

# Nutritional Literacy and Its Association with Dietary and Lifestyle Habits Among King Khalid University Students, Saudi Arabia: A Cross-Sectional Study

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**Background:** Unhealthy dietary habits and physical inactivity among university students are common across the world, predisposing them to obesity and its comorbidities. Nutritional literacy (NL), which plays an important role in the formation of these behaviors, is unexplored. This study was conducted to investigate the relationship of nutritional literacy with dietary and lifestyle practices among university students in Abha, Saudi Arabia.

**Methods:** A cross-sectional descriptive study was carried out on 385 students of King Khalid University (KKU) by convenient sampling. Information was collected between March and May 2024 using an online research form, which includes socio-demographics, the Nutrition Literacy Self-Assessment Short Form (NL-SF12), and the Dietary and Lifestyle Habits Questionnaire (DLHQ). Descriptive statistics were calculated, and Pearson's correlation and multiple regression models were applied, at significance level of  $p < 0.05$ .

**Results:** Highest levels of NL were found in the knowledge ( $M = 4.31$ ,  $SD = 0.74$ ) and understanding sections ( $M = 4.08$ ,  $SD = 0.70$ ), compared to using skills ( $M = 3.56$ ,  $SD = 0.96$ ). The average ( $M$ ) meal pattern was irregular,  $M = 2.41$ ,  $SD = 0.92$ , fruits and vegetable consumption was moderate (sweets intake and fast food intake frequent (soft drink intake also typical of the sample quantity being:  $M = 2.23$ ,  $SD = 0.77$ ). Lifestyle behaviors included high screen time, eating during sedentary periods, and moderate sports participation. NL was significantly correlated with dietary habits ( $r = 0.624$ ,  $p = 0.005$ ), but less so with lifestyle habits ( $r = 0.524$ ,  $p = 0.063$ ). Positive predictors included education, income, sleep, and age; negative predictors were smoking, chronic illness, and higher BMI.

**Conclusion:** The KKU students had satisfactory nutritional literacy, but weak application of their theoretical knowledge in terms of poor dietary and lifestyle practices. The present study is a valuable addition to the literature through focusing on actual application of nutritional literacy factors among university students in the Saudi context. Designed interventions that target practical food skills, mindful eating/social dining and regular physical activity are necessary to assist consumers in making healthy decisions and curtail the long-term burden of NCDs. These results provide pragmatic direction for universities and public health policymakers to develop specific, evidence-based programs that meet the needs of students living these realities.

**Keywords:** nutritional literacy, dietary habits, lifestyle behaviors, students, Saudi Arabia

## Introduction

University life is a vulnerable period in young adulthood, where autonomy of dietary choice, time limitation, and fluctuating social norms have a profound impact on dietary and lifestyle habits.<sup>1,2</sup> Nutrition literacy (NL), based on Nutbeam's health literacy model (functional, interactive, critical), encompasses the knowledge and skills necessary to obtain, understand, evaluate, and use nutrition information for healthier decisions.<sup>3</sup> Mechanistically, functional NL aids label use and nutrient understanding, interactive NL supports social exchange, and critical NL enables appraisal of conflicting information; higher NL is associated with healthier dietary behaviours.<sup>4,5</sup> As a subset of health literacy, NL

includes “obtain/analyze/apply” competencies that are linked to better dietary behaviour and are theoretically supportive of lifestyle practices (eg, planning active routines) through improved information processing and self-management.<sup>5,6</sup> Globally, student diets generally do not adhere to healthy eating guidelines (eg consumption of free sugars <10% total energy and sodium < five g salt per day), influencing weight status and non-communicable disease risk.<sup>7</sup> Studies on university students in Saudi Arabia have shown unhealthy nutritional status and lifestyle. King Khalid University (KKU) medical students suffer from a high prevalence of obesity with unhealthy practices.<sup>8–10</sup> Earlier data from Abha also showed high fast-food consumption and low physical activity among male students.<sup>11</sup> Recent national and multi-site research indicates that many Saudi university students have low nutrition literacy, which is linked to male gender, non-normal BMI, and unhealthy eating behaviours.<sup>12</sup> Additional studies reveal that Saudi undergraduates often do not meet the WHO physical activity recommendations.<sup>10,13</sup> Taken together, these patterns highlight the importance of NL as a modifiable factor influencing diet and lifestyle among students in Abha, where rapid urbanization and campus food environments may increase risk exposures.

Across Arab settings, NL challenges begin in adolescence and track into young adulthood. A national Saudi adolescent study found nearly half had poor nutrition literacy with sociodemographic gradients.<sup>14</sup> Emerging Arabic tools—for example, the Arabic Adolescent Nutrition Literacy Scale (ANLS)—now provide culturally adapted measurement infrastructure to assess NL reliably in the region.<sup>15</sup>

These advances enable rigorous assessment of NL-behavior links in Gulf university populations. Internationally, students report changing diets (increased convenience foods and irregular meals) and competing academic pressures undermining health behaviours.<sup>16</sup> The evidence of effectiveness of campus interventions is more mixed, but education oriented approaches can work if they are well designed.<sup>17</sup> In parallel, digital/mHealth nutrition interventions show positive effects on discrete dietary outcomes among postsecondary students, though effect sizes vary and longer follow-up is needed.<sup>18</sup> Given WHO guidance on healthy diets and the wide adoption of the Global Physical Activity Questionnaire (GPAQ) for youth/adult surveillance, linking NL with diet and activity behaviors is policy-salient for universities and health authorities.<sup>19</sup> Conceptually, higher NL can strengthen food-literacy domains (planning/management, selection, preparation, eating), improving diet quality and supporting healthier lifestyle choices, thereby reducing NCD risk in young adults.<sup>4,20</sup> Additionally, food systems contribute substantially to global environmental burdens, underscoring the value of integrating nutrition and sustainability in university initiatives.<sup>21</sup> Guided by Nutbeam’s framework and food-literacy domains, we hypothesize that higher NL among Abha students is positively associated with healthier dietary patterns and modestly associated with lifestyle behaviours (eg, physical activity), with campus food-environment features potentially moderating these relationships.<sup>4,13</sup>

