

Dietary Habits, BMI, and Demographic Characteristics affect the Academic Performance of University Students in Saudi Arabia: A Cross-sectional Study

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Abstract Background: Students' academic performance remains one of the ongoing debate topics among educators, academicians, and policy-makers. We aimed to assess the effect of dietary habits, demographic characteristics, and body mass index (BMI) on academic performance. **Method:** An epidemiological, cross-sectional, retrospective study design was conducted. Data were collected from 385 full-time Saudi undergraduate students at Taibah University. They aged between 18-24 years old. Students were asked about their breakfast, fast food, and soft drink consumption and their daily number of meals. Information about their gender, residence in hostels, and smoking status were obtained. Grade point average (GPA) was used to assess academic performance. BMI was also calculated. All statistical analyses were performed using the SPSS software program version 20. **Results:** More females (n = 290; 75.3%) than males were included. High academic performers were non-smokers (P < 0.0005) and didn't stay in hostels (P = 0.026). BMI associated negatively with academic performance. Females had better academic performance (95%) compared to males (58%, P < 0.0005), GPA (2.72 vs 3.53, P < 0.0005 respectively), lower number of meals (Mean: 2.31 vs 1.99), and low prevalence of overweight/obesity (43% vs 30%). **Conclusion:** Nutrition education programs targeting Taibah University students are to be developed to raise awareness about the importance of healthy eating and normal body weight.

Keywords: dietary habits, demographic characteristics, BMI, academic performance, university students, Al Madinah Al Munawarah, Saudi Arabia

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1. Introduction

Students' academic performance remains one of the ongoing debate topics among educators, academicians, and policy-makers [1]. The academic performance of college students affects their future occupational success and health. Studies indicate that dietary behaviours and practices are essential factors that can predict college students' academic performance [2]. A healthy dietary pattern rich in whole grain cereals, fruits, and vegetables can lead to better cognitive function, improved memory, better test grades, and school attendance, leading to an overall better academic performance [3].

Over the last decade, dietary habits have changed in Saudi Arabia due to the diverse ethnic backgrounds[4]. People have become more likely to consume western food rich in saturated fat, refined cereals, low in fruit and vegetables[5]. As well documented in the literature, unhealthy dietary habits may lead to weight problems, as

presented by the increased prevalence of obesity in the country [6,7]. The National Nutrition Survey ranked Saudi Arabia as number 15 worldwide for its prevalence of obesity, with an overall obesity rate of 33.7% [7]. Obesity and unhealthy dietary pattern have been associated with an increased risk of various health problems, including metabolic syndrome, Type 2 diabetes mellitus, cardiovascular disease [8], and low academic performance [9].

Moreover, a study conducted in India revealed that female students and those who stayed in hostels had better academic performance than their counterparts [10]. While the number of observational studies in this area is growing, studies are predominantly from the USA, the UK and Europe. Very few studies had investigated the association between dietary habits, BMI, demographic characteristics, and academic performance in college students in the KSA in general and in Al Madinah Al Munawarah specifically. Dietary habits were shown to affect the academic performance of college students in Riyadh. In that study, there was a significant association (P<0.0001) between

academic performance and dietary pattern leading to instability amongst students, lack of concentration, and inability to work during the day [11]. Also, inadequate adherence to a healthy diet such as the Mediterranean diet [12], high intake of fast food [13,14,15], sugar-sweetened drinks [16,17] and irregular breakfast consumption [18] may negatively affect students' academic performance.

Several factors affect the academic performance of university students. The present study aimed to examine the effect of dietary habits, demographic characteristics, and body mass index (BMI) on students' academic performance at Taibah University in Al Madinah Al Munawarah. We hypothesized that unhealthy dietary habits and obesity are associated with low academic performance. We also hypothesized that being a female and living in hostels are associated with high academic performances.

2. Materials and Methods

2.1. Study Design

An epidemiological, cross-sectional, retrospective study design was followed to fulfil the study aim. Data were collected at the beginning of the first semester of the academic year 2019-2020. Data collection was done to avoid busy times before and during exams. The sample size was determined based on a 95% power of the study, a two-tailed significance level of 0.05, and a z-value of 1.96. The following equation was used:

$$(Z - score)^2 * StdDev * (1 - StdDev) / (margin of error)^2$$

Thus, the minimum sample size should be 385 students.

