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The Association between Obesity and Grade Point Average (GPA) among College Students in Saudi Arabia: A Cross-Sectional Study

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Abstract: **- Background**: The WHO has recently identified obesity as one of the growing health issues worldwide. Additionally, obesity has been linked to lower academic achievement. Many studies have shown that having a healthy weight correlates with improving academic performance. Other studies showed that there is no relationship between obesity and intellectual achievement among students.

Objectives: This study aims to determine the association between obesity and GPA among College students in Saudi Arabia. With secondary objectives to look at differences between males and females.

Methodology: This is a cross-sectional study looking at undergraduate students at different universities from different regions in Saudi Arabia. The data was collected through a self-administered survey which includes questions regarding (BMI, GPA, Age, Gender, Marital Status, Weight in Kg, Height in cm, name of the College, and academic level). The data was analyzed using SPSS version 27.0.

Results: The study included 424 participants, the majority of respondents fall within the 21-25 age bracket, comprising 62.5% of the sample. As for BMI distribution, with the highest percentage falling within the normal range at 35.8%, closely followed by the obese category at 23.8%. The GPA distribution, both on a scale of 5 and 4, provides a comprehensive understanding of academic performance within the surveyed population. Notably, a significant proportion of respondents achieved a GPA between 4.75 and 5, constituting 26.4% of the sample on the 5-point scale, and 40.8% on the 4-point scale.

Conclusion: There was no significant association between BMI and participants' GPA whether out of 5 or 4. More research is needed to better understand the mechanisms behind this association and to develop effective interventions to support the academic success of all students, regardless of their weight status

Keywords: Obesity, Academic Performance, GPA, BMI.

1. Introduction:

Obesity, characterized by a Body Mass Index (BMI) equal to or greater than 30, is recognized as one of the swiftly expanding health concerns in the contemporary era, as stated by the World Health Organization. Moreover, it is linked to diminished academic achievement [1]. Prioritizing a dietary plan that highlights nourishing whole grains, fruits, and vegetables holds the capacity to enhance cognitive functions, amplify memory, raise test results, encourage consistent school attendance, thereby fostering an improvement in academic performance [2].

The presence of excessive body fat leads to disturbances in bodily functions, which can result in conditions such as diabetes, hypertension, coronary artery disease, and impaired cognitive function. Of these, the most noteworthy cognitive impact of obesity is evidenced by diminished academic performance [3]. In any educational system, the degree of educational performance serves as a crucial marker for achievement in academic pursuits [4].

Indicators of subpar performance included reduced scores in both mathematics and reading, diminished IQ scores, lower grade point averages (GPA), interrupted educational progression, heightened absenteeism, grade

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retention, and enrollment in specialized education and additional courses. Following their analysis, more recent investigations consistently validate poorer academic outcomes for students grappling with obesity [5].

Obesity has the capacity to affect health in ways that obstruct academic success. Obesity is correlated with sleep disorders such as sleep apnea and depression, both of which can contribute to compromised cognitive abilities and elevated instances of school absenteeism [6]. Weight-related teasing stands as the foremost factor leading to psychosocial consequences in overweight or obese adolescents. This results in a harmful influence on their self-assurance and overall well-being [7].

Over the past two decades, there has been a notable and concerning increase in the rate of obese patients, as indicated by scientific reports [8]. Saudi Arabia holds the third position globally when it comes to both laziness and obesity, signifying a significant concern [9].

It was shown that keeping a healthy body weight was associated with improved academic performance [10]. There is data showing a relationship between physical activity, body mass index (BMI), and intellectual achievement in younger kids. When it comes to university students, the evidence is, however, scarce [11].

numerous studies have shown a connection between adult obesity and impaired cognitive performance. This includes diminished performance on visual memory tests, a heightened propensity for delay discounting, structural deficits in the orbitofrontal cortices that can be seen, and issues with verbal memory, attention span, and decision-making [12].

In 2022, a study was conducted in Al-Imam Mohammad Ibn Saud Islamic University, and the findings revealed that obesity had no effect on academic performance [10]. Obesity and academic performance had no statistically significant relationship ($p = 0.335$) [10]. Another study conducted in Majmaah University in 2023, and statistical analysis revealed a link between cumulative grade point average and BMI [11]. Another study conducted in Jordan in 2019 found a strong negative link between obesity and academic achievement [13].