Saudi universities, including this one in Abha (Aseer region), house large, diverse student bodies navigating independent living and abundant food options. Local studies reveal the prevalence of obesity and overweight individuals, as well as unhealthy dietary habits,<sup>8,11</sup> while national research indicates that NL deficits are linked to poorer eating patterns.<sup>12</sup> Abha’s high-altitude, rainfall-affected highland climate creates distinct food-environment exposures and student living conditions compared with lowland cities, warranting localized evidence from KKU.<sup>22</sup> Universities can also shape behaviours through built-environment levers—healthier cafeteria defaults and pricing, vending standards, and point-of-purchase labelling—which complement NL strategies in campus settings.<sup>13</sup> Notwithstanding broader national evidence, Abha/Aseer cohorts remain understudied, and the NL–diet–lifestyle interplay in a high-altitude campus food environment is poorly characterized—constituting the specific gap this study addresses.<sup>13,22</sup>

The increasing prevalence of non-communicable diseases (NCDs) in Saudi Arabia, and rapid urbanization, changing eating habits indicate the importance to improve program for nutrition literacy in young adults. Students of universities in Abha might be at higher risk for AN because they are a young age group which according to psychology and health research is characterized by their personalities being shaped as regards eating habits and lifestyles, however, are more vulnerable to be offered unhealthy food choices. The all-girls education in comparison to students from the largest cities like Riyadh or Jeddah has remained unquarried.<sup>14,23</sup> Without research that is specific to their context, health initiatives and campus-based programs are likely to remain broad and less effective. Positioning nutrition literacy as a central determinant of behavior provides a pathway for developing interventions that are both culturally relevant and targeted to the needs of students in the Aseer region.

This single-site, cross-sectional study uses a convenience sample to examine NL–diet–lifestyle associations among KKU students in Abha; findings are intended to inform local campus interventions rather than to generalize nationally. The purpose of this study is to examine nutrition literacy among Saudi university students, despite policy efforts to prevent NCDs. Nutrition literacy and lifestyle habits appear to be suboptimal and are likely linked to unhealthy dietary habits, such as frequent fast-food and SSB consumption, as well as risk patterns of insufficient physical activity observed both nationally and within Aseer/Abha cohorts. However, the extent and nature of the relationships between nutrition literacy and students' diet and lifestyle behaviors in Abha are not well understood due to a lack of validated tools, which impedes the development of effective, culturally tailored interventions.

Thus, the following are formulated as such objectives of the study. The primary aim of this study is to investigate the relationship between nutritional literacy and dietary and lifestyle patterns in a population of undergraduate students at KKU, Saudi Arabia. More specifically, this study will use six different domains to measure the participants' nutritional literacy (knows and understands, obtains and uses, processes, and competencies); describe dietary habits of participants including eating frequency, snacking patterns, food group intakes; physical activity levels as well as screen time while eating during this period will be assessed; test for possible associations between nutritional literacy level among students with dietary habit positioning and lifestyle behaviors analysis set-ups will be employed; explore relationships between sociodemographic characteristics variables related lifestyle factors affecting/nutritional literacy level/dietary/lifestyle practices. Thus, the research addresses the following questions: How nutritionally literate are university students? What are their dietary habits? What kind of a life do they lead? How is dietary literacy correlated with dietary as well as life style habits? And how is nutritional literacy, dietary and lifestyle practices related to socio-demographic characteristics?

## Methods

It is a cross-sectional descriptive study, carried out at KKU (Abha/Asir-Region) where about 61.708 students are registered in its different colleges and departments, it was conducted according to the STROBE Statement. The data were obtained from March through May 2024 and population studied involved students of various academic departments to assess nutritional literacy against dietary and lifestyle habits. The enrollment conditions included to be a current student at KKU, aged over 18 years, and able to access the online-survey format. Participation was open to male and female university students to ensure representation. Participation was voluntary, and informed digital consent was obtained prior to data collection. The students enrolled in the University agreed to participate were included in this study.

A non-probability convenient sampling method was employed. The minimum sample size requirement was calculated using the Raosoft sample size formula,<sup>24</sup> and considering the entire students' population, a margin error of 5%, a confidence level of 95% and precision level of 0.05. Overall, 405 students were invited to participate and of these, 12 refused invitations to attend study meetings and eight withdrew having consented at the initial stage. As a result, 385 students were left in the final sample, which sufficiently fulfilled the demanded number of participants with a response rate of 95.1%.

## Instruments of Data Collection

Data were obtained online, and a structured self-administered questionnaire was distributed through Google Forms that arrived at the Email addresses of participants' academic institutions; a Demographic and Lifestyle Sheet for data on sociodemographic; the Nutrition Literacy Self-Assessment (NL-SF12) for nutrition literacy assessment; and the Dietary and Lifestyle Habits Questionnaire (LHQ) to evaluate eating behavior and lifestyle patterns.

## Demographic and Lifestyle Sheet

This includes 15 questions that cover some basic demographic and lifestyle features of the sample. The information collected at first was the participants' age, sex, marital status, educational level, type of college (medical or non-medical), financial situation, living arrangements, and place of residence. It also asks about lifestyle behaviors like physical

activity, sleep, and smoking. Also asked whether they had any of a list of chronic conditions. Respondents were invited to supply their anthropometric measures such as self-reported height and weight, from which the BMIs were calculated by dividing the weight (in kg) by the square of height (in m). According to WHO standard, BMI groups are: underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9) and obese ( $\geq 30$ ).<sup>3</sup>

### Nutrition Literacy Self-Assessment Questionnaire–Short Form 12 (NL-SF12) Scale

This scale was developed by Zhang et al to assess students' cognitive performance and nutrition-related skills.<sup>7</sup> The original NL-43 questionnaire includes 43 items, whereas the short form consists of 12 questions across six dimensions. These dimensions encompass knowledge, understanding, skill acquisition, skill application, interactive skills, and critical thinking skills.<sup>8</sup> Participants responded to questions using a Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (5). With approval from the tool designer, the questionnaire was translated and validated through a back-translation process. Two independent translators first created Arabic versions, which were then merged into a single version. This version was back translated into English by two additional translators working independently and without knowledge of the original. The back-back-translations were compared with the original questionnaire to ensure semantic and conceptual equivalence before data collection commenced.<sup>8</sup>

For assessing face validity, a panel of five experts—academic faculty in nutrition and public health sciences—reviewed the face validity of scales. They rated the appropriateness, relevance, and clarity of items. The respondents gave the impression that the items were appropriate and comprehensible. Subsequently, we performed EFA and CFA to examine the construct validity of the NL-SF 12. According to Kaiser–Meyer–Olkin (KMO) test of sampling adequacy, 0.89 suggested excellent factorability of data. Exploratory factor analysis extracted 12 items that explained 65% of the variance, and loadings on factors ranged from 0.52 to 0.79, supporting satisfactory construct validity. Confirmatory Factor Analysis (CFA) further endorsed the hypothesized structure with good model fit indices:  $\chi^2/df = 2.12$ , RMSEA = 0.045, CFI = 0.951 and TLI = 0.937. Moreover, the FSAII used in this study showed a Cronbach's alpha of 0.765, indicating moderate level of internal consistency.

