0.001	0.847	0.008
Institution region							
Northern	3.35 (0.66)	3.51 (0.81) ^b	3.08 (0.91)	3.17 (0.86)	3.30 (0.84)	3.56 (0.76)	3.46 (0.77)
Central	3.32 (0.70)	3.65 (0.80) ^{ab}	3.07 (0.95)	2.94 (1.03)	3.15 (0.90)	3.63 (0.79)	3.51 (0.78)
Southern	3.31 (0.69)	3.53 (0.83) ^b	3.04 (0.94)	3.08 (0.93)	3.20 (0.87)	3.56 (0.76)	3.47 (0.81)
Eastern	3.49 (0.75)	3.83 (0.81) ^a	3.20 (1.02)	3.16 (1.03)	3.34 (0.85)	3.77 (0.87)	3.63 (0.85)
p-value	0.352	0.008	0.674	0.189	0.101	0.181	0.424
Institution ownership							
Public	3.33 (0.67)	3.59 (0.81)	2.90 (0.96)	3.08 (0.94)	3.24 (0.86)	3.66 (0.75)	3.51 (0.74)
Private	3.34 (0.69)	3.55 (0.82)	3.15 (0.91)	3.10 (0.93)	3.23 (0.87)	3.55 (0.78)	3.47 (0.81)
p-value	0.779	0.490	<0.001	0.785	0.831	0.046	0.433
Institution orientation							
General universities	3.31 (0.60)	3.54 (0.77)	2.92 (0.90)	3.08 (0.87)	3.25 (0.79)	3.62 (0.71)	3.46 (0.72)
Vocational colleges	3.36 (0.75)	3.59 (0.85)	3.21 (0.94)	3.10 (0.98)	3.23 (0.92)	3.56 (0.83)	3.50 (0.85)
p-value	0.204	0.297	<0.001	0.822	0.678	0.194	0.350
Grade							
Lower-division	3.32 (0.68)	3.55 (0.80)	3.04 (0.94)	3.07 (0.93)	3.18 (0.90)	3.57 (0.78)	3.48 (0.77)
Upper-division	3.37 (0.69)	3.59 (0.84)	3.11 (0.92)	3.11 (0.93)	3.32 (0.81)	3.61 (0.77)	3.48 (0.82)
p-value	0.205	0.420	0.247	0.488	0.011	0.458	0.957
Monthly disposable income							
≤ 10,000 TWD	3.30 (0.72) ^b	3.54 (0.84)	3.00 (0.96) ^b	3.03 (0.95) ^b	3.21 (0.90)	3.58 (0.82)	3.45 (0.84)
10,001–15,000 TWD	3.31 (0.59) ^b	3.57 (0.75)	3.06 (0.87) ^b	3.06 (0.90) ^b	3.19 (0.78)	3.53 (0.66)	3.46 (0.67)
≥ 15,001 TWD	3.48 (0.68) ^a	3.62 (0.82)	3.32 (0.89) ^a	3.31 (0.91) ^a	3.37 (0.85)	3.67 (0.77)	3.60 (0.77)
p-value	0.005	0.556	<0.001	0.001	0.054	0.161	0.068
BMI (Kg/m ²)							
< 18.5	3.33 (0.68)	3.53 (0.83) ^{ab}	3.05 (0.94)	2.98 (0.99)	3.24 (0.84)	3.66 (0.77) ^a	3.52 (0.77)
18.5–23.9	3.37 (0.66)	3.63 (0.78) ^a	3.07 (0.94)	3.13 (0.92)	3.26 (0.86)	3.61 (0.75) ^{ab}	3.50 (0.78)
≥ 24.0	3.27 (0.73)	3.42 (0.88) ^b	3.09 (0.91)	3.06 (0.93)	3.15 (0.90)	3.48 (0.85) ^b	3.41 (0.82)
p-value	0.170	0.004	0.905	0.138	0.243	0.041	0.242
Daily duration of sleep							
< 4 h	2.98 (0.85) ^b	3.24 (1.03) ^b	2.95 (0.99)	2.81 (1.11) ^b	2.75 (1.11) ^c	3.08 (1.11) ^b	3.06 (1.01) ^b
4–6.9 h	3.26 (0.63) ^a	3.53 (0.77) ^a	2.99 (0.90)	2.99 (0.89) ^{ab}	3.11 (0.86) ^b	3.53 (0.72) ^a	3.39 (0.74) ^a
≥ 7 h	3.44 (0.68) ^a	3.63 (0.81) ^a	3.15 (0.95)	3.19 (0.93) ^a	3.38 (0.81) ^a	3.68 (0.75) ^a	3.59 (0.78) ^a
p-value	<0.001	0.001	0.219	<0.001	<0.001	<0.001	<0.001
Weekly duration of physical activity							
≤ 75 min	3.19 (0.73) ^b	3.45 (0.85) ^b	2.98 (0.97)	2.79 (0.99) ^c	3.10 (0.89) ^b	3.48 (0.83) ^b	3.34 (0.84) ^b
76–150 min	3.42 (0.59) ^a	3.65 (0.74) ^a	3.15 (0.89)	3.18 (0.78) ^b	3.34 (0.79) ^a	3.62 (0.69) ^{ab}	3.55 (0.69) ^a
≥ 151 min	3.52 (0.66) ^a	3.67 (0.83) ^a	3.14 (0.91)	3.56 (0.80) ^a	3.35 (0.87) ^a	3.75 (0.75) ^a	3.66 (0.77) ^a
p-value	<0.001	<0.001	0.071	<0.001	<0.001	<0.001	<0.001
Weekly number of night snacks							
None	3.35 (0.70)	3.56 (0.83)	3.03 (0.95)	3.13 (0.97) ^{ab}	3.31 (0.88)	3.56 (0.80)	3.49 (0.86)
1–3 times	3.31 (0.66)	3.59 (0.83)	3.01 (0.94)	2.96 (0.93) ^b	3.21 (0.84)	3.62 (0.74)	3.43 (0.75)
≥ 4 times	3.37 (0.69)	3.55 (0.80)	3.15 (0.91)	3.19 (0.91) ^a	3.22 (0.88)	3.57 (0.79)	3.52 (0.78)
p-value	0.435	0.761	0.095	0.001	0.378	0.548	0.273

