American Journal of Nursing Research, 2020, Vol. 8, No. 4, 426-434
Available online at http://pubs.sciepub.com/ajnr/8/4/2
Published by Science and Education Publishing
DOI:10.12691/ajnr-8-4-2

Nutrition Related Factors Affecting Academic Performance of Female Health Sciences Students

Alyaa Farouk Abdel Fattah Ibrahim[1,2,*], Arwa Abdulaziz Alhamed[3], Ghadir Mohammad Almusa[4]

[1]Community Health Nursing Department, Faculty of Nursing, Alexandria University, Egypt
[2]Community Health Nursing, College of Nursing-Riyadh, King Saud Bin Abdul-Aziz University for Health Sciences, KSA
[3]Pediatrics Nursing, College of Nursing-Riyadh, King Saud Bin Abdul-Aziz University for Health Sciences, KSA
[4]Nursing Student, College of Nursing-Riyadh, King Saud Bin Abdul-Aziz University for Health Sciences, KSA
*Corresponding author: alyaafaro@gmail.com

Received April 02, 2020; Revised May 04, 2020; Accepted May 11, 2020

Abstract Malnutrition during students' early life inhibits normal growth and affects their mental developmental. Several factors may contribute to the negligence of healthy nutrition practices among college students. **The current study aimed to** identify nutrition related factors affecting academic performance of female health science students. **Methodology**: One hundred seventy-two female health sciences students were included in an institutional-based cross-sectional study at KSAU-HS, Riyadh. Data were collected using youth students' bio-socio-demographic and lifestyle structured interview questionnaire. **Results**: medicine students tended to have higher Body Mass Index (BMI)s compared to nursing students. About two tenth (20.8%) of the medicine students were overweight compared to only 14% of the nursing students, and 7% of the nursing students were obese compared to 8.3% of the medicine students. On the other hand, 22% of the nursing students were identified as underweight compared to 12.5% of the medicine students. BMI was significantly associated with Grade Point Average (GPA) among nursing students (τ_b =0.120, p=0.029). Yet, it did not show significant correlation with GPA among medicine students (τ_b =0.067, p=0.481). However, BMI was highly correlated with GPA for the total participants (t=6.355, Sig.=0.000, 95%CI=1.111-2.112). Highly significant correlations were found between BMI and all assessed socio-demographic and lifestyle factors except age. In addition, highly significant correlations were detected between GPA and all assessed socio-demographic and lifestyle factors. **Conclusion:** Study participants' BMI was highly correlated with their GPA. High significant correlations were detected between BMI, GPA and all assessed socio-demographic factors including; academic semester, college, marital status, parents' education, father's occupation and family income but did not show significant correlation with age. In addition, BMI and GPA showed high significant correlation with all assessed lifestyle factors including; stress, TV watching, computer/electronic use, physical activity, daily sleeping time and day naps.

Keywords: *nutrition status, BMI, academic performance, GPA, life style*

Cite This Article: Alyaa Farouk Abdel Fattah Ibrahim, Arwa Abdulaziz Alhamed, and Ghadir Mohammad Almusa, "Nutrition Related Factors Affecting Academic Performance of Female Health Sciences Students." *American Journal of Nursing Research*, vol. 8, no. 4 (2020): 426-434. doi: 10.12691/ajnr-8-4-2.

1. Introduction

The ability of the body to function and maintain its health in all developmental stages is largely determined by its nutritional status. Nutritional status is the state of balance between nutrient intake and requirement. Thus, an imbalance between intake and requirement results in over nutrition or under nutrition [1]. Nutrition deficiency early in life can affect students' cognitive development, behavior, susceptibility to illness and increased symptoms of headaches and stomachaches resulting in school absences and decreased academic performance. Thus, access to nutrition not only improves students' cognition, concentration, and energy levels, but also their academic achievement [2].

Youth in particular face a number of food-related challenges including malnutrition, obesity, and hunger. Malnutrition during students' early life inhibits normal growth and affects their academic performance [3]. Also, it decreases the motivation and energy level. In contrary, good nutrition helps to keep students strength and gives them the needed energy for active lives. Female students in their reproductive age have particular nutritional needs, especially during menstruation, and if they are pregnant or breastfeeding that make them more vulnerable to suffer from nutritional deficiencies than their male counterparts [4,5]. It is documented that females have different response than males in food-related issues, including, having more food and nutrition related knowledge, more able to follow certain diet-regimen, and most probably perceive themselves as requiring weight loss and thus decrease their meals [6,7].

Obviously, brain health is affected significantly by the person nutritional condition. Therefore, enhancing student's nutrition and encouraging them to obtain good eating habits would help in increasing their brain health. The essential food components for the brain to work properly are carbohydrates, protein, fat, vitamins and minerals [8]. Human studies indicated that there is a direct relationship between access to food and brain size and that minor changes in eating habits can have major impacts on survival [8,9].

The interaction between the brain and the environment is ongoing and with diet being an integral aspect of the environment, brain health is directly affected by nutrition. Specific food components are in particular more strongly associated with cognition such as Omega-3 fatty acids. Iron and zinc were also found to be strongly associated with cognitive functions such as concentration and memory which are needed for any learning process [10,11].

On the other hand, academic achievement is the outcome of achieving educational goal that is measured by examination or continuous assessment. Previous literature suggested negative correlation between Body Mass Index (BMI) of students and their academic performance, and a weak but positive correlation between energy consumption and academic status. However, there are several other factors that could interfere with the academic performance such as gender differences, teaching style, communication technique, learning facilities, socioeconomic factors and family guidance [12,13,14].

Several factors may contribute to the negligence of healthy nutrition practices among college students such as inadequate money, meal-skipping, absence of variety food choices, inadequate time, and the lack of knowledge about healthy food choices. Students in health professions in particular face additional challenges that prevent them from maintaining their nutritional needs such as; heavy course work schedules, academic stressors and lack of time which predispose students to consuming high amounts of fast food instead of home prepared meals [12,15], noting that; healthy food choices can be much more expensive than junk food choices.

