

Statistical Analysis of Factors Influencing Health Literacy Level Using Multiple Linear Regression Analysis

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Abstract: Health literacy is defined as the ability to receive, read, comprehend, and use healthcare information to make informed health decisions and follow treatment guidelines. It is one of the most critical aspects of health promotion. Limited health literacy is also accounted for adverse health outcomes and a huge financial burden on society. The aim of this cross-sectional study is to identify on how gender, income, and attitude towards a healthy lifestyle can influence health literacy level. The objectives of this study are to determine the relationship between gender, financial status, and attitude towards a healthy lifestyle towards health literacy level and to determine the most influential factors between gender, income and attitude towards a healthy lifestyle that affect health literacy level. 301 samples out of 1369 undergraduate students in UiTM Cawangan Kelantan, Kampus Kota Bharu (UiTM KB) has been chosen by using stratified random sampling. This study is a consequence of a lack of study about the health knowledge level among university students. The instrument used to evaluate the students' health literacy was the European Health Literacy Survey Questionnaire (HLS-EU-16). The methods used were correlation analysis and multiple regression analysis. The findings show that the level of health literacy among university students is sufficient at the rate of 37 out of 50 points. Furthermore, health literacy among students explained by their attitude towards healthy lifestyle was 84.9%, whereas gender and income level were not significant factors determining health literacy level.

Keywords: Health literacy, HLS-EU-16, Healthy lifestyle, University students, Multiple linear regression

1 Introduction

Health literacy refers to the ability to act on health information, as well as take more responsibility for our health as individuals, families, and communities which directly depends on the individual's level of literacy [1]. Health literacy has gotten a lot of attention in the European Union (EU) in the last decade, based on studies which were mostly from the United States of America (USA), which showed that poor health literacy is linked to poor health outcomes, poor preventive care behaviors, and higher health-care use and expenditures [2].

Health literacy is what determines people's motivation and capacity to get, comprehend, and apply knowledge in ways that support and preserve good health [3]. In order to achieve the Sustainable Development Goal (SDG3) relating to health, the World Health Organization (WHO) has identified health literacy as a crucial tool [4]. It has been demonstrated lately to be crucial for enhancing universal



health coverage (UHC). Infrastructure provision alone will not be enough to improve UHC; people also need to be given the tools they need to learn about, comprehend, and make use of the channels already in place to improve their health [5].

Nowadays, there are still a lot of people who have limited knowledge about health. Conceptual knowledge of health and healthcare is an important element in health literacy, and also limited health knowledge and health literacy can significantly affect the utilization of conventional healthcare services. In Malaysia, even though technology nowadays is very sophisticated, yet there are people who are still ignorant about health knowledge and in the worse scenario, they might even made up their own opinion regarding diseases, medicines and ways to cure [6].

The undergraduate stage has the most learning capacity and is essential for developing the foundation of health literacy [7]. The university years provide a significant turning point in many students' lives as they go from being teenagers to young adults, living independently, and being less dependent on their parents for health-related decisions [8]. To produce health-literate practitioners who can comprehend and solve health-literacy requirements of families and communities, it is necessary to first identify the health literacy levels of these younger populations and then to address any gap that may exist [9].

Higher than average levels of psychological stress and psychological health issues are typically experienced by university students. Academic obligations, money concerns, and adjusting to new circumstances in life are the causes of this [10]. Students' health may be harmed by these circumstances. Due to these conditions, students must be health literate in order to take care of their personal health. Nonetheless, there is a disparity in health literacy, particularly among students [11].

This study aims to determine the health literacy level of university students, to study the relationship between factors and health literacy and to identify the significant factor or factors that influence health literacy level among university students using correlation analysis and multiple linear regression analysis. To improve their services to university students, health service providers and the universities must recognize and consider these factors.

A Factors Influencing Health Literacy

i. Gender

While gender is not always selected as a contributing factor, a small number of studies indicate that gender does differ significantly in health literacy. The study conducted by Dadaczynski et al. [12] revealed that male participants encountered greater challenges when it came to locating and navigating health-related information. This could potentially be attributed to the fact that women tend to use health promotions, prevention, and healthcare measures more frequently, which gives them greater experience with handling health-related information.

The study conducted by Vozikis et al. [13] provides additional support for this idea, finding a negative gender association in health literacy, with male students having lower health literacy. The finding shows that women seem to be more knowledgeable about health issues because they are more concerned with dieting or parenting (childbirth and care), thus the women appear to be more literate in health matters.