Note: Independent *t*-test for dichotomized variables and ANOVA combined with a Scheffé post-hoc test for variables with more than two categories. *p* < 0.05 are marked in bold letters. Values with different superscript letters in variables with more than two categories indicate significant difference.

The health responsibility subscale scores were significantly higher in men ($p < 0.001$), those from private universities ($p < 0.001$) and vocational colleges ($p < 0.001$), and those with a monthly income of more than 15,000 TWD ($p < 0.001$).

The exercise subscale scores were significantly higher in men ($p < 0.001$), those with a monthly income of more than 15,000 TWD ($p = 0.001$), those who slept seven hours or more per day ($p < 0.001$), those who exercised more than 75 min per week ($p < 0.001$), and those who had night snacks four times or more per week ($p = 0.001$).

The nutrition subscale scores were significantly higher in men ($p < 0.001$), those in the upper division ($p = 0.011$), those who slept four hours or more per day ($p < 0.001$), and those who exercised more than 75 min per week ($p < 0.001$).

The interpersonal support subscale scores were significantly higher in those from public universities ($p = 0.046$), those who were underweight ($p = 0.041$), those who slept four hours or more per day ($p < 0.001$), and those who exercised more than 150 min per week ($p < 0.001$).

The stress management subscale scores were significantly higher in men ($p = 0.008$), those who slept four hours or more per day ($p < 0.001$), and those who exercised more than 75 min per week ($p < 0.001$).

In addition, the differences in the subjects' PHS and HC according to personal factors are shown in Table 3. The PHS scores were significantly higher in men ($p = 0.043$), those from institutions in the eastern region ($p = 0.006$), those from vocational colleges ($p = 0.031$), those who had on-campus accommodation ($p = 0.017$), those with a monthly income of more than 15,000 TWD ($p < 0.001$), those who slept four hours or more daily ($p < 0.001$), and those who exercised

more than 75 min weekly ($p < 0.001$).

The overall HC scores were significantly higher in those from institutions in the eastern and central regions ($p < 0.001$), those from public universities ($p = 0.020$), those in the upper division (junior and senior) ($p = 0.038$), those who slept four hours or more daily ($p < 0.001$), those who exercised more than 150 min weekly ($p = 0.030$), and those who dined out ($p < 0.001$).