While dietary and nutritional knowledge is part of the academic curriculum of health professions' students, studies indicated that; lack of knowledge and inadequate preparation are the main barriers that prevent healthcare workers from offering nutritional support [16,17]. Nevertheless, knowledge alone is not enough to encourage healthcare profession students to adhere to healthy eating habits and lifestyle. It is essential to empower and enable students to adopt healthy dietary habits during the academic program and enforce such practices throughout the program. When students are well informed and accustomed during the training program to adhere to health lifestyle habits they will be better equipped to deliver such knowledge to their patients and community [17].

1.1. Study Aim

To identify nutrition related factors affecting academic performance of female health science students.

1.2. Research Questions

What is the body mass index of female health sciences students at KSAU-HS? Is there a relation between Body mass index and academic performance? Which socio-demographic factors affect the body mass index and academic performance? Which lifestyle factors affect the body mass index and academic performance? Is there a difference in the body mass index, academic performance, socio-demographic and lifestyle factors between the study groups?

2. Materials and Method

2.1. Study Design

This was an institutional-based cross-sectional study where the main study variables and the correlations among them were compared between health sciences female students.

2.2. Setting

This study was conducted at King Saud Bin Abdul-Aziz University for Health Sciences (KSAU-HS) in Riyadh, Saudi Arabia. The University was established in 2005 with three campuses, the central one in Riyadh. Riyadh campus includes seven colleges in different health sciences specialties.

2.3. Sample Size

The sample size was calculated using G power calculation for correlation analysis that was done using alpha 0.05, power of 0.95, and a medium effect size of 0.3 (Faul et al., 2009). A sample of at least 150 students should be included in this study. To compensate for expected dropouts or incomplete questionnaires; 175 students were invited to take part in this study. The non-response rate was 1.71%, the non-responders justified their refusal by being busy.

2.4. Sampling

Study participants were selected based on a multi- stage sampling technique. Out of 7 health sciences colleges in KSAU-HS, Riyadh-campus, at the first level, 2 colleges were randomly selected. At the second stage, students were proportionally allocated. Third, systematic random sampling method was used to elect female students proportionally from each level. A total sample of 172 female students was elected. Specifically, 100 Nursing and 72 Medicine students were included according to the following criteria: female, full time student, free from any chronic illness, not pregnant or breastfeeding, free from any physical disability and agreed voluntarily to participate in the study with no exclusion criteria.

2.5. Data Collection0

Data were collected using **Youth Students' bio-socio-demographic and lifestyle structured questionnaire**:

This tool was developed by the researchers after extensive literature review and consists of five parts;

2.5.1. Socio-demographic Data

Such as; age, marital status, parents' education, occupation and family income.

2.5.2. Health-related Data

Including; medical history, malnutrition manifestations such as headache, poor concentration, hair loss, and loss of appetite, stress level, and medications history.

2.5.3. Academic Data

Student's Grade Point Average (GPA) was assessed using a single item where each student reported her last (previous year) GPA.

2.5.4. Body Mass Index (BMI)

Weight and height were measured for each student using standardized techniques and calibrated equipment. Weight was measures in kilogram (Kg), and height was measured in meters (m). BMI was considered according to the formula (Weight (kg)/height (m^2) and categorized into 4 classes: underweight (BMI <18.5), normal (BMI 18.5-<24.9), overweight (BMI 25-<30), and obese (BMI >30) (World Health Organization, 2016).

2.5.5. Life style Data

Including TV watching, computer usage, physical activity, and sleeping habits. Reliability of the tool was determined using Cronbach Alpha Coefficient test, the result was 0.829.

2.6. Pilot Study

The study tool was piloted on a group of 15 students to examine its clarity, feasibility, and the time needed to complete the questionnaire. Necessary modifications were done accordingly.

2.7. Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (IBM Corp., Armonk, NY, USA) version 26. Descriptive statistics such as percentages, mean, SD were used accordingly. Pearson r correlation analysis was used to determine the degree of association between BMI and academic performance. To assess the association between the categorical variables, the nonparametric chi-square test of association was used. Contingency tables were utilized to present the variables based on the two groups (nursing vs. medicine). Linear regression model including 95% confidence interval was used to assess the correlations.

2.8. Ethical Considerations

Study proposal was reviewed and approved by the research unit at the College of Nursing-Riyadh (CON-R), KSAU-HS, and an IRB approval was obtained from King Abdullah International Research Center (KAIMRC). Approval to conduct the study was guaranteed by administrations of both Colleges of Nursing and Medicine. Before participation all study subjects were approached and informed about the purpose of the study. The participants were given a written description about the study and an informed consent was obtained. Anonymity was considered by asking the participant not to put their names on the questionnaire or any identifying information. In addition, participants were reassured that their participation is voluntary, and they have the right to withdraw at any time, also the privacy was protected during all study process and in the final report.

3. Results

Socio-demographic characteristics of the sample are presented in Table 1. The mean for age for nursing student (20.73±1.46) was less than that for medicine students (21.15±2.09) with statistically significant difference (t=1.555, p=0.000), and only 6 % of the students in both groups were married.