2.2. Participants

Five hundred male and female students were recruited from various Colleges at Taibah University, Al Madinah Al Munawarah, Saudi Arabia. The inclusion criteria were full-time Saudi undergraduate students aged between 18-24 years old, not suffering from chronic diseases such as hypertension, diabetes mellitus, not pregnant, nor lactating and not following a dietary regimen at the time of the study. Since randomization will help reduce selection bias and give all participants a chance to be included in this study, a list of the different colleges was obtained from the official website of Taibah University (www.taibahu.edu.sa). This method will further assure the representativeness of the data obtained. The required number of participants was selected proportionally according to the total number of students in each college. Colleges with many students, such as the College of Education, were selected from a higher proportion of students.

2.3. Data Collection

Recruited participants completed a screening questionnaire that included background information such as age,

pregnant or not, lactating, and the presence of any chronic diseases. Those who fulfilled the inclusion criteria were further invited to proceed with the study. A self-report questionnaire was used to collect data from students about demographic characteristics, including age range (18-20 and 21-24 years), gender, smoking habits (smokers, non-smokers, and ex-smokers), and residence in hostels (non-hostels, hostels). Students were asked about their current GPA as a measure of their academic performance. A similar method for determining academic performance was previously reported [19]. The grades were then divided into low academic performers (GPA ≤ 2.99) and high academic performers (GPA ≥ 3.00). Respondents were given instructions on how to fill out the questionnaire, which was then checked for completeness. It is important to note that the students were not compensated for their voluntary participation.

Weight was measured twice using OMRON - Body Fat Scales (BF5081, China) after calibration. Students were asked to remove heavy clothes, shoes and accessories and readings were taken to the nearest 0.1g. A portable stadiometer (SECA-213 model, Germany) was used after calibration to measure height twice. Students removed their shoes and anything on the head that might affect the measurement.

Furthermore, to assess dietary habits, students were asked to recall specific information about their intake during the previous seven days. Information was noted about the number of meals consumed, and results were grouped as 1-2 meals or ≥ 3 meals per week. Their breakfast consumption was assessed, and results were presented as daily, 0-2 times a week, or 3-5 times a week. Moreover, the frequency of consuming fast foods (more than once daily, 0-2 times a week, or 3-5 times a week) and soft drinks (more than once daily, 0-2 times a week or 3-5 times a week) was determined. The questionnaire was pretested for clarity, and minor modifications were carried out accordingly.

Ethical approval was obtained from the committee of research ethics at Taibah University. Written informed consent was sought from each student before the start of the survey.

2.4. Statistical Analysis

Data were coded numerically and transferred to the Statistical Package for Social Sciences (SPSS Ins., Chicago, IL, USA) version 20. Frequency and percentage were used to present the demographic characteristics. Descriptive statistics such as the means and standard deviations were calculated for continuous variables. Independent student's t-test was used to test the differences between the dependent (academic performance) and the independent variables. It was also used to determine the differences between male and female students. Pearson's correlation was used to determine the relationship between variables. Multiple Regression Model was used to determine the factors that affected academic performance based on significance and confidence intervals (CI). Statistical significance was set at $<5\%$.

3. Results

In the first part of the result section, findings are presented based on students' academic performance. In the second part, results are grouped based on gender differences.

3.1. Part I

3.1.1. Demographic Characteristics

Out of the 500 students screened, 400 met the inclusion criteria. Of these, ten refused to participate, and five had missing data and thus excluded from the study. The overall response rate was 77%. Completed data was obtained from 385 undergraduate students aged 18-24 from different colleges. Half of them aged 18-20 years, and 95 (24.7%) were males. Students ($n = 55$, 14.3%) had low academic performance ($GPA \leq 2.99$) compared to high performers ($GPA \geq 3.00$, $n = 330$, 85.7%). Few students were smokers ($n = 69$, 18%) who were mostly males, and only 19 (5%) of the students stayed in hostels. Results also showed that few female ($n = 15$, 4%) students had low academic performance compared to their counterparts ($n = 40$, 14%, $P < 0.0005$). Besides, most of the high performers were non-smokers and did not stay in hostels (Table 1).

3.1.2. Anthropometric Measurements

The mean BMI of students was within the normal range, and there were no significant differences between low ($24.0 \pm 5.6 \text{ Kg m}^{-2}$) and high academic performers ($23.0 \pm 5.0 \text{ Kg m}^{-2}$, $P = 0.253$). The distribution of BMI amongst high and low academic performers is presented in Figure 1.

3.1.3. Dietary Pattern

Overall, there were no significant differences between high and low academic performers regarding their dietary patterns (Table 2). Students ($n = 273$, 71%) reported having on average, two meals daily during the previous week and consumed fast foods 0-2 times/week. Besides, 308 students (80%) consumed soft drinks 0-2 times/week. A few students reported daily breakfast consumption ($n = 150$, 39%) only (Results not shown in Table 2).