However, there are inconsistent findings on the association of gender with health literacy. Panjrath and Ahmad [14] found that women have a higher frequency of limited health literacy than men and the findings could be explained by the fact that female participants in the study had lower educational attainment. On the other hand, Golboni et al. [15], reported that gender differences in health literacy have a conflicting result where there is no significant difference between gender and health literacy. Furthermore, Wong et al. [16] found that men were more likely to have higher literacy level in some areas such as the medication regime while women score higher in other areas that is in health-related decision making.

ii. Financial Status

Numerous studies suggest that one factor influencing health literacy is one's financial situation. Vozikis et al. [13] found that health literacy is positively and statistically associated with income, and that people with higher family income are more likely to score higher on health literacy questions. These findings support the idea that people with higher health literacy tend to be higher earners, either through their own means or through their family. The researcher added in the article that the results are in line with the European Health Literacy Survey Questionnaire (HLS-EU-Q47) report for Greece.

Tang et al. [17] found that there is a positive correlation between individual income and health literacy. Lower income has been found to have a detrimental impact on health literacy and increasing the likelihood of poor health outcomes.

Lael-Monfared et al. [18] had conducted a study on low income and low social standing, which has been linked to low health literacy, lack of diabetes awareness and poor blood glucose management. It was found that there was a strong correlation between the variable of income and health literacy. The result shows that individuals who are employed with stable income had a greater degree of health literacy than those who are unemployed.

iii. Attitude towards healthy lifestyle

Kickbusch et al. [19] reported that people with low health literacy had unhealthy lifestyles, disregarded medical advice, benefited little from preventative care, and were more likely to seek medical attention. In addition, Tabee Burdbar et al. [20] confirmed that health literacy is one of the most important factors in a healthy lifestyle. Thus, in order to be healthy, people must continuously raise the standard of their lifestyle and develop their health literacy.

2 Methodology

This study was carried out at a public university in Kelantan using an online cross-sectional design. The study's target population comprised all UiTMKB students, specifically those from the Faculty of Business Management and the College of Computing, Informatics, and Mathematics. Stratified random sampling was employed in this study to obtain samples for every stratum. This method was selected because it has the least bias and can most accurately represent the entire population. This study included six strata, each of which represents different courses in UiTMKB.

There were 1369 students in the population, and using the generated random number, samples were chosen proportionately from each stratum. Using the formulas developed by Krejcie and Morgan [21], the estimated sample size for this investigation was determined. With a recommended error range of 5 percent and a 95 percent confidence level, the sample size of 301 students from the total population was determined. Table 1 below shows the number of samples selected from each strata.

Table 1 : The Number of Samples from Each Strata

Course	Population size	Sample size
Marketing	215	$(215/1369)*301 = 47.27 \approx 47$
Finance	420	$(420/1369)*301 = 92.34 \approx 92$
Islamic Banking	215	$(215/1369)*301 = 47.27 \approx 47$
Business Economics	185	$(185/1369)*301 = 40.67 \approx 41$
Statistics	317	$(317/1369)*301 = 69.69 \approx 70$
Statistics and Entrepreneurship	17	$(17/1369)*301 = 3.73 \approx 4$
TOTAL	1369	301

Using online questionnaires, the primary data was gathered from UiTMKB students. Google Form was used to create the questionnaire, and instant messaging was used to send the link of the form to the chosen sample. Statistical Package for the Social Sciences (SPSS) version 25.0 was used in this study to analyze the data. Finally, the multiple linear regression and Pearson's correlation were the statistical methods employed in this investigation.

A Theoretical framework

In order to investigate the relationship between the factors that influence health literacy among university students, a theoretical framework that explains the logical meaning of the relationship between independent variable and dependent variable was assumed. Gender, financial status, and attitude toward a healthy lifestyle were considered to be the three independent variables that influence health literacy. Figure 1 displays the theoretical framework.