### Dietary and Lifestyle Habits Questionnaire (DLHQ)

This instrument is an adaptation of a validated questionnaire by Al-Sendi (2002) to explore dietary habits and life style patterns, which had been further developed by Musaiger et al.<sup>9,25</sup> It was made up of 28 items, presented in two sections. The food habits section consisted of 20 items about breakfast consumption, meal frequency (breakfast, lunch, and dinner), where they obtained their meals (from home, the school cafeteria or bought outside) and daily snacking. It also explored how often and what type of foods were eaten, including fruits, vegetables; dairy, meat, fish/poultry; legumes/nuts/juices (inlet energy dense foods: hamburgers, potato chips and similar snacks: chocolates and sweets; soft drinks), paying attention for the preference toward servings. The response options in this part of the questionnaire included a 4-point Likert-type frequency scale (daily, 4–6 times/week, 1–3 times/week rarely) for food intakes, and three-point-options scales (always, sometimes never), and portion size alternatives (eg, small-medium-large or I don't eat) provided for eating-in-between meals and eating out of home were also collected.

The lifestyle habits section consisted of eight items assessing screen time, hours spent watching television or using the Internet, eating behaviors during these activities, and participation in physical activity both within school and outside school, including frequency of sports involvement. Items were rated using four-point scales for screen time (none, 1–2 hours, 3–4 hours,  $\geq 5$  hours per day), three-point scales (always, sometimes, never) for eating during sedentary activities, and five-point scales (none, 1–2 times/week, 3–4 times/week, 5–6 times/week, daily) for physical activity, supplemented with yes/no items for school and outside sports participation.

Reliability of the Musaiger et al study and revealed a good level of internal consistency (Cronbach's alpha=0.87).<sup>9</sup> In the current test, the questionnaire was translated into Arabic and back-translated by bilingual experts in nutrition and public health to make it culturally appropriate and linguistically clear. Face validity was assessed by five specialists in nutrition, epidemiology, and public health who confirmed that items pertained to relevant aspects of healthy eating as well as their clarity. To assess the construct validity, EFA and CFA were conducted. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.82. The 28 items explained 58.7% of the total variance (EFA), and factor loadings

fluctuated between 0.48 and 0.72, which evidenced an adequate functioning in the items. The CFA provided additional evidence for the instrument's structure resulting in acceptable model fit indices:  $\chi^2/df = 2.35$ , RMSEA = 0.056, CFI = 0.923, and TLI = 0.905. Cronbach's alpha for reliability in the present study was 0.729, showing an acceptable internal consistency of the scale.

## Preliminary Test

### Data Collection

Before the collection of data, participants were informed about the purpose of the study and gave a digital informed consent. The participation was voluntary, and they could withdraw at any time without negative consequences. Ethical approval was in place before the study began. The survey questions were translated to minimize suggestive language and cultural sensitivity, whilst responding was anonymous to minimize response bias.

### Ethical Considerations

This study was approved by the REU of King Khalid University (Approval No: REC # 2024–3163). All procedures were performed in accordance with ethical standards established by Declaration of Helsinki as well as institution research guidelines. Students received detailed information about the aims, procedures, possible benefits for themselves and minimal risks of participation before participating. They were explicitly informed that their participation was entirely voluntary and that they had the right to decline involvement or withdraw at any stage of the study without penalty or academic consequences. Informed digital consent was obtained from all participants. Confidentiality and anonymity were strictly maintained throughout the research process.

### Data Analysis

The socio-demographic characteristics, nutritional literacy, dietary habits, and lifestyle habits of the 385 participants were analyzed by SPSS V.26. Categorical and continuous variables were summarized with descriptive statistics, including frequencies, percentages, means, and standard deviations. NT literacy was measured through six domains (knowledge, understanding, sourcing, and applying; interactive and critical) with mean composite scores of each domain. Pearson correlation coefficients were used to examine the relationships between nutritional literacy and dietary habits, lifestyle factors, and socio-demographics. We performed multiple regression analyses to identify the most potent predictors of nutrition literacy among both dietary/lifestyle and socio-demographic variables. Significance levels were  $p < 0.05$  and  $p < 0.01$ .

## Results

Table 1 shows that the total sample ( $n = 385$ ) was mostly female participants (66.2%), with males making up 33.8%. Most were aged 18–22 (69.1%), followed by those aged 23–27 (19.5%), and 28 years and older (11.4%). Over half the participants were single (57.1%), while 41.5% were married. In terms of education, the vast majority were bachelor's students (83.4%), with smaller proportions attending Diploma programs (15.1%) or pursuing postgraduate studies

**Table 1** Socio-Demographic, Lifestyle, and Clinical Profile of the Participants ( $n = 385$ )

Variable	Categories	No	%
Gender	Female	255	66.2
	Male	130	33.8
Age	18- < 23 years	266	69.1
	23-< 28 years	75	19.5
	> or = 28	44	11.4

(Continued)

**Table I** (Continued).

Variable	Categories	No	%
Marital status	Single	225	57.1
	Married	160	41.5
Education	Diploma Students	58	15.1
	Bachelor's Students	321	83.4
	Postgraduate Student	6	1.6
College	Medical	227	59.0
	Non-Medical	158	41.0
Living Arrangements	With family	300	77.9
	On my own	60	15.6
	With friends	25	6.5
Place of Residence	City	358	93.0
	Village	27	7.0
Income	Financially independent and sufficient	208	54.0
	Financially independent but insufficient	136	35.3
	Dependent on others	41	10.6
Smoking Status	No	324	84.2
	Yes	61	15.8
Sleep Hours	Inadequate (less than 6 hours per day)	231	60.0
	Adequate (6–8 hours per day)	154	40.0
Chronic Illness	No	281	73.0
	Yes	104	27.0
BMI	Underweight	27	7.0
	Normal	232	60.3
	Overweight	103	26.8
	Obese	23	6.0

**Notes:** City: urban areas, Village: rural areas.

(1.6%). Academic background was mostly medical (59.0%), versus non-medical (41.0%). Regarding living arrangements, most lived with family (77.9%), while 15.6% lived on their own, and 6.5% lived with friends. Most [93.0%] lived in the urban area compared to the rural area [7.0%]. 54% were self-sufficient, 35.3% partially independent and 10.6% dependent on others financially. A majority of patients were non-smokers (84.2%) smokers accounted for 15.8%. In relation to sleep patterns, 60.0% were classified as having inadequate sleep (<6 h/day) and 40.0% had adequate sleep (6–8 h/day). Most of them were not suffering from any chronic illness (73.0%) and around 27.0% had chronic diseases. Most participants had normal BMI (60.3%), and the remaining were overweight (26.8%), underweight (7.0%), and obese (6.0%).