Table 1. Demographic characteristics of Taibah University students based on their academic performance as defined by GPA. The total number of students is 385. Number (%) are shown

	GPA ≤ 2.99 n (%)	GPA ≥ 3.00 n (%)	P-value*
Gender			<0.0005
Males	40 (72.7)	55 (16.7)	
Females	15 (27.3)	275 (83.5)	
Age (years)			0.172
18-20	23 (41.8)	171 (51.8)	
21-24	32 (58.2)	159 (48.2)	
Smoking status			<0.001
Smokers	22 (40)	47 (14.2)	
Non-smokers	33 (60)	283 (85.8)	
Residence in hostels			0.026
Non-hostels	47 (85.5)	319 (96.7)	
Hostels	8 (14.5)	11 (3.3)	

*P-value was obtained using Independent Student t-test. Most of the high academic performers were females, aged 18-20 years, were non-smokers and did not stay in hostels.

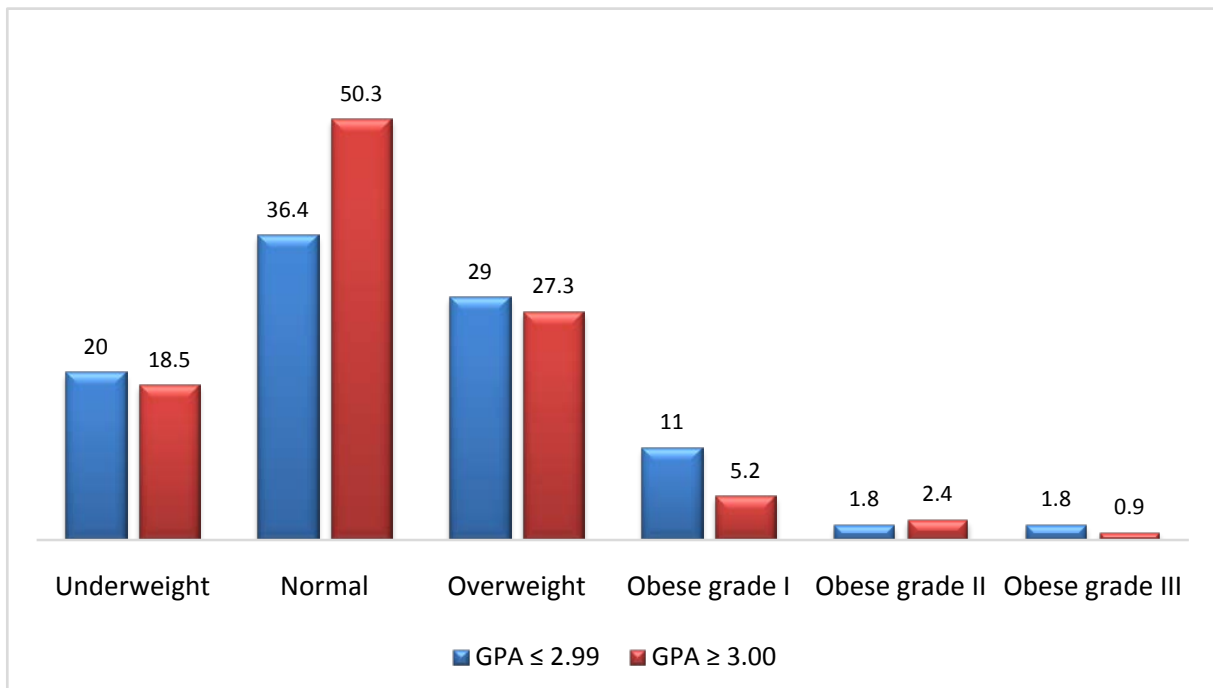


Figure 1. Students' BMI classification based on their academic performance (defined by GPA values). The Percentages of students in each category are shown. Most of the students had normal BMI ranges. No significant differences in the BMI classification between low and high performers. The total number of students is 385

Table 2. The dietary habits of Taibah University students based on their academic performance as defined by GPA. The total number of students is 385. Number (%) are shown

	GPA ≤ 2.99 n (%)	GPA ≥ 3.00 n (%)	P-value*
Number of meals			
Mean (SD)^a	2.05 (0.9)	2.07 (0.9)	0.89
1-2 meals daily	42 (76.4)	231 (70)	
>3 meals daily	13 (23.6)	99 (30)	
Frequency of Fast food consumption			0.397
0-2 times/week	41 (74.6)	233 (70.6)	
3-5 times/week	12 (21.8)	75 (22.7)	
Daily	2 (3.6)	22 (6.7)	
Consumption of Soft drinks			0.116
0-2 times/week	10 (18.2)	267 (80.8)	
3-5 times/week	5 (9.1)	36 (11)	
Daily	40 (72.7)	27 (8.2)	
Consumption of Breakfast			0.471
0-2 times/week	24 (43.7)	148 (44.8)	
3-5 times/week	13 (23.6)	49 (14.9)	
Daily	18 (32.7)	133 (40.3)	

*P-value is obtained using Independent Student t-test. ^aGeometric mean, SD= standard deviation.