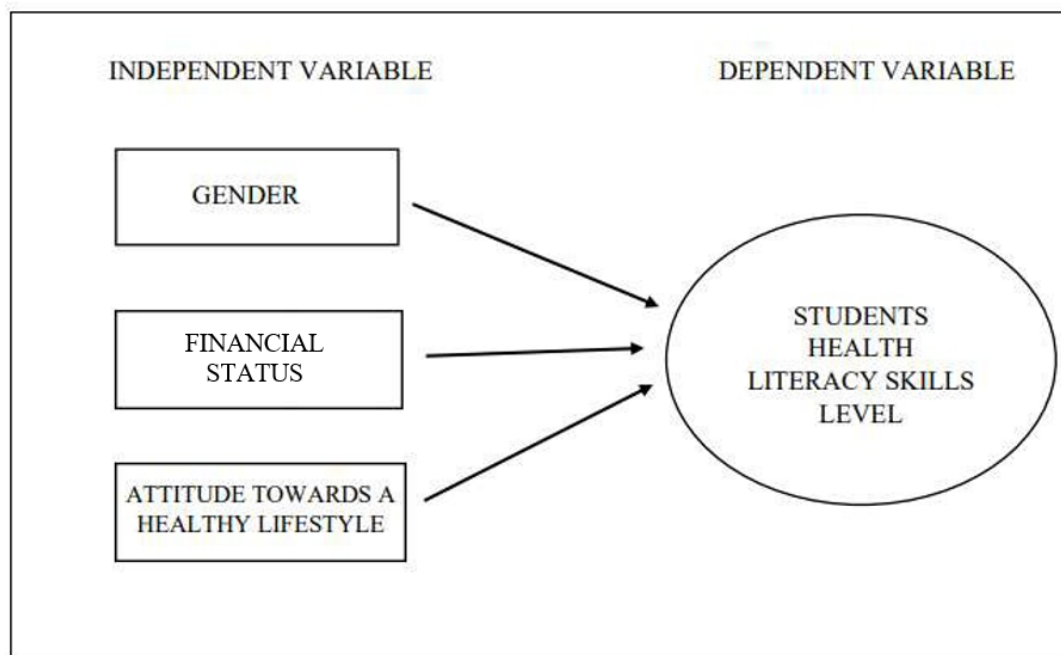


Figure 1: The Theoretical Framework of the Study

B Measuring Instrument

i. Health Literacy Index

University students' health literacy was evaluated using the 16-items English version of the European Health Literacy Survey Questionnaire (HLS-EU-Q16). In order to prevent illness, promote health, and provide healthcare, this assessment examines how difficult or easy individuals believe it to be to find, understand, assess, and apply health information [22].

Every item in the HLS-EU-Q16 was measured using four levels of responses: very easy, easy, difficult, and very difficult. In addition, respondents had the option to select "don't know." The answers were assigned the following numerical code: 1, extremely difficult; 2, challenging; 3, simple; 4, extremely simple; and 0, uncertain. The European Health Literacy Consortium's recommendations were followed in calculating the mean score for each item and converting it to an index using the equation (Eq. (1)) below [23].

$$\text{Health literacy index score} = (\text{mean}-1) \cdot (50/3) \quad (1)$$

The formula for health literacy index score is $(\text{mean} - 1) * (50/3)$, where the mean is the average of the scale's items, 1 denotes the mean's lowest value, 3 denotes its range, and 50 is the new index score's selected maximum value [24]. The index scores were recorded into four health literacy categories, as indicated in Table 2, based on the threshold set by the HLS-EU consortium: excellent (>42–50); sufficient (>33–42); problematic (>25–33); and inadequate (0–25).

Table 2 : The Health Literacy Index Score and Level

Health Literacy Index Score	Health Literacy Level
0 – 25	Inadequate
> 25 – 33	Problematic
> 33 – 42	Sufficient
> 42 – 50	Excellent

ii. Attitude Towards Healthy Lifestyle

The instrument used to measure the attitude towards healthy lifestyle was a set of questionnaires adopted from both Duong et al. and Ghanbari et al. [25,26]. The questionnaires contain 10 items and were assigned to fit the objective of this research. Likert scale was chosen for all questions as an option for the respondents on whether they agree or disagree for each of the question.

iii. Gender

Gender was categorical and was simply determined by asking the respondents to state their gender whether they are male or female.

iv. Financial Status

The respondents' financial status was measured by evaluating the monthly income of their household using the Department of Statistics Malaysia (DOSM) Survey of Household Income and Basic Amenities Survey Report [27] that classifies household groups according to monthly income as presented in Table 3. Respondents were asked to choose which household income group they are in.