Table 2 indicates that nutritional literacy was considered high overall with variation between domains. Knowledge was the highest ( $M = 4.31$ ,  $SD = 0.74$ ), with a majority agreeing on the usefulness of a balanced diet in preventing chronic disease and the importance of using healthier methods to cook food (see Table 3). Comprehension was also high ( $M = 4.08$ ,  $SD = 0.70$ ) with individuals frequently able to understand which food items were nutritious and make sense of

**Table 2** Nutritional Literacy of the Participants (n=385)

Items	Strongly Agree No (%)	Agree No (%)	Neutral No (%)	Disagree No (%)	Strongly Disagree No (%)	Mean (SD)
<b>Knowledge</b>						
A balanced diet is a crucial measure for preventing and controlling chronic diseases, including diabetes and hypertension.	215 (55.8%)	152 (39.5%)	13 (3.4%)	2 (0.5%)	3 (0.8%)	4.49 (0.666)
Steaming and boiling are healthier cooking methods than frying and grilling.	129 (33.5%)	201 (52.2%)	38 (9.9%)	11 (2.9%)	6 (1.6%)	4.13 (0.820)
<b>Overall</b>	344 (44.7%)	353 (45.9%)	51 (6.6%)	13 (1.7%)	9 (1.2%)	4.31 (0.74)
<b>Understanding</b>						
Understand the nutritional information delivered by new and traditional media.	94 (24.4%)	229 (59.5%)	41 (10.6%)	19 (4.9%)	2 (0.5%)	4.02 (0.772)
A good understanding of expert consensus regarding dietary information.	100 (26.0%)	242 (62.9%)	37 (9.6%)	6 (1.6%)	0 (0.0%)	4.13 (0.634)
<b>Overall</b>	194 (25.2%)	471 (61.2%)	78 (10.1%)	25 (3.2%)	2 (0.3%)	4.08 (0.70)
<b>Obtaining Skills</b>						
Know where to find reliable information on healthy diets.	109 (28.3%)	238 (61.8%)	25 (6.5%)	9 (2.3%)	4 (1.0%)	4.14 (0.719)
Read nutrition information shared through new media, such as WeChat and microblogging, or watch nutrition-related programs.	62 (16.1%)	224 (58.2%)	66 (17.1%)	29 (7.5%)	4 (1.0%)	3.81 (0.832)
<b>Overall</b>	171 (22.2%)	462 (60.0%)	91 (11.8%)	38 (4.9%)	8 (1.0%)	3.98 (0.78)
<b>Applying Skills</b>						
Drink milk or dairy products every day.	73 (19.0%)	178 (46.2%)	80 (20.8%)	49 (12.7%)	5 (1.3%)	3.69 (0.964)
Buy food based on nutrition facts on food packages.	39 (10.1%)	166 (43.1%)	112 (29.1%)	58 (15.1%)	10 (2.6%)	3.43 (0.953)
<b>Overall</b>	112 (14.5%)	344 (44.7%)	192 (24.9%)	107 (13.9%)	15 (1.9%)	3.56 (0.96)
<b>Interactive Skills</b>						
I am open to reasonable nutrition and health advice from family or friends.	78 (20.3%)	246 (63.9%)	48 (12.5%)	12 (3.1%)	1 (0.3%)	4.01 (0.690)
If my family members or friends are overweight and enjoy eating high-fat foods, I will encourage them to make dietary changes.	138 (35.8%)	184 (47.8%)	33 (8.6%)	22 (5.7%)	8 (2.1%)	4.10 (0.923)
<b>Overall</b>	216 (28.0%)	430 (55.8%)	81 (10.5%)	34 (4.4%)	9 (1.2%)	4.06 (0.81)

(Continued)

**Table 2** (Continued).

Items	Strongly Agree No (%)	Agree No (%)	Neutral No (%)	Disagree No (%)	Strongly Disagree No (%)	Mean (SD)
<b>Critical Skills</b>						
Easily tell whether my daily diet is reasonable.	84 (21.8%)	246 (63.9%)	40 (10.4%)	14 (3.6%)	1 (0.3%)	4.03 (0.701)
Estimate the suitable food intake for maintaining a healthy body weight.	82 (21.3%)	226 (58.7%)	54 (14.0%)	20 (5.2%)	3 (0.8%)	3.95 (0.794)
<b>Overall</b>	166 (21.6%)	472 (61.3%)	94 (12.2%)	34 (4.4%)	4 (0.5%)	3.99 (0.75)

expert recommendations. Skills were a little lower ( $M = 3.98$ ,  $SD = 0.78$ ) although it did not differ by much where people knew they would find trustworthy dietary information. Task application had the lowest meaning ( $M = 3.56$ ,  $SD = 0.96$ ) since far fewer people regularly use nutrition facts or eat dairy each day. Interactive ( $M = 4.06$ ,  $SD = 0.81$ ) and critical skills ( $M = 3.99$ ,  $SD = 0.75$ ) were in comparatively high levels indicating openness to nutrition advice and ability to determine needs for dietary modifications.

Eating and snacking behavior is presented in [Table 3](#). Frequency of meal timing (overall mean = 1.00,  $SD = 0.52$ ) was low and snacking, particularly at night, was frequent. Consumption of the basic food groups was fair (meaning = 2.36,  $SD = 0.98$ ) and fish, lentil, and nuts were the most consumed foods, but fruit and vegetables were less frequently consumed than guidelines recommended. Fast-food consumption was prevalent (mean overall = 2.41,  $SD = 0.92$ ), both in terms of regular fast-food consumed at home and away from home and a high intake of soft drinks, sweets, and chocolate were reported. These combined results reveal irregular meal patterns, moderate but heterogeneous healthy eating frequency, and a marked preference for fast food and sweet snacks – exposure trends that are potentially escalate long-term health risk.