3.1.4. Multiple Regression

Academic performance was significantly affected by gender. Females had better performance than their counterparts (Table 3). Residence in hostels negatively affected academic performance; those who resided in their homes had a better academic performance. Besides, BMI affected the performance negatively; those with higher BMI values had low performance.

Table 3. Factors affecting the academic performance of students at Taibah University

Factors	B	SE	Beta	95% CI	P-value
Gender	0.331	0.041	0.408	0.250 to 0.412	<0.0005
BMI	-0.093	0.029	-0.243	-0.150 to -0.037	0.001
Residence in hostels	-0.171	0.076	-0.106	-0.320 to -0.022	0.024

$R^2 = 0.264$; $R = 0.513$; Multiple Regression model was used with GPA being the dependent variable. Gender, BMI, and residence in hostels significantly affected the academic performance of Taibah University students.

3.2. Part II

3.2.1. Gender Differences

Gender was one of the factors that affected academic performance. Independent Student *t*-test revealed statistical differences between male and female students in their academic performance, selected demographics characteristics, BMI, and dietary habits. Females had higher academic performance, mainly were non-smoker, and did not reside in hostels compared to their counterparts (Table 4). Half of the females had normal weight and consumed a few numbers of meals daily. Fast-food consumption was not a common practice among female students. Also, more male students were overweight and/or obese (43%) than females (30%, $P = 0.049$).

Among females, Pearson's correlation showed that GPA correlated positively with the number of meals consumed daily ($r = 0.13$, $P = 0.029$). Females' BMI increased with increasing soft drink ($r = 0.16$, $P = 0.008$) and fast food consumption ($r = 0.13$, $P = 0.03$). On the other hand, the dietary pattern of male students did not affect their academic performance. Males' BMI negatively affected their performance ($r = -0.24$, $P = 0.02$). Multiple Regression model indicated gender differences in terms of their academic performance, smoking status, housing status, number of meals, and fast food consumption (Table 5).

Table 4. Demographic characteristics, BMI, and dietary pattern of Taibah students. The total number of students is 385. Number (%) are shown

	Males (n = 95)	Females (n = 290)	P-value*
Accumulative GPA for the last semester			
Mean (SD)^a	2.72 (0.8)	3.53 (0.6)	<0.0005
≤ 2.99	40 (42)	15 (5.2)	
≥ 3.00	55 (58)	275 (94.8)	
Number of meals			
Mean (SD)	2.31 (1.0) [§]	1.99 (0.8)	0.006
1-2 meals daily	60 (63.2)	213 (73.4)	
>3 meals daily	35 (36.8)	77 (26.6)	
Frequency of Fast food consumption			<0.0005
0-2 times/week	58 (61.0)	216 (74.5)	
3-5 times/week	30 (31.6)	57 (19.5)	
Daily	7 (7.4)	17 (6.0)	
Residence in hostels			<0.0005
Non-hostels	83 (87.4)	283 (97.6)	
Hostels	12 (12.6)	7 (2.4)	
Smoking status			
Smokers	42 (44.2)	27 (9.3)	<0.0005
BMI classification (Kgm⁻²)			
Mean (SD)^a	24.2 (5.4) [§]	22.8 (5.0)	0.049
Underweight	15 (15.8)	57 (19.7)	
Normal	39 (41.1)	147 (50.7)	
Overweight	29 (30.5)	62 (21.4)	
Obese ^b	12 (12.6)	24 (8.3)	

*P-values are obtained from Independent Student t-test. Only significantly different parameters are shown. ^aGeometric mean, SD= standard deviation; ^bObese refers to BMI ≥30 Kgm⁻².

Table 5. Gender differences based on academic performance, demographic characteristics, and dietary pattern at Taibah University

Factors	B	SE	Beta	95% CI	P-value
GPA	0.445	0.055	0.361	0.336 to 0.553	<0.0005
Smoking status	0.314	0.049	0.279	0.217 to 0.411	<0.0005
Residence in hostels	-0.207	0.087	0.139	-0.379 to 0.035	0.018
Number of meals	-0.064	0.014	-0.13	-0.105 to -0.024	0.002
Fast-food consumption	0.045	0.014	0.139	0.018 to 0.073	0.001

$R^2 = 0.350$; $R = 0.592$; Multiple Regression model was used with gender being the dependent variable. The GPA, smoking status, residence in hostels, number of meals, and fast food consumption were significantly different among Taibah University students.