Table 3 : The Financial Status Classification

Household Group	Monthly Income Range
T20	More than RM 11000
M40	Between RM 4800 and RM 11000
B40	Less than RM 4800

C Spearman's Rank Correlation

This method was used to identify whether there is a significant relationship between gender, financial status and attitude towards healthy lifestyle on university students' health literacy level.

Spearman correlation assumes that data is at least ordinal and that the scores on one variable are monotonically connected to the scores on the other variable. Hence, Spearman rank correlation is used to identify the correlation between variables as the questionnaire are in Likert scale form. The degree of linear association of variables will be measured in intervals or ratio. The rule of thumb for interpreting the size of Guilford's law correlation is shown in Table 4 [28].

Table 4 : Rule of Thumb for Interpreting the Size of Correlation (Guilford's Law)

Size of Correlation	Interpretation
$0.90 \geq r > 1.00$	Very high positive correlation
$0.70 \geq r > 0.90$	High positive correlation

$0.50 \geq r > 0.70$	Moderate positive correlation
$0.30 \geq r > 0.50$	Low positive correlation
$0.00 \geq r > 0.30$	Negligible correlation
$-0.90 \geq r > -1.00$	Very high negative correlation
$-0.70 \geq r > -0.90$	High negative correlation
$-0.50 \geq r > -0.70$	Moderate negative correlation
$-0.30 \geq r > -0.50$	Low negative correlation
$0.00 \geq r > -0.30$	Negligible correlation

D Multiple Linear Regression

Multiple regression analysis allows researchers to assess the strength of the relationship between the dependent variable and several independent variables as well as the importance of each of the independent variables to the relationship, often with the effect of other independent variables statistically eliminated. The multiple regression model is as shown in Eq. (2).

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon_i \quad (2)$$

Where;

Y_i is the student's health literacy.

$\beta_0, \beta_1, \beta_2, \beta_3$ are the regression coefficients.

X_1, X_2, X_3 are the independent variables (X_1 is gender, X_2 is financial status and X_3 is attitude towards healthy lifestyle).

ε_i is the error term.

The data was first tested for the assumption of normality, assumption of homoscedasticity, assumption of independence and assumption of linearity and multicollinearity before multiple regression analysis can be done.

3 Results and Discussion

A Students' Health Literacy Index

Table 5 shows that the three measures of central tendency indicate that most of the respondents were above the illiterate level which is 37. The minimum value for health literacy index was 21.88 and the maximum was 50 which gives the difference between the lowest literacy and the highest literacy of students was 28.13. Moreover, about 25% of the respondents have a health literacy index greater than 42.5. Overall, the health literacy index shows that the level of literacy among the students was sufficient. This means, the students do have a sufficient health knowledge.

Table 5 : Health Literacy Index Summary Statistic

Mode	37.50	Range	28.13
Mean	37.6658	Minimum	21.88
Median	37.5000	Maximum	50
Standard Deviation	6.4864	Percentile (25)	33.1250
Variance	42.073	Percentile (50)	37.5000
Skewness	-0.127	Percentile (75)	42.5000

B Spearman’s Rank Correlation Analysis

The correlation matrix is used to determine the patterns of relationships. The strength and direction of a linear relationship is determined using the Spearman’s Rank Correlation Coefficient and ensuring that the independent variables (Financial Status, Attitude Towards Healthy Lifestyle), as well as the Health Literacy, are present in the study. This preliminary study was conducted before multiple regression analysis to ensure that the regression model did not represent a serious violation.

Table 6 : Result of Spearman’s Correlation

Variables	Correlation coefficient	p-value
Health Literacy Level with Financial Status	-0.103	0.085
Health Literacy Level with Attitude	0.912	0.000

Table 6 above shows the Spearman’s Rank correlation coefficient for all variables. The result shows that only Attitude Towards a Healthy Lifestyle was correlated to Health Literacy. The *p*-value was less than 0.05, indicates that there is a significant relationship between the two variables.

C Multiple Linear Regression

i. Checking the Assumptions

Figure 2 shows that the normal P-P plot of the points was scattered along the straight line on the health literacy. Therefore, the normality assumption was satisfied.