[Table 4](#) highlights the fact that lifestyle habits in both players and non-players are characterized by a combination of sedentary and active behaviours. 16.1% TV daily, 20.0% 1–2 h, 22.6% 3–4 h, 9.6% n = –5+h and 31.7% almost never watched:  $M = -2.78$  ( $SD = \pm 1.286$ ). For eating behavior while watching TV, 22.6% always ate, 61.8% did so sometimes, and 15.6% never did so ( $M = 1.93$ ;  $SD = 0.615$ ). Internet use was frequent: 33.5% on-line every day, 49.9% for 1–2 h, and seldom for 16.6%, with a mean of 2.16 ( $SD = 0.899$ ). While eating while they used the internet, 51.9% ate, 16.6% at times and 31.4% did not eat (mean = 1.85;  $SD = 0.678$ ). Eighty percent and 19.3% did not participate in sports with a mean age of participation of 0.68 participants ( $SD = 0.490$ ). Mean frequency of sports per week was 1–2 (19.2%), 3–4 (33.0%), 5–6 (24.2%), 6–7 (15.3%), and 7 + times/week (7.5%). Mean frequency of participating in sports activities was  $M = 2.61$ ,  $SD = 1.215$ ). Regarding university sports activities, 19.0% always participated, 55.1% sometimes, and 26.0% never (mean = 2.07;  $SD = 0.668$ ). A similar pattern emerged for sports outside of university where always participation was reported by 17.9%, sometimes by 56.1% and to never participate (26.0%), mean score = 2.08 ( $SD = 0.658$ ).

Level of education had a positive association with nutritional literacy ( $r = 0.276$ ,  $P = 0.020$ ), dietary practices ( $r = 0.305$ ,  $p = 0.010$ ), and lifestyle habits in driving health attitudes ([Table 5](#)). In addition, personal income positively correlated significantly with nutritional literacy ( $r = 0.224$ ,  $p = 0.043$ ) and dietary habits ( $r = 0.256$ ,  $p = 0.028$ ). On the other hand, there was a negative association between tobacco use and all the three factors with nutritional literacy taking the table as independent predictor ( $r = -0.318$ ;  $p = 0.008$ ). Nutrition literacy ( $r = -0.284$ ,  $p = 0.017$ ) and lifestyle practices ( $r = -0.276$ ,  $p = 0.020$ ) were negatively correlated with the chronic disease component of the SLPs score. Body mass index (BMI) was negatively associated with nutritional literacy ( $r = -0.294$ ,  $p = 0.012$ ), dietary patterns ( $r = -0.276$ ,  $p = 0.020$ ) and lifestyle habits ( $r = -0.312$ ,  $p < 9$ ). The nutritional literacy positively correlated significantly with dietary habits ( $r = 0.624$ ,  $p = 0.005$ ), and the  $r$  with lifestyle habits positive was not statistically significant ( $r = 0.524$ ,  $p = 0.063$ ). Diet and lifestyle were strongly related ( $r = 0.576$ ,  $p < .001$ ), indicating greater diet quality is related to healthier lifestyles.

**Table 3** Dietary Habits of the Participants (n = 385)

<b>Food Consumption and Snacking Patterns</b>	<b>Mean</b>	<b>SD</b>
Eating breakfast regularly	0.70	0.461
Place of eating breakfast	1.35	0.476
Bring food from home	0.67	0.472
Eating during school break time	0.71	0.454
Eat from the school canteen	0.61	0.488
Eating food while going home	0.73	0.446
Eating lunch regularly	0.71	0.454
Eating supper regularly	0.74	0.442
Snacking between breakfast and lunch	1.64	0.667
Snacking between lunch and supper	1.61	0.645
Midnight snacks	1.65	0.683
Overall	1.01	0.52
<b>Type and frequency of food consumed</b>		
Fruits	2.38	1.054
Vegetables/Salad	2.32	0.994
Milk and Dairy Products	2.17	0.970
Meat	2.24	0.951
Fish	2.68	1.072
Chicken	2.06	0.921
Lentils/Beans	2.53	1.028
Nuts	2.51	1.071
Canned Fruit Juice	2.32	1.032
Overall	2.36	0.98
<b>Fast Food Intake</b>		
Frequency of eating fast food per week	2.38	0.966
Frequency of eating fast food outside the home	2.76	1.210
Frequency of eating fast food at home/week:	2.83	1.172
Size of burger preferred	2.02	0.637
Size of chips preferred	2.05	0.643
Soft drinks consumption	2.53	1.010
Size of soft drinks preferred	2.32	0.847
Intake of sweets per week	2.44	0.962
Intake of chocolates/ week	2.38	0.966
Overall	2.41	0.92

**Abbreviation:** SD, standard deviation.

**Table 4** Lifestyle Habits of the Participants (n = 385)

Items	N	%	Mean	SD
Hours watching TV				
Every day	62	16.1	2.78	1.236
Rarely	122	31.7		
1-2 hours	77	20.0		
3-4 hours	87	22.6		
5+ hours	37	9.6		
Eating while watching TV				
Always	87	22.6	1.93	0.615
Sometimes	238	61.8		
Never	60	15.6		
Hours using the internet				
Every day	129	33.5	2.16	0.899
Rarely	64	16.6		
1-2 hours	192	49.9		
Eating while using the internet				
Do not eat	121	31.4	1.85	0.678
Eat	200	51.9		
Sometimes	64	16.6		
Participating in sporting activities			0.68	0.490
Yes	311	80.7		
No	74	19.3		
Frequency of participating in sports per week				
None			2.61	1.215
1-2 times	74	19.2		
3-4 times	127	33.0		
5-6 times	93	24.2		
6-7 times	59	15.3		
7+ times	29	7.5		
Participation in university sports activities				
Always	73	19.0	2.07	0.668
Sometimes	212	55.1		
Never	100	26.0		

(Continued)

**Table 4** (Continued).

Items	N	%	Mean	SD
Participation in sports outside the university				
Always	69	17.9	2.08	0.658
Sometimes	216	56.1		
Never	100	26.0		