4. Discussion

Unhealthy eating habits have been associated with poor academic performance and could affect college students' overall health status [20,21]. Little is known about the effect that dietary pattern, weight status, and demographic factors have on university students' academic performance in Saudi Arabia in general and in Al Madinah Al Munawarah specifically. Determining the effect of these factors will help develop appropriate nutritional programs that could improve the health status and, eventually, these students' academic performance.

In this study, we assessed the effect of dietary pattern, BMI and demographic characteristics on students' academic performance. The current study hypothesized that being a female and staying in hostels improve performance. It was further hypothesized that unhealthy dietary pattern and obesity are associated with low academic performance. Through a structured questionnaire and measured anthropometrics, the researchers found that female students had higher GPAs than their counterparts. Our findings were consistent with a study conducted at Peshawar University in Pakistan, where females had high marks and performed much better than males [22]. Indian female students from the Adichunchanagiri Institute of Medical Sciences also had higher academic performance than males. Similar justifications for better performance as in the current study were noted [23].

On the contrary, a previous study demonstrated that Pakistani male students at the University of Sargodha worked harder and studied more than female. The academic performance of Pakistani males was related to their socio-economic status [24]. The Pakistani female students regularly attended their lectures and were very keen on their studies. This justification is similar to lecturers' comments at Taibah University: "*Female students are highly motivated and hard workers compared to their counterparts*".

Moreover, our study revealed that students who stayed in hostels had lower academic performances than their counterparts; thus, the study hypothesis is rejected. The hostels are outside the university campus and could be a source of stress to students since they have to stay away from their families [25]. For some, this might be their first time leaving their homes and live with strangers. Also, living with a family might have positive emotional stability, increased time spent studying, more parental control, and better university performance. A study conducted on 400 Nigerian students demonstrated that students who stayed on off-campus housing had low academic performance [26]. That was related to the distance between the campus and the university and the difficulty of transportation. The findings of our study were not consistent with an Indian study on 289 medical students. That study revealed that higher academic performers stayed in hostels [10].

Furthermore, the relationship between BMI and academic performance was affected by gender; males' BMI negatively affected their performance. As such, the study hypothesis is accepted. Previous studies revealed that GPA is negatively associated with BMI. For instance, in a systematic review that included 60 studies, He and Co-workers concluded a weak negative association between

BMI and academic performance [27]. Our study findings are consistent with the study, which included American students ($n = 57$). In that study, students with high BMIs also had lower GPAs [28]. Contradictory to our findings, academic performance at the University of Kelaniya in Sri Lanka, positively associated with BMI. This positive relationship's possible justification could be because of the high prevalence of normal-weight students (77.5%) [29].

The higher fast-food consumption among male students might be one of the causes for their increased BMI. In the study by Alfawaz (2012), there was no association between BMI and fast food consumption among Pakistani female students [30], indicating that other risk factors correlate with the BMI in that study. Consistent with our findings, Shatabdi and co-workers reported that among 426 Bangladeshi students aged 18-24 years, fast-food consumption is linked with obesity risk [31].

In conclusion, the factors affecting the academic performance of college students need more focus. The current study is considered the first type of study to focus on the demographic characteristics, BMI and dietary pattern of Taibah University students and their association with academic performance. It is well designed and included both male and female students. The study showed that high performers were primarily females, non-smokers and did not stay in hostels. There were gender differences in that male students consumed more meals, were smokers, stayed in hostels and were obese. We recommend developing a nutrition education program targeting Taibah students to increase their awareness about the importance and content of a healthy dietary pattern, smoking cessation, and ideal body weight. It is also essential to determine the key factors that face students staying in hostels since most of them had low academic performance.

The study has some limitations that need to be into consideration. The dietary recall method used to assess the dietary pattern has the risk of over-or-underreporting consumption. It would have been better to use other methods such as keeping repeated food diaries. However, it was not possible due to the busy schedule of students. If time permits, a detailed dietary pattern will also be determined to know their macro-and micro-nutrient consumption. Other factors affecting academic performance, such as psychological and mental health status, the severity of food security and quality of life, need to be studied. Moreover, the study's findings can't be generalized to the whole population of Taibah university students. One of the main reasons is the relatively small sample size.

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Statement of Competing Interests

None.

Contribution

RJ: Construction of the questionnaire, writing the introduction and the methodology sections of the manuscript

ABS: Data analysis, writing the result and discussion parts of the manuscript

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