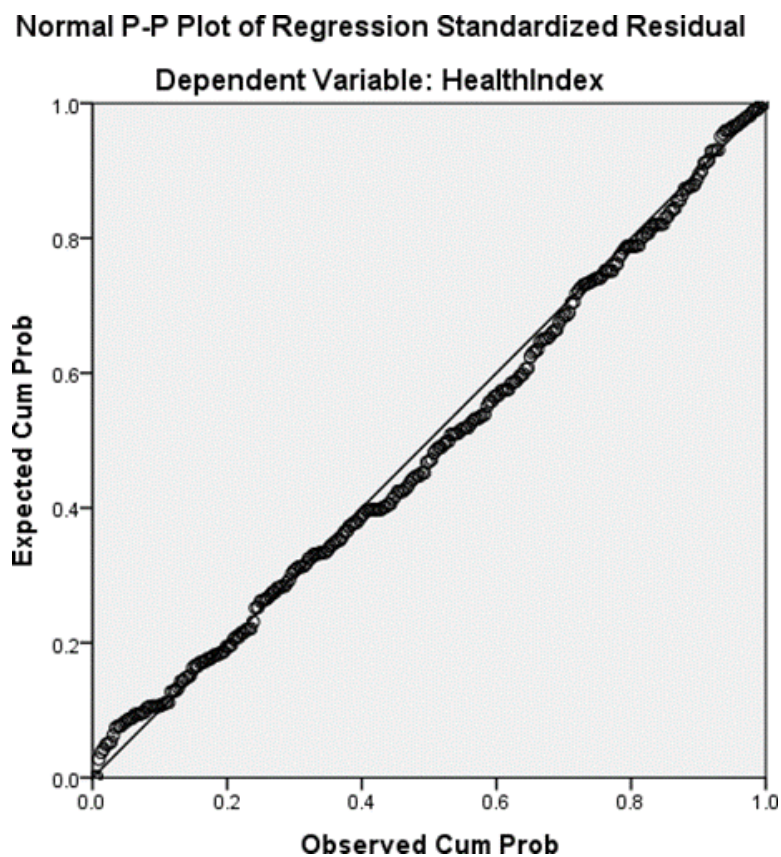


Figure 2: The Normality Distribution Test Using P-P Plot

Figure 3 shows that the scatter plot of the points was scattered around randomly. Therefore, the homoscedasticity assumption was satisfied.