Table 1. Distribution of the studied sample according to their socio-demographic characteristics

Variables	Nursing (n=100)		Medicine (n=72)		Test of significance (n=170)
Age Min-max Mean ± SD	18-24 20.73±1.46		18-28 21.15±2.09		χ^2=45.41** P=0.000
Academic semester	Freq.	%	Freq.	%	
First	20	20	5	6.9	
Second	18	18	12	16.7	
Third	32	32	34	47.2	χ^2=29.581 P=0.240
Fourth	26	26	14	19.4	
Fifth	1	1	6	8.3	
Seventh	3	3	1	1.4	
GPA					
E	1	1	0	0.0	
D^+-D	6	6	0	0.0	χ^2=126.283** P=0.000
C^+-C	59	59	9	12.5	
B^+-B	30	30	17	23.6	
A^+-A	4	4	46	63.9	
Marital status					
Married	6	6	5	6.9	χ^2=0.316 P=0.745
Single	94	94	67	93.1	
Mother education					
College and above	29	29	53	73.6	χ^2=35.123* P=0.050
Below college	71	71	19	26.4	
Father education					
College and above	44	44	57	79.2	χ^2=42.652 P=0.063
Below college	56	56	15	20.8	
Father occupation					
Employed/private	61	61	42	58.3	χ2=2.619 P=0.624
Unemployed	11	11	3	4.2	
Retired/dead	28	28	27	37.5	
Family income					
Adequate	95	95	71	98	χ^2=2.748 P=0.601
Not adequate	5	5	1	1.4	

**P<0.001, *P<0.05.

In relation to their academic performance, the majority of nursing students were in their third academic semester

of their undergraduate program followed by fourth then first years (32.0%, 26.0% & 20.0%, respectively), while medicine students were mostly in their third semester followed by the fourth then the second year (47.2%, 19.4%, 16.7%, respectively). Table 1 also shows that only 4 % of the nursing students had A+-A last year GPA compared to almost two thirds (63.9%) of the medicine students, and this difference in high statistical significance (χ^2=126.283, p=0.000).

Regarding parents' education, slightly more than one quarter (29%) of the nursing students' mothers had college degree or above compared to almost three quarters (73.6%) of the medicine students' mothers with statistically significant difference (χ^2=35.123, p=0.050). However, 44% of the nursing students' fathers had college degree or above compared to 79.2% of the medicine students.

Figure 1 depicts that medicine students tended to have higher BMIs compared to nursing students. About two tenth (20.8%) of the medicine students were overweight compared to only 14% of the nursing students, and 7% of the nursing students were obese compared to 8.3% of the medicine students. On the other hand, 22% of the nursing students were identified as underweight compared to 12.5% of the medicine students. Nevertheless, the difference between the two groups did not reach statistically significant (p=0.827).

Table 2 indicates that BMI was significantly associated with GPA among nursing students as indicated by a significant value for Kendall's Tau Correlation coefficient (τb =0.120, p=0.029). Yet, it did not show significant correlation with GPA among medicine students (τb =0.067, p=0.481). Table 3 also shows that BMI of the study participants was significantly correlated with GPA (χ^2= 2.270, P=0.024).

Distribution of the studied sample according to their reported symptoms of malnutrition is shown in Table 3. The table illustrates that more than half of the study participants from both the nursing and the medicine groups reported inability to concentrate sometimes per week (58.0%, and 62.5%, respectively), with higher percentage of daily inability to concentrate among medicine students (9.7%) compared to nursing students (6.0%), and this result showed a high statistically significant difference (χ^2= 52.701, p=0.000). Yet the difference between the two groups did not reach statistical difference for headache, loss of appetite or hair loss.

Regarding the relation between BMI and reported symptoms of malnutrition; Table 4 presents significant correlation between headache and BMI (χ^2=11.673, P=0.015), and a highly significant correlation between loss of appetite and BMI among students in both groups (χ^2=17.988, P=0.004).

Table 5 shows that 17% of the nursing students perform daily physical activity compared to 13.9% of the medicine students, and almost one fifth (19%) of the nursing students perform physical activity twice per week compared to only 5.6% of the medicine students. Slightly less than half (43.1%) of the medicine students did not perform any physical activity compared to slightly more than one quarter (29.0%) of the nursing students. Walking was the most frequently (44.6%) performed activity by the studied sample followed by running (24.1%) then stretching (13.4%), and more than half (57.1%) of the studied sample performed physical activity for a period of less than an hour.

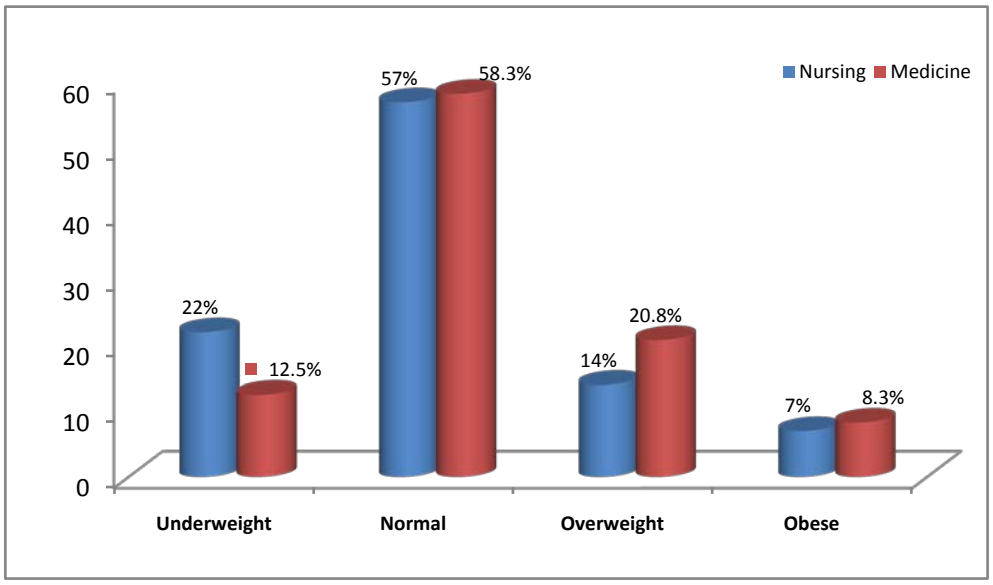

Figure 1. Percent distribution of the studied sample according to their Body Mass Index

Table 2. Distribution of the studied sample according to their Body Mass Index (BMI) and last year Grade Point Average (GPA) by their specialty