Influencing Factors of HPLP-S

Pearson's product-moment correlation was analysed between the HPLP-S, PHS, and HC, as shown in Table 4. The PHS score showed a significant positive correlation with the overall HPLP-S score ($r = 0.484$, $p < 0.001$) and each subscale of the HPLP-S ($r = 0.351$ – 0.418 , $p < 0.001$). In addition, a significant positive correlation was found between the overall HC score and overall HPLP-S score ($r = 0.580$, $p < 0.001$). The scores for functional/role performance, adaptive, clinical, and eudaimonistic subscales of HC also showed a significant positive correlation with all HPLP-S subscales ($r = 0.235$ – 0.561 , $p < 0.001$).

A stepwise multiple regression was used to analyse the predictors of HPLP-S. All samples were analysed in advance (data not shown). The results showed that male students, and those who exercised more than 75 min weekly, those who dined out less than 15 times weekly, those who had high scores for PHS, and those who had high scores for functional/role performance, clinical, and eudaimonistic subscales of HC had significantly better HPLP-S, which explained 47.7% of the variance (adjusted $R^2 = 0.477$).

After stratification according to the school ownership or educational orientation, a stepwise multiple regression was used to further analyse the predictors of HPLP-S among

Table 3. Comparing scores of PHS and HC by personal factors (n =1,062)

Variables	PHS		HC	
	Mean (SD)	p-value	Mean (SD)	p-value
Gender				
Male	3.36 (0.91)	0.043	3.85 (0.65)	0.625
Female	3.24 (0.96)		3.87 (0.59)	
Institution region				
Northern	3.35 (0.88) ^{ab}	0.006	3.74 (0.63) ^c	<0.001
Central	3.21 (1.01) ^b		3.96 (0.55) ^{ab}	
Southern	3.21 (0.94) ^b		3.90 (0.62) ^{bc}	
Eastern	3.62 (1.05) ^a		4.11 (0.60) ^a	
Institution ownership				
Public	3.26 (0.97)	0.405	3.92 (0.59)	0.020
Private	3.31 (0.93)		3.83 (0.63)	
Institution orientation				
General universities	3.23 (0.92)	0.031	3.82 (0.57)	0.087
Vocational colleges	3.35 (0.96)		3.89 (0.66)	
Grade				
Lower-division	3.29 (0.95)	0.909	3.83 (0.62)	0.038
Upper-division	3.30 (0.93)		3.91 (0.61)	
Residential status				
With relatives	3.33 (0.89) ^{ab}	0.017	3.81 (0.66)	0.075
On-campus	3.37 (0.94) ^a		3.87 (0.60)	
Off-campus	3.18 (0.99) ^b		3.91 (0.58)	
Monthly disposable income				
≤ 10,000 TWD	3.23 (0.97) ^b	<0.001	3.89 (0.63)	0.073
10,001–15,000 TWD	3.28 (0.88) ^b		3.79 (0.58)	
≥ 15,001 TWD	3.52 (0.92) ^a		3.86 (0.61)	
Daily duration of sleep				
< 4 h	2.77 (1.03) ^c	<0.001	3.52 (0.77) ^b	<0.001
4–6.9 h	3.11 (0.93) ^b		3.82 (0.59) ^a	
≥ 7 h	3.48 (0.90) ^a		3.92 (0.61) ^a	
Weekly duration of physical activity				
≤ 75 min	3.17 (0.97) ^b	<0.001	3.82 (0.65) ^b	0.030
76–150 min	3.36 (0.91) ^a		3.84 (0.58) ^{ab}	
≥ 151 min	3.46 (0.91) ^a		3.95 (0.60) ^a	
Weekly number of dine-outs				
None	3.33 (0.96)	0.095	3.30 (0.87) ^b	<0.001
1–14 times	3.36 (0.91)		3.86 (0.61) ^a	
≥ 15 times	3.23 (0.97)		3.87 (0.60) ^a	

Note: Independent *t*-test for dichotomized variables and ANOVA combined with a Scheffé post-hoc test for variables with more than two categories. *p* < 0.05 are marked in bold letters. Values with different superscript letters in variables with more than two categories indicate significant difference.