**Abbreviation:** SD, Standard Deviation.

**Table 5** The Association Between Socio-Demographic Factors and Nutritional Literacy, Dietary, and Lifestyle Habits Among the Participants (n = 385)

Variables		Nutritional Literacy	Dietary Habits	Lifestyle Habits
Gender	<i>r</i>	-0.142	0.087	-0.051
	Sig. (2-tailed)	0.21	0.398	0.615
Age	<i>r</i>	0.185	0.243*	0.197
	Sig. (2-tailed)	0.115	0.041	0.098
Marital status	<i>r</i>	0.092	0.135	0.164
	Sig. (2-tailed)	0.372	0.229	0.156
Level of Education	<i>r</i>	0.276*	0.305**	0.218*
	Sig. (2-tailed)	0.02	0.010	0.049
College	<i>r</i>	0.081	0.124	0.097
	Sig. (2-tailed)	0.428	0.268	0.352
Living Arrangements	<i>r</i>	0.102	0.187	0.143
	Sig. (2-tailed)	0.328	0.111	0.206
Place of Residence	<i>r</i>	-0.067	-0.084	-0.052
	Sig. (2-tailed)	0.508	0.412	0.609
Income	<i>r</i>	0.224*	0.256*	0.199
	Sig. (2-tailed)	0.043	0.028	0.095
Chronic diseases	<i>r</i>	-0.284*	-0.215*	-0.276*
	Sig. (2-tailed)	0.017	0.052	0.02
Smoking	<i>r</i>	-0.318**	-0.291**	-0.227*
	Sig. (2-tailed)	0.008	0.015	0.041
Sleep Habits	<i>r</i>	0.208	0.256*	0.312**
	Sig. (2-tailed)	0.059	0.027	0.009
BMI	<i>r</i>	-0.294**	-0.276*	-0.312**
	Sig. (2-tailed)	0.012	0.02	0.009

(Continued)

**Table 5** (Continued).

Variables		Nutritional Literacy	Dietary Habits	Lifestyle Habits
Nutritional Literacy	<i>r</i>	1	0.624*	0.524
	Sig. (2-tailed)	-	0.005	0.063
Dietary Habits	<i>r</i>	0.624	1	0.576**
	Sig. (2-tailed)	0.005	-	0.000
Lifestyle Habits	<i>r</i>	0.524	0.576**	1
	Sig. (2-tailed)	0.063	0.000	-

**Notes:** \*P ≥ 0.05 level (2-tailed), \*\* P ≥0.01 level (2-tailed), *r*: Pearson correlation coefficient.

There were identified nutritional literacy (B = 0.228, p = 0.002) lifestyle habits (B = 0.184, p = 0.006) as major predictors in dietary behavior mo if nutritional and lifestyle status is improved, healthy demanding was improved significantly for all boys and girls (Table 6). Socio-demographic factors were also associated: education (B = 0.185, p = 0.009), income (B = 0.148, p = 0.035) age (B = 0.016, p = 0.046) and sleep hours (B = .125, P = .013) acted as a positive predictor for this value. Smoking (B = -0.132, p = 0.041), chronic diseases (B = -0.142, p = 0.041), and BMI (B = -0.117, p < 0.05) were negative predictors of dietary habits, on the other hand.

As shown by Table 7, dietary habits were the most influential life habit on overall lifestyle (B = 0.265, p < 0.001) which confirms the association of eating to other lifestyles. In addition, the number of hours slept (B = 0.154, p = 0.003), educational level (B = 0.161, p = 0.024), and age (B = 0.018, p = 0.044) showed a significant positive effect as well; thus, high educational levels, sufficient sleep time, and maturity are also factors associated with healthier lifestyle habits or behaviors. Chronic diseases (B = -0.167, p = 0.021) and BMI (B = -0.134, p = 0.027), on the other hand, were negative predictors for health behavior, meaning that having more health burdens is related to unhealthy lifestyle habits negatively. Nutrition knowledge (B = 0.094, p = 0.192) did not enter the model significantly indicating a more marginal place compared to dietary habits in intention formation.

**Table 6** Multiple Linear Regression Predicting Dietary Habits from Nutrition Literacy, Lifestyle Habits, and Socioeconomic Factors (n = 385)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.120	0.340	-	9.176	0.000
Nutritional Literacy	0.228	0.071	0.196	3.211	0.002**
Lifestyle Habits	0.184	0.066	0.168	2.788	0.006**
Age	0.016	0.008	0.092	2.001	0.046*
Level of Education	0.185	0.070	0.165	2.643	0.009**
Income	0.148	0.070	0.136	2.114	0.035*
Smoking Status	-0.132	0.064	-0.109	-2.063	0.041*
Chronic Diseases	-0.142	0.069	-0.121	-2.059	0.041*
Sleep Habits	0.125	0.050	0.106	2.489	0.013*
BMI	-0.117	0.059	-0.099	-1.983	0.048*

**Notes:** \*P ≥ 0.05 level (2-tailed) \*\* P ≥0.01 level (2-tailed). B = raw effect size; Std. Error = precision of B; Beta = effect size in standardized units; t = test statistic (B ÷ Std. Error).

**Table 7** Multiple Linear Regression Predicting Lifestyle Habits from Nutrition Literacy, Dietary Habits, and Socioeconomic Factors (n = 385)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.870	0.360	–	7.972	0.000
Nutritional Literacy	0.094	0.072	0.082	1.308	0.192
Dietary Habits	0.265	0.069	0.233	3.841	0.000**
Gender	–0.027	0.059	–0.019	–0.462	0.644
Age	0.018	0.009	0.098	2.019	0.044*
Level of Education	0.161	0.071	0.142	2.268	0.024*
Chronic Diseases	–0.167	0.072	–0.141	–2.319	0.021*
Sleep Hours	0.154	0.052	0.129	2.962	0.003**
BMI	–0.134	0.061	–0.115	–2.213	0.027*

**Notes:** \*P ≥ 0.05 level (2-tailed). \*\* P ≥ 0.01 level (2-tailed). B = raw effect size; Std. Error = precision of B; Beta = effect size in standardized units; t = test statistic (B ÷ Std. Error).