BMI/ GPA	Nursing Students (n=100)				Medicine Students (n=72)				χ^2 P
	Under-weight	Normal	Over-weight	Obese	Under-weight	Normal	Over-weight	Obese	
A+ - A	1(1.0%)	3(3.0%)	0(0.0%)	0(0.0%)	5 (6.9%)	29(40.3%)	8(11.1%)	4(5.6%)	
B+ - B	4(4.0%)	20(20.0%)	3(3.0%)	3(3.0%)	1 (1.4%)	8(11.1%)	6(8.3%)	2(2.8%)	
C+ - C	13(13.0%)	32(32.0%)	10(10.0%)	4(4.0%)	3 (4.2%)	5(6.9%)	1(1.4%)	0(.0%)	χ^2= 2.270, P=0.024*
Correlation coefficient		0.120				0.067			
Sig. (2-tailed)		0.029*				0.481			

Table 3. Distribution of the studied sample according to their reported symptoms of malnutrition by their specialty

Reported symptoms of malnutrition	Nursing Students (n=100)		Medicine Students (n=72)		Total (n=172)		Test of significance
	No.	%	No.	%	No.	%	
Inability to concentrate							
• Daily	6	6	7	9.7	13	7.6	χ^2=52.701 P=0.000*
• Sometimes	58	58	45	62.5	103	59.9	
• Seldom	28	28	15	20.8	43	25.0	
• Never	8	8	5	6.9	13	7.6	
Headache							
• Daily	11	11	6	8.3	17	9.9	χ^2=5.757 P=0.764
• Sometimes	56	56	37	51.4	93	54.1	
• Seldom	29	29	26	36.1	55	32.0	
• Never	4	4	3	4.2	7	4.1	
Loss of appetite							
• Daily	7	7	4	5.6	11	6.4	χ^2=11.400 P=0.249
• Sometimes	46	46	27	37.5	73	42.4	
• Seldom	36	36	28	38.9	64	37.2	
• Never	11	11	13	18.1	24	13.9	
Hair loss							
• Daily	46	46	30	41.7	76	44.2	χ^2=3.624 P=0.934
• Sometimes	36	36	23	31.9	59	34.3	
• Seldom	13	13	17	23.6	30	17.4	
• Never	5	5	2	2.8	7	4.1	
Night Sleep							
• < 8 hour	48	48	53	73.6	101	58.7	χ^2=2.402 P=0.662
• 8-9 hours	42	42	16	22.2	58	33.7	
• ≥ 10 hours	10	10	3	4.2	13	7.6	
Day Nap							
• < 1 hour	17	17	12	16.7	29	16.9	χ^2=1.822 P=0.769
• ≥1 hours	52	52	27	37.5	79	45.9	
• None	31	31	33	45.8	64	37.2	

Table 4. Relation between Body Mass Index (BMI) of the studied sample and their reported symptoms of malnutrition by their specialty

BMI/ Reported symptoms of Malnutrition	Nursing Students (n=100)				Medicine Students (n=72)				Test of significance
	Under-weight	Normal	Over-weight	Obese	Under-weight	Normal	Over-weight	Obese	
Inability to concentrate									
• Daily	3(3.0%)	2(2.0%)	1(1.0%)	0(0.0%)	1(1.4%)	3(4.2%)	2(2.8%)	1(1.4%)	χ^2= 7.075 P=0.629
• Sometimes	11(11.0%)	33(33.0%)	10(10.0%)	4(4.0%)	4(5.6%)	27(37.5%)	10(13.9%)	4(5.6%)	
• Seldom	7(7.0%)	17(17.0%)	3(3.0%)	1(1.0%)	3(4.2%)	9(12.5%)	2(2.8%)	1(1.4%)	
• Never	1(1.0%)	5(5.0%)	0(0.0%)	7(7.0%)	1(1.4%)	3(4.2%)	1(1.4%)	0(0.0%)	
Headache									
• Daily	2(2.0%)	7(7.0%)	1(1.0%)	1(1.0%)	3(4.2%)	2(2.8%)	1(1.4%)	0(0.0%)	χ^2= 11.673 P=0.015*
• Sometimes	15(15.0%)	32(32.0%)	4(4.0%)	5(5.0%)	4(5.6%)	25(34.7%)	7(9.7%)	1(1.4%)	
• Seldom	5(5.0%)	15(15.0%)	8(8.0%)	1(1.0%)	2(2.8%)	14(19.4%)	5(6.9%)	5(6.9%)	
• Never	0(0.0%)	3(3.0%)	1(1.0%)	0(0.0%)	0(0.0%)	1(1.4%)	2(2.8%)	0(0.0%)	
Loss of appetite									
• Daily	3(3.0%)	3(3.0%)	1(1.0%)	0(0.0%)	0(0.0%)	3(4.2%)	1(1.4%)	0(0.0%)	χ^2= 17.988 P=0.004**
• Sometimes	14(14.0%)	23(23.0%)	5(5.0%)	4(4.0%)	8(11.1%)	15(20.8%)	4(5.6%)	0(0.0%)	
• Seldom	5(5.0%)	22(22.0%)	7(7.0%)	2(2.0%)	0(0.0%)	16(22.2%)	7(9.7%)	5(6.9%)	
• Never	0(0.0%)	9(9.0%)	1(1.0%)	1(1.0%)	1(1.4%)	8(11.1%)	3(4.2%)	1(1.4%)	
Hair loss									
• Daily	8(8.0%)	27(27.0%)	6(6.0%)	5(5.0%)	4(5.6%)	13(18.1%)	9(12.5%)	4(5.6%)	χ^2= 11.618 P=0.244
• Sometimes	9(9.0%)	21(21.0%)	4(4.0%)	2(2.0%)	4(5.6%)	16(22.2%)	3(4.2%)	0(0.0%)	
• Seldom	3(3.0%)	8(8.0%)	2(2.0%)	0(0.0%)	1(1.4%)	12(16.7%)	2(2.8%)	2(2.8%)	
• Never	2(2.0%)	1(1.0%)	2(2.0%)	0(0.0%)	0(0.0%)	1(1.4%)	1(1.4%)	0(0.0%)	

Table 5 also shows that more than one quarter (26.4%) of the medicine students watch TV daily compared to 11% of the nursing students. The vast majority of both nursing and medicine students use computer daily (64.0% & 75.0%, respectively). Slightly less than three quarters (73.6%) of the medicine students sleep less than eight hours daily compared to slightly less than half (48.0%) of the nursing students, and 42% of the nursing students sleep between 8 and 9 hours compared to 22.2% of the medicine students. Yet, slightly less than half (45.9%) of the study sample take day nap more than one hour daily. Nevertheless, the difference between the two groups did not show a significant differ in any of the assessed lifestyle factors.