Table 4. Pearson's correlation coefficient for the correlation between HPLP-S, PHS, and HC (n = 1,062)

Variables	overall HPLP-S	Self- actualisation	Health responsibility	Exercise	Nutrition	Interpersonal support	Stress management
	<i>r</i> (p-value)	<i>r</i> (p-value)	<i>r</i> (p-value)	<i>r</i> (p-value)	<i>r</i> (p-value)	<i>r</i> (p-value)	<i>r</i> (p-value)
PHS	0.484 (<0.001)	0.418 (<0.001)	0.386 (<0.001)	0.351 (<0.001)	0.414 (<0.001)	0.354 (<0.001)	0.413 (<0.001)
HC	0.580 (<0.001)	0.602 (<0.001)	0.430 (<0.001)	0.357 (<0.001)	0.401 (<0.001)	0.510 (<0.001)	0.522 (<0.001)
Functional/role performance	0.500 (<0.001)	0.541 (<0.001)	0.346 (<0.001)	0.298 (<0.001)	0.358 (<0.001)	0.447 (<0.001)	0.448 (<0.001)
Adaptive	0.447 (<0.001)	0.519 (<0.001)	0.277 (<0.001)	0.235 (<0.001)	0.288 (<0.001)	0.429 (<0.001)	0.443 (<0.001)
Clinical	0.398 (<0.001)	0.325 (<0.001)	0.357 (<0.001)	0.302 (<0.001)	0.289 (<0.001)	0.314 (<0.001)	0.329 (<0.001)
Eudaimonic	0.531 (<0.001)	0.561 (<0.001)	0.417 (<0.001)	0.317 (<0.001)	0.362 (<0.001)	0.457 (<0.001)	0.463 (<0.001)

Note: Significance level was set at $p < 0.05$.

students from different types of universities, as shown in Table 5. In the public universities, the male students, those with a monthly income of more than 15,000 TWD, those who had no night snacks weekly, those who had high scores for PHS, and those who had high scores for functional/role performance and eudaimonic subscales of HC had significantly better HPLP-S, which explained 50.9% of the variance (adjusted $R^2 = 0.509$). In the private universities, the male students, those who exercised more than 75 min weekly, those who had high scores for PHS, and those who had high scores for functional/role performance, clinical, and eudaimonic subscales of HC had significantly better HPLP-S, which explained 45.8% of the variance (adjusted $R^2 = 0.458$).

Furthermore, in the general universities, the male students, those who had no night snacks weekly, those who had high scores for PHS, and those who had high scores for functional/role performance, clinical, and eudaimonic subscales of HC had significantly better HPLP-S, which explained 46.5% of

the variance (adjusted $R^2 = 0.465$). In the vocational colleges, the male students, those who exercised more than 75 min weekly, those who dined out less than 15 times weekly, those who had high scores for PHS, and those who had high scores for functional/role performance, clinical, and eudaimonic subscales of HC led to significantly more positive HPLP-S, which explained 47.6% of the variance (adjusted $R^2 = 0.476$).

DISCUSSIONS

According to the Nutrition and Health Survey in Taiwan 2013–2016, underweight adults ranging from ages 19 to 44 and ages 45 to 64 accounted for 7.7% and 3.2% of the total, respectively [35]. Whereas, overweight/obese adults ranging from ages 19 to 44 and ages 45 to 64 accounted for 37.3% and 50.9% of the total, respectively, in the same survey [35]. In this study, more underweight (17.3%) students and fewer overweight/obese students (21.5%) were seen, but the increase in body weight with age requires attention in the future. In addition,

Table 5. Multiple regression analysis for factors associated with HPLP-S among students at different types of university (n = 1,062)