**Table 8** shows the factors; social demographic factors were statistically significant predictors of nutritional literacy. The level of education (B = 0.21, p = 0.004), type of college attended (B = 0.135, p = 0.048) and income (B = 0.175, p = 0.015) had a positive impact; that is higher educational status, and incomes were positively associated with nutritional literacy. Smoking (B = –0.142, p = 0.030), chronic diseases (B = –0.198, p = 0.006) and BMI (B = –0.125, p = 0.038) were negative predictors which indicated that these factors decrease nutritional literacy. Sleep hours (B = 0.11, p = 0.031) also had a positive significant effect.

**Table 8** Multiple Linear Regression Predicting Nutritional Literacy from Socio-Demographic Factors Among the Participants (n = 385)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.950	0.320	–	9.219	0.000
Level of Education	0.210	0.072	0.182	2.917	0.004**
College	0.135	0.068	0.109	1.985	0.048*
Income	0.175	0.071	0.152	2.464	0.015**
Smoking Status	–0.142	0.065	–0.118	–2.185	0.03*
Chronic diseases	–0.198	0.071	–0.161	–2.789	0.006**
Sleep Hours	0.110	0.051	0.091	2.157	0.032*
BMI	–0.125	0.060	–0.105	–2.083	0.038*

**Notes:** \*P < 0.05 level (2-tailed). \*\* P < 0.01 level (2-tailed). B = raw effect size; Std. Error = precision of B; Beta = effect size in standardized units; t = test statistic (B ÷ Std. Error).

## Discussion

Nutrition literacy has been recognized as of great importance in influencing dietary and lifestyle behaviors especially among university students who are challenged for making healthy decisions. The current cross-sectional study conducted at KKU, Abha in Saudi Arabia is to determine the prevalence of nutritional literacy and its correlation with eating habits and lifestyle among students. With this age group experiencing high academic stress, the role curiosity about nutrition information plays on eating and physically activity decisions is important.

The results of this study are the implications for nutritional literacy among college students. People generally have good understanding of nutrition: they appreciate the fact that one should eat a balanced diet and cook food in healthy way. This represents successful acquisition and mastery of basic nutritional knowledge in line with the functional dimension of food literacy. However, even when able to comprehend nutrition information from numerous sources and having an understanding of professional consensus regarding dietary guidelines, students have difficulty in employing such knowledge on a consistent basis when making these decisions with respect to their daily eating.<sup>10</sup> There is a discrepancy between nutrition knowledge and its application in daily diet, specifically with respect to consuming dairy products regularly and the reading of food labels while shopping. This suggests that something other than just knowledge – of personal preference, of convenience and cost – is crucial. Also, this research emphasizes the importance of interactive and critical skills, physiques reveal also to be proponent about receiving advice on food and being a good place for discriminating against the guaranteed with their diet. These are the skills we need to participate in intelligent conversations about what we eat, and to sort out dietary facts from fiction.

In general, the results underscore the need for interventions extending beyond simple nutrition education. Successful methods should approach the knowledge–behaviour gap by focusing on resolving those barriers that prevent students from putting healthier dietary choices into practice. Culture-specific interventions pertaining to Saudi students may include offering cooking demonstrations that involve traditional Saudi dishes prepared in a manner reflective of healthy principles, providing nutrition education that is heterogenous regarding local practices and dietary sensitivities, and implementing community gardens with locally grown vegetables and herbs. Engaging local chefs and nutritionists to design customized meal plans incorporating familiar tastes that are also nutritionally balanced may increase engagement and applicability.<sup>11</sup> Culturally relevant interventions that enhance self-efficacy, increase access to nutritious food options, and bolster the skills necessary for navigating the food environment are essential for improving the nutritional health of university students.<sup>12</sup>

The findings exhibit dietary behaviors such as low food intake and snacking practices of the university students that are indicative of poor meal frequency and a possible nutrient deficiency. Students who say that they eat a variety of foods does not mean it's a BALANCED diet. This result is consistent with more general research suggesting that college students have difficulty eating regular meals because they are busy with their studies, lack of time, and the fact that nutritional food options being few.<sup>13</sup> There is also a consistent practice of fast-food consumption evident from the fact that students often favor convenience and not necessarily healthy, lifestyle choices – known behavior patterns for young adults in higher education due to student affordability as well as preference and taste. These dietary practices might have adverse health effects such as gaining weight and being at risk for chronic diseases.<sup>14</sup>

The examination of lifestyle habits reveals an important pattern in sedentary behaviors, especially with screen time and eating patterns. A moderate duration for watching TV and using the internet, such quick durations of frequent eating during these activities may indicate mindless eating. Studies have suggested that eating with screens may result in higher caloric intake and worse dietary quality.<sup>26</sup> Nevertheless, although the literature supports that eating in front screens may result in consuming more calories.<sup>16,26,27</sup> The high proportion of students who report eating while watching a screen highlights the need to promote mindful eating practices, specifically in settings where fast foods are abundant.

The physical activity participation data also tends to show a worrying pattern of very low levels of involvement in sport among students. Most report some involvement, but the level of active participation remains minimal, with many exercises only once or twice a week. This is consistent with previous research that has identified the barriers to regular physical activity levels amongst university students, namely academic work and lack of time.<sup>17</sup> The low organized sports

participation shows that the universities need to provide more attractive possibilities for exercise in order to promote a healthier lifestyle among students.

These findings may indicate an intricate relationship among dietary and lifestyle habits in university students, who tend to be dependent on processed foods and experience inadequate amounts of physical activity. The high prevalence of sedentary behaviors and regularity of the inadequate practice frequency of PA, RD shows the great need for integral strategies for health promotion at universities.<sup>19</sup> Future efforts should focus on creating a healthy culture of eating and frequent physical activity by implementing multiple-element-based interventions, including programs for nutrition education with practical cooking classes and management of aerobics on customer-alluring campus areas at three different fitness levels, as well as association of participants into peer support community to share experience in making healthier lifestyle choices. Universities can also take advantage of technology (eg, mobile apps) to develop individual health challenges and monitor progress in an effort to motivate students to be more consistent with their nutrition and physical activity involvement. Educational programs with opportunities for physical activity, combined with behavioral exercises, can facilitate the process and assist students in adopting a healthier lifestyle that may impact their future well-being.