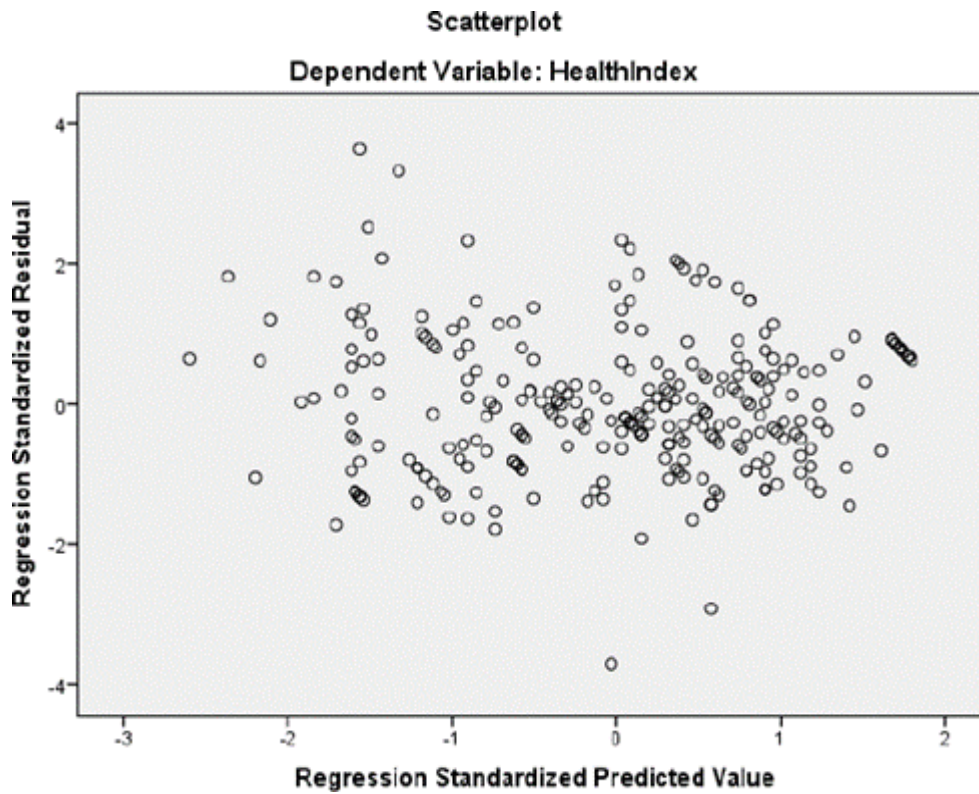


Figure 3: Scatter Plot of Health Literacy

ii. Multicollinearity

Table 7 shows that all the tolerance values exceeded 0.1 and the VIF values were less than 10. Therefore, it can be concluded that no multicollinearity exists among independent variables. Thus, the independent variables of the study has no relationship among each other and not dependent on each other.

Table 7 : Multicollinearity among variables

Variable	Tolerance	VIF	Findings
Gender	0.987	1.013	No multicollinearity
Financial Status	0.992	1.008	No multicollinearity
Attitude	0.984	1.016	No multicollinearity

iii. Goodness of Fit

Table 8 shows the measure of coefficient of determination. The value of *R* square was 0.851. This indicates that 85.1% of the variation in students’ health literacy can be explained by a list of independent variables (gender, financial status, attitude towards healthy lifestyle) while 14.9% can be explained by other factors.

Table 8 : Model Summary

<i>R</i>	<i>R</i> Square
0.851	0.849

iv. General Fitness Model

Table 9 presents the general fitness model for this study. The *F* statistic was 521.527 and the significant value was <0.001. As the *p*-value was less than the significance level (0.05), this demonstrated that the data utilized was consistent with the model. As a result, it can be concluded that the overall model was significant and testing on regression coefficient can be done where at least one of the independent variables is significant.

Table 9 : Multiple Linear Regression ANOVA Results

Variables	<i>F</i> -test	<i>p</i> -value
Health Literacy	521.527	0.000

v. Test of Regression Coefficient

Table 10 shows summary result of the regression analysis. From the result, it was found that only attitude towards healthy lifestyle was significant towards the health literacy.

Table 10 : Regression Coefficient Summary

Variable	Coefficient Value	<i>p</i> -value	Finding
Constant	-0.315	0.000	
Gender	-0.126	0.695	Not Significant
Financial Status	-0.301	0.111	Not Significant
Attitude Towards Healthy Lifestyle	9.831	0.000	Significant

vi. Model Estimation

Multiple regression model was used to describe the relationship between the dependent variables of the study. Since there was only one significant variable, hence, the new model for this study is as below.

Let:

Y = Health Literacy

X₁ = Attitude Towards Healthy Lifestyle

General model, Eq. (3):

$$Y = \beta_0 + \beta_1 X_1 \tag{3}$$

$$Y = -0.315 + 9.831X_1$$

The interpretation for each beta coefficient is presented in table 11.

Table 11 : Interpretation of Beta Coefficient

$\beta_0 = -0.315$	Based on the value, it can be concluded that if the values of independent variables, which were Attitude Towards a Healthy Lifestyle are equal to 0, that means Health Literacy is -0.351.
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$\beta 1 = 9.831$	This indicates that one unit increase on the mean of Attitude Towards a Healthy Lifestyle will increase the mean of Health Literacy Level by 9.831 units.
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4 Conclusion

Based on the health literacy index, the results of the study showed that university students' health literacy is adequate. This indicates that Malaysian university students possess the necessary health knowledge to take care of their own health.

The correlation analysis reveals a weak relationship between financial status and health literacy. On the other hand, attitudes toward healthy lifestyle and health literacy were strongly correlated. This suggests that health literacy is greatly influenced by one's attitude toward leading a healthy lifestyle.

The results of the multiple linear regression analysis demonstrate that all of the presumptions were met and that the two independent variables in the model – income and gender – were not found to be significant. Nonetheless, the attitude towards healthy lifestyle is what affects university students' health literacy. This suggests that a one-unit rise in the average attitude towards leading a healthy lifestyle will translate into a 9.831-unit increase in the average health literacy index level.

Therefore, it was suggested by the study's findings that improving students' attitudes toward leading healthy lives would be the best way to raise their health literacy index level.

Future studies are advised to take into account a few additional independent variables, such as the educational attainment and smoking status of parents, when determining the health literacy index level of students. The elements that influence students' health literacy index level can be examined in a future study by applying the same concept in a different setting.

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Conflict of Interest Statement

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

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