Factors	Institution ownership						Institution orientation					
	Public universities (n = 332)			Private universities (n = 730)			General universities (n = 498)			Vocational colleges (n = 564)		
	B	SE	p	B	SE	p	B	SE	p	B	SE	p
(Constant)	0.901		<0.001	0.524		<0.001	0.805		<0.001	0.367		0.009
Personal factors												
Male	0.156	0.118	0.003	0.129	0.092	0.001	0.174	0.144	<0.001	0.112	0.075	0.018
Monthly income ≤ 10,000 TWD	-0.289	-0.209	<0.001									
Monthly income 10,001–15,000 TWD	-0.226	-0.142	0.014									
Weekly none night snacks	0.169	0.102	0.010				0.107	0.071	0.038			
Weekly physical activity 76–150 min				0.165	0.114	<0.001				0.193	0.120	<0.001
Weekly physical activity ≥ 151 min				0.214	0.122	<0.001				0.219	0.116	<0.001
Weekly none dine-outs										0.352	0.075	0.018
Weekly 1–14 times dine-outs										0.103	0.070	0.026
PHS	0.227	0.335	<0.001	0.214	0.292	<0.001	0.221	0.341	<0.001	0.203	0.265	<0.001
HC												
Functional/role performance	0.186	0.185	<0.001	0.223	0.235	<0.001	0.175	0.192	<0.001	0.245	0.246	<0.001
Clinical				0.092	0.127	<0.001	0.054	0.086	0.024	0.094	0.124	0.002
Eudaimonistic	0.276	0.307	<0.001	0.203	0.227	<0.001	0.227	0.268	<0.001	0.209	0.226	<0.001
R	0.721			0.681						0.687		0.696
R ²	0.519			0.463						0.472		0.485
Adjusted R ²	0.509			0.458						0.465		0.476
F (p-value)	49.833 (<0.001)			88.739 (<0.001)			62.561 (<0.001)			57.717 (<0.001)		

Note: An inclusion criterion of 0.05 and an exclusion criterion of 0.10 were adopted to perform the stepwise multiple regression analysis. Significance level was set at $p < 0.05$.

university students with daily 3C usage exceeding six hours reached 54.0%, while only 22.6% had weekly physical activity reaching 150 min, as recommended by the WHO, suggesting that they had become accustomed to a sedentary lifestyle. The US Centres for Disease Control and Prevention suggested that adults should sleep seven hours or more per day [36]. However, in this study, 46.0% of the students reported sleeping for less than seven hours per day. Research has also shown that the frequent use of products such as smartphones and computers increases sedentary behaviour, and that a high BMI combined with sedentary behaviours leads to shorter sleep duration and lower sleep efficiency [37]. In this study, only 1.9% of students did not dine out and 50.3% dined out for more than two meals per day, while only 21.5% did not develop the habit of night snacking. These dietary habits might be related to the fact that 63.8% of students lived on campus or rented an apartment off campus. A recent study reported that students who live away from home dine out frequently, and that those who dine out frequently are more likely to have night snacks [38]. However, food services often focus on the appearance and taste of food, and ignore balanced nutrition and preparation. In summary, there is still considerable room for improvement in the habits and health behaviours of university students in Taiwan. Developing an HPL during this period is important, as it can help avoid future health issues.

In this study, the HPLP-S of university students was above the medium level, with the highest score for interpersonal support, followed by self-actualisation; exercise and health responsibility scores were the lowest, which is consistent with the results of most recent studies [11,15,17,23-26]. Therefore, it should be a top priority to teach university students in Taiwan about the importance of

regular physical activity and to promote the idea that they should pay attention to and be responsible for their own health.

A stepwise multiple regression analysis was performed in this study to firstly explore the predictors of HPLP-S in all university students. The results showed that the PHS and HC in the cognitive-perceptual factors as well as gender, weekly duration of physical activity, weekly number of dine-outs in the modifying factors were important indicators. Meanwhile, the prediction effect of institution-ownership or orientation on the HPLP-S of university students was insignificant. However, in view of the research questions raised in this study, after stratifying the different types of universities and colleges, the results showed that the predictors of HPLP-S were different by the university type. The gender, PHS, and HC still were important indicators for all types of universities. Females, those with low PHS, and those with low scores on the functional/role performance, eudaimonistic, and clinical subscales of HC had relatively negative HPLP-S and should be the primary targets for the modification of health-promoting behaviours; this is similar to the results of recent studies [12,13,16]. However, research has reported that gender cannot predict HPLP [14], while another study stated that men have poorer HPLP [15]. It is presumed that sex had different predictive effects for subjects in different regions or ages. We believe that gender remains a simple and valuable indicator for HPL of university students in Taiwan.