Table 6 depicts highly significant correlation between BMI and all assessed socio-demographic and lifestyle factors except age. It also presents highly significant correlation between GPA and all assessed socio-demographic and lifestyle factors.

Table 5. Distribution of the studied sample according to their lifestyle factors by their specialties

Lifestyle factors	Nursing Students (n=100)		Medicine Students (n=72)		Total (n=172)		Test of significance
	No.	%	No.	%	No.	%	
Perform Physical activity							
• Daily	17	17	10	13.9	27	15.7	
• Once/week	16	16	12	16.7	28	16.3	χ^2=18.498
• Twice/week	19	19	4	5.6	23	13.4	P=0.296
• ≥3/week	19	19	15	20.8	34	19.8	
• Never	29	29	31	43.1	60	34.9	
Physical activity type	(n=71)		(n=41)		(n=112)		
• Running	20	28.2	7	17.1	27	24.1	
• Swimming	5	7.0	2	4.9	7	6.3	
• Basketball	3	4.2	5	12.2	8	7.1	χ^2=39.750 P=0.570
• Walking	27	38.1	23	56.1	50	44.6	
• Stretching	12	16.9	3	7.3	15	13.4	
• Dancing	4	5.6	1	2.4	5	4.5	
Physical activity duration	(n=71)		(n=41)		(n=112)		
• < 1 hour	39	54.9	25	61.0	64	57.1	χ^2=7.908
• 1-2 hours	30	42.3	14	34.1	44	39.3	P=0.543
• > 2 hours	2	2.8	2	4.9	4	3.6	
Watch TV.							
• Daily	11	11	19	26.4	30	17.4	
• Sometimes weekly	28	28	15	20.8	43	25.0	χ^2=21.657
• Once/week	23	23	9	12.5	32	18.6	P=0.155
• Seldom	37	37	23	31.9	60	34.9	
• Never	1	1	6	8.3	7	4.1	
Use computer							
• Daily	64	64	54	75	118	68.6	χ^2=5.981
• Sometimes weekly	26	26	13	18.1	39	22.7	P=0.425
• Once/week	10	10	5	6.9	15	8.7	
Night Sleep							
< 8 hour	48	48	53	73.6	101	58.7	χ^2=2.402
• 8-9 hours	42	42	16	22.2	58	33.7	P=0.662
• ≥ 10 hours	10	10	3	4.2	13	7.6	
Day Nap							
• < 1 hour	17	17	12	16.7	29	16.9	χ^2=1.822
• ≥1 hours	52	52	27	37.5	79	45.9	P=0.769
• None	31	31	33	45.8	64	37.2	

Table 6. Linear regression model for BMI, GPA and assessed socio-demographic and lifestyle factors of the study participants

Variables	BMI			GPA		
	t	Sig.	95% CI	t	Sig.	95% CI
Socio-demographic variables						
Age	1.151	0.251	-0.594 - 2.254	5.031	0.000	2.585 - 5.924
Academic semester	19.230	0.000	1.922 - 2.362	37.574	0.000	4.162 - 4.623
College	11.739	0.000	1.567 - 2.201	16.963	0.000	1.793 - 2.265
Marital status	16.687	0.000	1.741 - 2.208	25.450	0.000	2.674 - 3.124
Mother education	17.282	0.000	3.050 - 3.578	25.234	0.000	3.059 - 3.578
Father education	17.135	0.000	2.005 - 2.527	33.546	0.000	4.331 - 4.872
Father occupation	14.797	0.000	1.851 - 2.422	21.238	0.000	3.209 - 3.866
Family income	12.078	0.000	1.401 - 1.948	19.339	0.000	2.600 - 3.192
GPA or BMI	t=6.355, Sig.=0.000, 95% CI= 1.111-2.112					
Malnutrition manifestations						
Inability to concentrate	16.001	0.000	1.965 - 2.518	36.469	0.000	4.617 - 5.145
Headache	10.612	0.000	1.598 - 2.329	13.128	0.000	2.080 - 2.816
Loss of appetite	18.378	0.000	2.862 - 3.551	12.970	0.000	1.708 - 2.321
Hair Loss	22.132	0.000	1.926 - 2.303	32.975	0.000	3.100 - 3.495
Taking medication	14.002	0.000	1.807 - 2.401	18.773	0.000	2.770 - 3.421
Lifestyle variables						
Stress	19.017	0.000	1.900 - 2.340	40.685	0.000	4.296 - 4.734
Watch TV	16.198	0.000	2.184 - 2.791	28.787	0.000	4.398 - 5.046
Computer/electronic use	15.008	0.000	1.737 - 2.263	21.498	0.000	2.527 - 3.038
Physical activity	17.873	0.000	1.775 - 2.216	28.535	0.000	2.672 - 3.069
Daily sleeping time	19.862	0.000	1.815 - 2.216	33.598	0.000	2.773 - 3.119
Day naps	19.002	0.000	1.842 - 2.269	29.256	0.000	2.785 - 3.189

4. Discussion

As students transition from home to college life, nutritional status becomes more of concern because dietary options varies and nutritional challenges develops. Despite the enormous transformations and advancements experienced by Saudi community during recent decades, rare researches have been conducted on the nutritional status and academic performance of female university students. In this respect, the current study aimed to identify nutrition-related factors affecting nutritional status and academic performance of female health sciences students at KSAU-HS in Riyadh.