One of the main reasons behind this study is the inconsistencies in the results of previous studies. With some of the studies revealing negative association between, BMI and GPA while other studies showed no association between them. Also, most of the studies conducted in Saudi Arabia were limited to specific universities around the country or involved small numbers of sample size. Our study aims to includes different universities from different regions in Saudi Arabia with a larger sample size in hope of achieving more convincing association.

2. Objectives:

To determine the association between BMI and GPA among College students in Saudi Arabia, to assess the differences in the relationship between BMI and GPA among male and female college students and to determine the prevalence of obesity among college students in Saudi Arabia.

Materials and Methods:

Study design:

This research employed a cross-sectional study design to examine the correlation between Body Mass Index (BMI) and Grade Point Average (GPA) among college students in Saudi Arabia.

Study setting: Participants, recruitment, and sampling procedure:

The participants of the study was undergraduate students at different universities from different regions in Saudi Arabia.

Inclusion and Exclusion criteria:

Inclusion criteria: The inclusion criteria for this study was as follow:

Gender (Male, Female) Age (18- 24) Marital Status (Single, Married, Divorced, Widow) Academic status (Students currently enrolled in a college in Saudi Arabia) Nationality (Saudi, Non-Saudi).

Exclusion criteria: History of eating disorders (Bulimia nervosa, Anorexia nervosa, etc.) History of chronic medical conditions (Diabetes, Hypertension, etc.) Participants with psychological disorders (bipolar, Major depression, etc.) Pregnant ladies, participants who are not currently enrolled in college. Participants who are not willing to provide accurate information about their weight and GPA.

Sample size:

The sample size was 385 with 5% margin of error and CI of 95% and the population size is 1,620,000 with a 50% response distribution this has been calculated using Raosoft.

Method for data collection and instrument (Data collection Technique and tools):

An online self-administered questionnaire-based data collection was arranged and given by data collectors to gather data randomly from undergraduate students in Saudi Arabia.

The questionnaire was including five segments. in the first part, informed consent was obtained from the participant. The second segment was containing sociodemographic data (Age, Gender, Marital Status, Nationality, and City of residency. The third segment was involving questions regarding (Weight in Kg, Height in cm, GPA, name of college, and the academic year). The fourth part was including medical and surgical data. And the last segment was containing questions about the daily habit of the participants.

Scoring system:

Analysis and entry method:

The data was analyzed using SPSS version 27.0. Descriptive statistics was used to describe the sample. Pearson's correlation coefficient was used to test the association between BMI and GPA. A p-value of <0.05 was considered statistically significant.

The data was collected through a self-administered survey. The survey was distributed to a random sample of 385 bachelor college students in Saudi Arabia. The survey includes questions about the student's BMI, GPA, and other demographic information.

3. Results:

As illustrated in table (1), age distribution reveals that the majority of respondents fall within the 21-25 age bracket, comprising 62.5% of the sample, followed by the 18-20 age group at 34.4%. The smallest proportion is represented by individuals aged 26-30, accounting for 3.1% of the total. In terms of gender, the data indicates a slightly higher representation of females, constituting 66.5% compared to 33.5% for males. Nationality-wise, the majority of participants are Saudi nationals, comprising 91.3% of the sample, with non-Saudis making up the remaining 8.7%. The province of residency distribution demonstrates that the Eastern Province is the most prevalent location, with 34.0% of respondents residing there. Makkah and Riyadh also show significant representation at 51.2% and 3.8%, respectively. The remaining provinces exhibit relatively lower percentages. Regarding education level, the distribution across various academic years and colleges/faculties provides a detailed overview of the academic composition of the sample. The majority of respondents are in their third and fifth years of study, representing 23.6% and 22.6% of the sample, respectively. Additionally, the College of Medicine has the highest representation at 46.9%, followed by the College of Engineering at 13.7%. Marital status and living status indicate that the vast majority of respondents are single (94.6%) and reside with their families (88.7%). Furthermore, the data includes insights into the BMI distribution, with the highest percentage falling within the normal range at 35.8%, closely followed by the obese category at 23.8%.

The GPA distribution, both on a scale of 5 and 4, provides a comprehensive understanding of academic performance within the surveyed population. Notably, a significant proportion of respondents achieved a GPA between 4.75 and 5, constituting 26.4% of the sample on the 5-point scale, and 40.8% on the 4-point scale.