Male students performed better than females in the overall HPLP-S and subscales for exercise, stress management, health responsibility, and nutrition in this study. Recent research has shown that men perform better in exercise and stress management [14, 24]. Another study also pointed out that in addition to exercise, men perform better in health responsibility and nutrition, which

is consistent with the findings of this study [16]. In addition, this study found that men had better PHS than women, and that there was a positive correlation between PHS and HPLP-S. Since a better PHS may encourage university students to engage in more health-promoting behaviours [10,13], this result indirectly confirmed the result of a better HPLP-S for men in this study. However, research has shown that except for exercise, women perform better in overall as well as stress management, nutrition, and interpersonal support of HPL [23]. Another study reported that women performed better in exercise and health responsibility and speculated that this difference may be attributable to the different social responsibilities and roles given to men and women in the local culture [17]. It is seen that gender differences in HPL might indeed vary by region. Therefore, we believe that the Taiwanese government should pay more attention to female students when designing health promotion education plans to modify their health-promoting behaviours and help them develop a healthier lifestyle.

In addition, except for gender, PHS, and HC, this study found other noteworthy modifying factors of HPLP-S at different types of universities. Considering institution ownership, public university students with a monthly income of 15,000 TWD or less, those who have night snacks four times or more weekly, and private university students who exercise less than 76 min weekly, should also be the targets of special attention for health-promoting behaviours. Presumably, the difference of predictors of HPLP-S between students in public and private universities may be related to different financial burdens for themselves. Private university students are known to have lower socio-economic status than those in public university in Taiwan [29]. Research has also shown that regardless of

during the semester or not, private university students have more hours in off-campus part-time jobs than those in public university [39]. Evidence shows that the economy is the main factor behind university students working part-time after school, which further contributes to rest and eating disorders [40]. Therefore, we believe that when the financial burdens and off-campus part-time jobs engaged in for a long time come to a general situation for private university students, the predictive powers of income and dietary habits to their HPLP-S are not significant.

Considering institution orientation, except for gender, PHS, and HC, special attention should be paid to the HPLP-S in students at general universities who have night snacks four times or more weekly, as well as vocational college students who exercise less than 76 min or dine out more than 14 times weekly. Few studies show the difference of health-promoting behaviours between general university and vocational college students. However, the learning methods and curriculum design of general university and vocational college are different [30]. Future research must substantiate whether the differences affect the daily routines and health behaviours of university students. This study showed that the predictors of HPLP-S among students were different by the institution orientation, which may precisely predict the target students who should take health education at general university or vocational college.

Research has reported that personal or family income is often a significant factor of HPLP [24,41]. In this study, students with a high monthly disposable income had better overall HPLP-S, and exercise and health responsibility subscales of the HPLP-S. Several studies noted that individuals with better socio-economic status tend to lead healthier lifestyles, while low-income status is particularly likely

to make students ignore various aspects of health-promoting behaviours in their daily lives [17,24]. In terms of physical activity in the health-related information, the HPLP-S of university students in this study was better with an increase in weekly physical activity duration, similar to recent findings [25]. Recent research has also suggested that sportive activity is a significant factor of HPLP, and maintaining a regular exercise habit can improve various aspects of health-promoting behaviours [14,26]. Moreover, students with sufficient physical activity in this study had better PHS and HC, which might make them more willing to engage in health-promoting behaviours.

In terms of dietary habit in the health-related information, although there is evidence that late-night snacks might cause metabolic impairments in the body, leading to obesity or failure to lose weight and other chronic diseases [42], there have been few studies on relationship of late-night snacking behaviour and HPL. This study showed that the consumption of late-night snacks might be an independent influencing factor of students' HPL in public university or general university, which needs to be substantiated by future research. Furthermore, homemade foods were reported to be more natural and less oily; therefore, all aspects of HPLP by people who eat at home were better than those who dine out [17]. In this study, the scores for health responsibility and nutrition subscales of those who dined out for 15 meals or more per week were slightly lower. It is also worth mentioning that in this study, the students who dined out had better HC. It is speculated that dining out at a moderate frequency may prompt students to try their best to understand and choose the ideal food types and cooking methods. However, dining out for every meal made it difficult to adhere to healthy dietary principles, thereby weakening the behaviours of health

responsibility and nutrition. Therefore, we believe that the correct dietary habits are also important. In the design of health education, in addition to prioritizing interventions for target individuals with poor health behaviours, should also specifically convey the complete health knowledge including concepts of regular exercise and correct diet.