Findings of the current study depicted that medicine students' mean for age was slightly higher than that of the nursing students, with this difference showing significant statistical difference. Such an observation is expected giving the difference in the duration of the nursing versus the medicine undergraduate program which rungs longer. In general, one third of the students in both groups were on their third year of the undergraduate program which is considered as a midway in the medicine program but approaching the end of the nursing program. In addition, current findings depicts significant correlation between age and academic performance, however age did not show association with BMI. This result came in accordance with previous studies in Ethiopia and America documenting the significant association between age and academic performance [18,19].

In addition, statistically significant difference was detected between the current study groups' GPA level. Such finding was not a surprise given that the differences in the nature of the applicants for both nursing and medical programs in this demographical is well noted. Nursing students in this sample predominantly come from a lower socioeconomic status determined by lower parental educational level compared to medicine students. The effect of higher parental education on predicting higher academic performance among children is well established in the literature [20,21]. Moreover, due to the existing social stigma toward nursing profession in the Middle East, application and attrition rate of nursing programs is low. Therefore, in an attempt to attract more students into nursing, the admission criteria of the BSN program tends to include those of lower high school GPA with less English proficiency level. Unlike the admission criteria for the undergraduate medicine program that are extremely strict and competitive.

Nevertheless, in the current study, medicine students showed a tendency to have a higher BMIs compared to nursing students. In addition, medicine students not only reported higher GPAs, but also predominantly came from a high socioeconomic status as indicated by their parental education. For example, about half the sample of medicine students reported that their mothers' have completed college, and about a third of them have a graduate degree. On the other hand, only almost a quarter of the nursing students had mothers who completed college and less than a fifth with a graduate degree. This difference showed high statistical significance. Another high statistically significant difference was detected between fathers' education and occupation of medicine and nursing students relating higher levels of fathers' education and occupation with higher students' GPA and BMI levels. In this respect, parental education presented statistically significant correlation with students' BMI and GPA. The current results came in accordance with the results of a previous study in Denmark showing obesity among children been associated with higher levels of parental education and occupation [22]. In contrast, a previous study in Jeddah documented that parents' education and occupation showed no significant association with children's BMI [23]. It should be noted that the subjects' age in both studies were younger than the age of the current study participants.

Conversely, family income among the two groups was not different, whereas, family income proved to be significantly correlated with students' BMI and GPA. This result supports Jeddah study findings that reported overweight and obesity among their study sample were associated with higher or middle family income [24]. Nevertheless, current study observation suggests that despite of having the same family income level for both groups, parental education has a much stronger implication on the academic performance of their siblings in a country where all levels of education are offered free of charge.

Given the documented increasing trends of obesity among the Saudi population with prevalence running more than one third of the adult population [25], it is reassuring to see that the proportion of obesity among all students in the current study was less than one tenth with both groups being almost equal. Similar results were reported in a previous study [26]. But, the prevalence of overweight that showed almost double the obesity values signals a warning. It is worth saying that students BMI was significantly correlated with their GPA, and this finding contradicts the results of a recent meta-analysis reporting negative correlation between BMI and academic achievement [27]. As higher BMI and GPA frequencies were observed among medicine students compared to nursing students and these differences were statistically significant. BMI was associated with GPA which is consistent with many previous studies [28,29,30]. In contradicting, a recent study by Alswat et al, 2017 demonstrated no correlation between body mass index (BMI) and school performance, except for physics results, where students with obesity perform worse than those who are normal weight [31].

In relation to self-reported symptoms of malnutrition, higher frequencies of inability to concentrate, headache, loss of appetite, and hair loss were observed among medicine students compared to nursing students in all BMI levels. Of all the assessed symptoms of malnutrition with BMI, headache and loss of appetite were the only symptoms showing statistically significant difference between the two groups. Apart from this, all assessed malnutrition symptoms showed high statistically significant correlation with students' BMI and GPA. Previous research studies documented the impact of malnutrition on scholastic achievement [12,18,32]; however they limited the evaluation of the nutritional status to BMI measures ignoring the clinical manifestations.

Although the two study groups did not differ in relation to the measured lifestyle factors, there was a trend towards higher rate of sedentary lifestyle indicated by low rate of

physical activity and long hours of computer use especially among the medicine students. In short, physical activity, computer use and TV watching proved to be significantly correlated with BMI and GPA, which is consistent with a well document body of evidence linking extended hours of screen use with higher BMIs [33]. In addition, a previous study in Saudi Arabia reported that the vast majority of students spend daily more than 2 hours on screen, and they do not fulfill the required physical activity guidelines [34]. Moreover, previous studies across the world suggested a need to incorporate physical activities in college curriculums and enforce measures to manage extended hours of sitting [35,36], because students with low physical activity were more likely to be obese and showed lower GPA. Not only due to its tremendous positive impacts on health, the incorporation of physical activities in college curricula enhances students' cognitive skills and academic performance as indicated by many studies [31,36,37]

After all, sleep duration and day naps showed higher frequencies among nursing students, but the reported differences between the two groups in the current study were not significant, however, stress, sleep duration and day naps presented high significant correlations with BMI and GPA. In contrast, previous studies reported high prevalence of academic stress and sleep disorders among medical students that was associated with the use of sedatives [38,39].

5. Conclusion

Study participants' BMI was highly correlated with their GPA. Medicine students tended to have higher BMIs levels compared to nursing students. High significant correlations were detected between BMI, GPA and all assessed socio-demographic factors including; academic semester, college, marital status, parents' education, father's occupation and family income but did not show significant correlation with age. In addition, BMI and GPA showed high significant correlation with all assessed lifestyle factors including; stress, TV watching, computer/electronic use, physical activity, daily sleeping time and day naps.