The correlation analysis provides important information on the associations between nutritional literacy, dietary habits, and lifestyle dietary habits. The positive association between nutritional literacy and dietary habits suggests that university students who have better nutritional knowledge are more likely to adopt healthy eating practices. When contrasted to the study which explored on Malaysian adults 5, a comparable strong relationship emerged with increase rating in the nutrition literacy dimensions—obtain, analyze, and apply—and increase rate of dietary behavior. In both studies, those with higher nutrition competences scored significantly higher in the adherence to healthier dietary habits, indicating that personalized nutrition educational strategies focusing at optimizing these literacies can be effective on improving the quality of diet in a broad range of populations. This result is consistent with previous research which suggests that improved nutritional knowledge allows individuals to base food choices on a solid information background and adopt healthier dietary behavior.<sup>6</sup> It emphasizes the necessity of interventions that educate and not only increase learning, but also support its application in practice aiming towards better health.

However, as regards positive relationship between nutritional literacy and lifestyles, it is a correlation but not significant demonstrating that the latter may be less association. The lack of a statistically significant relationship between nutritional literacy and lifestyle behaviors, however, indicates that other factors (social norms, environmental circumstances, and psychological aspects) may have stronger influences on these patterns. This calls for further exploration of the mechanisms that determine lifestyle behavior over and above knowledge. For clarity, one must not merely present statistical findings in the regression tables but create a story that draws all of these independent variables together and shows how they affect lifestyles. Social norms, environmental factors, and individual situations can also greatly influence lifestyle behavior, suggesting that simply improving nutrition literacy may not be enough to result in an overall change of lifestyle.<sup>23</sup> This highlights the importance of ensuring that health interventions including a social determinants of health lens, reminding us that while knowledge is necessary to influence a change in behavior other socio-economic factors, cultural environment, and context, as well as physical environment also affect individual choices.

Additionally, socio-demographic correlation analysis is crucial for the understanding of how health behavior and these factors intersect. Nutritional literacy and dietary behavior are positively associated with education level and income so that a higher socioeconomic status is suggested to provide better facilities concerning the availability of healthy food items and resources for physical activity.<sup>28</sup> Contrarily, smoking status and chronic diseases are inversely correlated to nutritional literacy as well as lifestyle suggesting that those suffering health challenges may be finding it difficult to adhere to healthy dietary or any lifestyle behaviors.<sup>29</sup>

Regression analysis showed that lifestyle behavior such as physical activity influenced dietary intake and thus general health. Moderate to strong correlations have been found between physical activity and healthy eating patterns. Student who reported higher levels of physical activity are more likely to display better dietary practices, which is also in line with findings from other studies suggesting that active individuals are predisposed to maintaining healthy diets and non-eating unhealthy behaviors.<sup>30</sup> The relatively low participation rate of organized sports among the students' needs to be

taken into account by universities and to revamp possibilities for physical activity, simultaneously with educational programs that will address both eating and exercise.<sup>31</sup>

Finally, socio-demographic variables (education level and income) were identified as predictors of nutritional literacy. Level of education has been positively associated with knowledge on nutrition, which is an understandable trend since more educated people are exposed to information and resources.<sup>32</sup> Finally, socio-demographic variables (education level and income) were identified as predictors of nutritional literacy. Level of education has been positively associated with knowledge on nutrition, which is an understandable trend since more educated people are exposed to information and resources.<sup>33</sup> Through the emphasis on programs that enhance nutrition literacy and lifestyle considerations, with both content supported by evidence-based research, universities have a crucial role in establishing a healthier student community.

Furthermore, the results of this study may provide evidence for national policies on health promotion by emphasizing the significant role of nutritional literacy in dietary behaviors. NUTRITION EDUCATION One way in which policymakers might consider addressing these and other social determinants of health is to incorporate nutrition education within the context of larger public health efforts, such as those that promote healthy food accessibility or community efforts to support a healthier lifestyle. Although the present study provides a number of insights regarding the relationship between nutrition literacy and dietary behaviour, further interventions need to be considered in this respect. Identify whether digital self-monitoring analogy for campus programs may have utility. This might include using NGO-led, peer-facilitation-based models that have been successful in health promotion programs. For example, peer support models could be adapted to improve nutritional behaviors<sup>34</sup> and used in oral health for similar purposes.<sup>34</sup>

**Limitations** This is a cross-sectional, single-site study that utilizes a convenience sample of university students thus constraining causal inference and external validity. Self-reporting of behavior and anthropometrics are subject to recall and social-desirability bias, with potential for misclassification of BMI and selection effects from the online survey. Over-representation of some colleges/sex limits generalization to other than study-campus and -region. Regarding these methodological limitations, we should put findings within the larger theoretical framework of health behavior theory that may contribute to the strength of future interpretations.<sup>35</sup> Moreover, direct mention of the effect sizes of findings will also elucidate the practical significance of relationships observed. Despite these restrictions, its practical implications are evident. It is locally relevant evidence and will measure the extent to which nutritional literacy is associated with modifiable diet and lifestyle behaviors of Saudi university students, using culturally sensitive Arabic instruments that has been previously tested for reliability or validity. The findings provide campus-level (indicated) baseline metrics for universities to address including curriculum-integrated NL training, improved cafeteria labelling and healthier defaults as well as targeted messages related to breakfast regularity by health authorities.

Longitudinal research is suggested for future studies to assess the long-term effects of nutrition literacy interventions on dietary behaviours and lifestyle factors of university students. This would help to determine whether long-term gains in nutritional knowledge can lead to lasting health benefits and identify specific factors that facilitate or impede behaviour change over time. Furthermore, the development of a more representative participant sample across other socio-demographic groups would improve the generalizability of results to the wider population.

## Conclusion

This study indicates that higher nutrition literacy is linked with a more favorable pattern of modifiable diet and lifestyle behaviors among university students in Saudi Arabia. The present study also provides evidence of the appropriateness and congruence of Arabic nutrition-literacy tools among this population. While not generalizing these findings, some of the major methodological constraints such as a cross-sectional sampling design, using convenience sample and gender bias were considered. Based on the observed relationships, the study suggests two potential practical implications for universities to action: adopted structured nutrition-literacy programs (such as peer-supported learning or electronic methods), and enhancing campus food environments by providing clearer nutritional information and greater availability

of low-cost nutrient-rich choices. These mechanisms represent plausible, evidence-informed approaches to encourage greater choices for optimal health among university students.

## Data Sharing Statement

The datasets generated and analyzed during the current study are available from the corresponding author (Maha Hamed Mohamed Ali), upon reasonable request. Any shared data will be fully anonymized and dissociated from all identifying characteristics to comply with ethical and privacy requirements.

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## Disclosure

The authors declare that they have no competing interests in this work.

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