In conclusion, three suggestions regarding health education strategies for health-promoting lifestyles among university students are proposed by this study for the reference of university students, the government and institutions, and future studies. (1) The rapid development of 3C products have made life more convenient for the public but have also resulted in sedentary lifestyles and sleep deprivation. However, universities offer a good opportunity and environment to develop a healthy lifestyle. This study found that the best health-promoting behaviour among university students in Taiwan was interpersonal support. It is recommended that university students make good use of time with relatives and friends, and participate in activities or group sports instead of screen viewing or playing computer games in order to increase their physical activity and reduce 3C usage, thereby increasing the body's metabolism which will be beneficial to the maintenance of body fitness and improving sleep.

(2) The nutrition, exercise, and health responsibility of university students in this study require improvement. It is recommended that the government and university design and provide comprehensive knowledge or intervention on nutrition and physical activity to target groups with poor HPLP-S, especially women, students with poor PHS, and students with poor functional/role performance, eudaimonistic, and clinical subscales of HC. They should also be taught the importance of being responsible for their own health. In

addition, the government should encourage different types of institutions to propose health promotion plans that meet their own needs. For example, public universities might target students with little disposable income or the habit of night snacking; private universities might target students with inadequate exercise; general universities might focus on students who have the habit of night snacking, and vocational colleges might focus on students with inadequate exercise or excessive dining out. The corresponding health education planning and budgeting could be made by the different types of institutions to carry out health education plans that keep abreast of the times and are customised to the institutions.

(3) Due to the limitations of time and other criteria, the subjects of this study were limited to university students from the universities and colleges on the main island of Taiwan, excluding students from outlying islands. The results of this study could only be extrapolated to the HPL of students in different types of universities on the main island of Taiwan. In consideration that the living patterns and resource acquisition of universities and colleges in the outlying islands might be different from those on the main island of Taiwan, the corresponding health education strategies should be discussed and planned separately. Future studies on universities in the administrative regions of offshore islands are recommended to make the research results even more inferential. Furthermore, factors affecting HPL are complex and diverse. In addition to demographic characteristics, this study only explored the impact of the health-related information of university students on HPL based on existing literature. The discussion of other factors was not included. Further discussions on the psychological and social influencing factors can be used to develop appropriate methods for health education and guidance.

ACKNOWLEDGMENTS

The author gratefully acknowledges Professor Silvia Wen-Yu Lee and Professor Shyh-Hsiang Lin for helpful suggestions in the research process.

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台灣不同類型大專校院之大學生健康促進生活型態及其影響因素

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目標：大學是青少年邁入成年的關鍵，此時養成促進健康的生活方式（HPL）將有助於遠離慢性疾病。本研究欲探討不同類型大學學生的HPL現況及影響因素。**方法：**以台灣大學生為對象，採二階段抽樣進行自填問卷，先依學校區域、公私立、定向，分層隨機抽出37所學校，再於各校依學號隨機抽出受試學生，共回收1,062份有效問卷。**結果：**大學生的健康促進生活型態量表（HPLP-S）得分在中等程度之上，但營養、運動和健康責任得分較低。多元逐步迴歸分析顯示，女性、自覺健康狀況低分、健康概念之角色功能性、安寧幸福性或臨床性低分，為所有大學生HPLP-S相對消極的重要因素；而可支配金額較低、有進食宵夜可做為公立大學的參考因素，運動時間不足為私立大學的參考因素，有進食宵夜為一般大學的參考因素，運動時間不足、外食次數過多為技職校院的參考因素。**結論：**本研究建議各類型大學現階段亟需針對前述學生，積極規劃正確飲食搭配規律運動的衛教方案，並灌輸對自身健康負責的正確觀念。（台灣衛誌 2022；41(3)：312-330）

關鍵詞：大學類型、健康促進生活型態、性別、自覺健康狀況、健康概念

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投稿日期：2021年12月24日

接受日期：2022年6月10日

DOI:10.6288/TJPH.202206_41(3).110153