6. Recommendations for Future Research

Findings of the current study suggest the necessity for additional research about the nutrition-related factors affecting academic performance of university students with bigger sample size and variety of settings. An intervention study about the effect of nutrition-educational program for university students is also required. Results also encourage institutional authorities' professional sensitivity for identifying high-risk students, and prepare programs for prioritizing management strategies for students' nutritional problems. Findings also recommend activating a strategic college-based nutritional program including nutrition education and physical activity which is expected to be reflected on better academic performance for students.

7. Study Limitations

Despite being one of the few studies examining the link between BMI, physical activity, and reported symptoms of poor nutrition among health sciences students in the KSA, this study has some limitations. The sample size among the two groups was not equal. Given the high number of variables examined, the sample size is relatively small limiting our ability to compare between categories among each variable.

Given the nature of the cross sectional design, causality can't be inferred from this analysis. Moreover, given the nature of survey based studies, the effects of recall and social desirability bias can't be avoided. In addition, only female health sciences students were included in this study, and they were recruited from one campus indicating that this sample might not be the best representation of all college students in KSA.

Acknowledgments

The authors would like to acknowledge Lamia Khalid Al-Asfoor for her contribution to the data collection in this study.

References

[1] J. M. Hamid Jan, A. K. Mitra, H. Hasmiza, C. D. Pim, L. O. Ng, and W. M. Wan Manan, "Effect of gender and nutritional status on academic achievement and cognitive function among primary school children in a rural district in Malaysia," *Malays. J. Nutr.*, vol. 17, no. 2, pp. 189-200, 2011.

[2] B. Amy Ross and D. L. Anderson, "Nutrition and Academic Performance 1 NUTRITION AND ITS EFFECTS ON ACADEMIC PERFORMANCE HOW CAN OUR SCHOOLS IMPROVE?," 2010.

[3] M. R. Rashmi, B. M. Shweta, F. N. Fathima, T. Agrawal, M. Shah, and R. Sequeira, "Prevalence of Malnutrition and Relationship with Scholastic Performance among Primary and Secondary School Children in Two Select Private Schools in Bangalore Rural District (India)," *Indian J. Community Med.*, vol. 40, no. 2, pp. 97-102, Apr. 2015.

[4] A. Nyaradi, J. Li, S. Hickling, A. J. O. Whitehouse, J. K. Foster, and W. H. Oddy, "Diet in the early years of life influences cognitive outcomes at 10 years: A prospective cohort study," *Acta Paediatr. Int. J. Paediatr.*, vol. 102, no. 12, pp. 1165-1173, Dec. 2013.

[5] A. Nyaradi, J. Li, S. Hickling, J. Foster, and W. H. Oddy, "The role of nutrition in children's neurocognitive development, from pregnancy through childhood," *Frontiers in Human Neuroscience*, no. MAR. Frontiers Media S. A., Mar. 07, 2013.

[6] V. Manippa, C. Padulo, L. N. van der Laan, and A. Brancucci, "Gender differences in food choice: Effects of superior temporal sulcus stimulation," *Front. Hum. Neurosci.*, vol. 11, Dec. 2017.

[7] A. Uccula and G. Nuvoli, "Body perception and meal type across age and gender on a Mediterranean island (Sardinia)," *Psychol. Heal. Med.*, vol. 22, no. 10, pp. 1210-1216, Nov. 2017.

[8] F. Gómez-Pinilla, "Brain foods: The effects of nutrients on brain function," *Nature Reviews Neuroscience*, vol. 9, no. 7. NIH Public Access, pp. 568-578, Jul. 2008.

[9] S. J. Spencer, A. Korosi, S. Layé, B. Shukitt-Hale, and R. M. Barrientos, "Food for thought: how nutrition impacts cognition and emotion," *npj Sci. Food*, vol. 1, no. 1, pp. 1-8, Dec. 2017.

[10] G. Lin Khor and S. Misra, "Micronutrient interventions on cognitive performance of children aged 5-15 years in developing countries," 2012. Accessed: Apr. 18, 2020. [Online]. Available: http://unstats.un.org/unsd/methods,.

[11] S. More, V. B. Shivkumar, N. Gangane, and S. Shende, “Effects of iron deficiency on cognitive function in school going adolescent females in rural area of central India.,” 2013, p. 819136, 2013.

[12] S. Ghosh, D. Sambhunath Rakshit, and M. Bhattacharya, “Academic Performance and Nutritional Status-A Case Study on College Students in North Tripura.” 2014 *IOSR-JRME* vol 1, no. 4 (May. -Jun. 2013), PP 57-68.

[13] K. A. Alswat, A. D. Al-Shehri, T. A. Aljuaid, B. A. Alzaidi, and H. D. Alasmari, “The association between body mass index and academic performance,” *Saudi Med. J.*, vol. 38, no. 2, pp. 186-191, Feb. 2017.

[14] J. He, X. Chen, X. Fan, Z. Cai, and F. Huang, “Is there a relationship between body mass index and academic achievement? A meta-analysis,” *Public Health*, vol. 167. Elsevier B.V., pp. 111-124, Feb. 01, 2019.

[15] B. A. Mohamed, M. S. Mahfouz, and M. F. Badr, “Food selection under stress among undergraduate students in riyadh, saudi arabia,” *Psychol. Res. Behav. Manag.*, vol. 13, pp. 211-221, 2020.

[16] V. Mogre, F. C. J. Stevens, P. A. Aryee, A. Amalba, and A. J. J. A. Scherpbier, “Why nutrition education is inadequate in the medical curriculum: A qualitative study of students’ perspectives on barriers and strategies,” *BMC Med. Educ.*, vol. 18, no. 1, Feb. 2018.

[17] P. M. Kris-Etherton *et al.*, “The need to advance nutrition education in the training of health care professionals and recommended research to evaluate implementation and effectiveness,” *Am. J. Clin. Nutr.*, vol. 99, no. 5, May 2014.

[18] B. Asmare, M. Taddele, S. Berihun, and F. Wagnew, “Nutritional status and correlation with academic performance among primary school children, northwest Ethiopia,” *BMC Res. Notes*, vol. 11, no. 1, p. 805, Nov. 2018.

[19] S. Abraham, B. R. Noriega, and J. Y. Shin, “College students eating habits and knowledge of nutritional requirements,” *J. Nutr. Hum. Heal.*, vol. 02, no. 01, 2018.

[20] J. Erola, S. Jalonen, and H. Lehti, “Parental education, class and income over early life course and children’s achievement,” *Res. Soc. Stratif. Mobil.*, vol. 44, pp. 33-43, Jun. 2016.

[21] A. Björklund and K. G. Salvanes, “Education and Family Background: Mechanisms and Policies,” *IZA Discuss. Pap.*, 2010.

[22] J. Matthiessen, A. Stockmarr, S. Fagt, V. K. Knudsen, and A. Biltoft-Jensen, “Danish children born to parents with lower levels of education are more likely to become overweight,” *Acta Paediatr. Int. J. Paediatr.*, vol. 103, no. 10, pp. 1083-1088, Oct. 2014.

[23] A. E. Al-Agha, ah O. Tatwany, D. A. Aiash, L. A. Mandourah, and N. T. Abukhalil, “The Effect of Socioeconomic Status, Number of Siblings and Parental of Education on Children’ Body Mass Index at Jeddah, Saudi Arabia: Cross Sectional Study,” *Fam Med Med Sci Res*, vol. 4, no. 5, p. 184, 1000.

[24] F. Alqarni *et al.*, “DO PARENTAL EDUCATION AND OCCUPATION AFFECTS CHILDREN’S BODY MASS INDEX (BMI)?,” *Int. J. Adv. Res*, vol. 5, no. 12, pp. 1381-1388.

[25] A. M. Al-Qahtani, “Prevalence and Predictors of Obesity and Overweight among Adults Visiting Primary Care Settings in the Southwestern Region, Saudi Arabia,” 2019.

[26] A. F. A. Ibrahim, A. Monica, and D. I.Cabansag, " Diabetes Prevalence and Quality of Life of Female Nursing Students" *IOSR-JNHS*, vol. 8, no. 6, pp. 39-47, 2019.

[27] J. He, X. Chen, X. Fan, Z. Cai, and F. Huang, “Is there a relationship between body mass index and academic achievement? A meta-analysis,” *Public Health*, vol. 167. Elsevier B.V., pp. 111-124, Feb. 01, 2019.

[28] A. S. Anderson and D. J. Good, “Increased body weight affects academic performance in university students,” *Prev. Med. Reports*, vol. 5, pp. 220-A223, Mar. 2017.

[29] T. M. Burkhalter and C. H. Hillman, “A Narrative Review of Physical Activity, Nutrition, and Obesity to Cognition and Scholastic Performance across the Human Lifespan,” *Adv. Nutr.*, vol. 2, no. 2, pp. 201S-206S, Mar. 2011.

[30] Z. A. Memish *et al.*, “Obesity and associated factors - Kingdom of Saudi Arabia, 2013,” *Prev. Chronic Dis.*, vol. 11, no. 10, 2014.

[31] K. A. Alswat, A. D. Al-Shehri, T. A. Aljuaid, B. A. Alzaidi, and H. D. Alasmari, “The association between body mass index and academic performance,” *Saudi Med. J.*, vol. 38, no. 2, pp. 186-191, Feb. 2017.

[32] S. Ghosh, D. Sambhunath Rakshit, and M. Bhattacharya, “Academic Performance and Nutritional Status-A Case Study on College Students in North Tripura.” Accessed: Apr. 17, 2020. [Online]. Available: www.iosrjournals.org.

[33] “WHO EMRO | Association between dietary habits and body mass index of adolescent females in intermediate schools in Riyadh, Saudi Arabia | Volume 20, issue 1 | EMHJ volume 20, 2014.” http://www.emro.who.int/emhj-vol-20-2014/volume-20-issue-1/association-between-dietary-habits-and-body-mass-index-of-adolescent-females-in-intermediate-schools-in-riyadh-saudi-arabia.html (accessed Apr. 15, 2020).

[34] H. M. Al-Hazzaa, N. A. Abahussain, H. I. Al-Sobayel, D. M. Qahwaji, and A. O. Musaiger, “Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region,” *Int. J. Behav. Nutr. Phys. Act.*, vol. 8, p. 140, Dec. 2011.

[35] L. G. Rangel Caballero, L. Z. Rojas Sánchez, and E. M. Gamboa Delgado, “Sobrepeso y obesidad en estudiantes universitarios colombianos y su asociación con la actividad física,” *Nutr. Hosp.*, vol. 31, no. 2, pp. 629-636, Nov. 2015.

[36] H. Al-Kilani, M. Waly, and R. Yousef, “Trends of obesity and overweight among college students in oman a cross sectional study,” *Sultan Qaboos Univ. Med. J.*, vol. 12, no. 1, pp. 620-627, Feb. 2012.

[37] D. D. Franz and S. A. Feresu, “The relationship between physical activity, body mass index, and academic performance and college-age students,” *Open J. Epidemiol.*, vol. 3, pp. 4-11, 2013.

[38] H. M. Abdulghani, A. A. AlKanhal, E. S. Mahmoud, G. G. Ponnamperuma, and E. A. Alfaris, “Stress and its effects on medical students: A cross-sectional study at a college of medicine in Saudi Arabia,” *J. Heal. Popul. Nutr.*, vol. 29, no. 5, pp. 516-522, 2011.

[39] A. Waqas, S. Khan, W. Sharif, U. Khalid, and A. Ali, “Association of academic stress with sleeping difficulties in medical students of a Pakistani medical school: A cross sectional survey,” *PeerJ*, vol. 2015, no. 3, 2015.