Table (1): Sociodemographic characteristics of participants (n=424)

Parameter		No.	Percent
Age	18_20	146	34.4
	21_25	265	62.5
	26_30	13	3.1
Gender	Male	142	33.5
	Female	282	66.5
Nationality	Saudi	387	91.3
	Non-Saudi	37	8.7
Province of Residency	Baha	3	.7
	Jouf	3	.7
	Riyadh	16	3.8
	Qassim	8	1.9
	Madinah	21	5.0
	Eastern Province	144	34.2
	Tabuk	3	.7

	Asir	5	1.2
	Makkah	217	51.2
	Najran	3	.7
Education Level	Second year	89	21.0
	Third year	100	23.6
	Fourth year	61	14.4
	Fifth year	96	22.6
	Sixth year	78	18.4
College	Architecture and Planning Faculty	2	.5
	College of Applied Medical Sciences	16	3.8
	College of Art and Design	11	2.6
	College of Business	11	2.6
	College of Engineering	58	13.7
	College of Law	6	1.4
	College of Science	10	2.4
	College of Sport Sciences	3	.7
	Faculty of Arts & Humanities	3	.7
	Faculty of Computing and Information Technology	30	7.1
	Faculty of Tourism	3	.7
	Other college	20	4.7
	College of Nursing	22	5.2
	College of Public Health	15	3.5
	College of Pharmacy	6	1.4
	College of Medicine	199	46.9
	College of Dentistry	9	2.1
Marital Status	Married	21	5.0
	Single	401	94.6
	Divorced	2	.5
living status	Alone	48	11.3
	With my family	376	88.7
BMI	underweight	87	20.5
	normal	152	35.8
	overweight	84	19.8
	obese	101	23.8
GPA Out of 5	(Less than 3)	3	.7
	(3 - 3.24)	10	2.4
	(3.25 - 3.49)	15	3.5
	(3.5 - 3.74)	12	2.8
	(3.75 - 3.99)	38	9.0
	(4 - 4.24)	52	12.3
	(4.25 - 4.49)	42	9.9
	(4.5 - 4.74)	68	16.0
	(4.75 - 5)	112	26.4
	4.5 - 4.74	1	.2
	The GPA used in my university is out of 4	71	16.7
GPA out of 4	(2 - 2.24)	2	2.8
	(2.25 - 2.49)	2	2.8
	(2.5- 2.74)	5	7.0
	(2.75 - 2.99)	13	18.3
	(3 - 3.24)	3	4.2
	(3.25 - 3.49)	8	11.3
	(3.5 - 3.74)	9	12.7
	(3.75 - 4)	29	40.8

As in table (2), it is evident that a very low percentage (0.9%) of the sample population has undergone bariatric surgery, while the vast majority (99.1%) has not. Additionally, 90.3% of the respondents reported not having any chronic diseases, while 9.7% indicated that they do have chronic diseases. When it comes to eating disorders, 4.0% of the respondents reported having them, while the majority (96.0%) did not. In terms of smoking habits, 9.9% of the sample population reported being smokers, with the remaining 90.1% indicating that they do not smoke. The frequency of fast-food consumption varied, with 5.4% reporting daily consumption, 60.8% consuming 1-3 meals per week, 11.8% consuming 4-6 meals per week, and 21.9% rarely consuming fast food. Regarding soft drink consumption, 8.5% reported consuming at least 1 can per day, 33.5% reported consuming 1-3 cans per week, 11.6% reported consuming 4-6 cans per week, and 46.5% reported rarely consuming soft drinks. When it comes to exercise, 13.4% reported exercising for less than 1 hour per week, 17.2% for 1-2 hours, 12.3% for 3-4 hours, 9.9% for 5-6 hours, and 6.6% for more than 6 hours, while 40.6% indicated that they do not exercise at all. Finally, in terms of studying hours per week, 3.1% reported studying for less than 1 hour, 8.3% for 1-2 hours, 21.7% for 3-4 hours, 17.5% for 5-6 hours, and 49.5% for more than 6 hours.

Table (2): Knowledge of participants of online nutritional applications and tele-dietetics (n=424).

Parameter		**No.**	**Percent**
Undergo any bariatric surgery before	Yes	4	.9
	No	420	99.1
Have any chronic diseases	No	383	90.3
	Yes	41	9.7
Have any eating disorders	Yes	17	4.0
	No	407	96.0
Smoke	Yes	42	9.9
	No	382	90.1
Frequency of fast food per week	Daily meal	23	5.4
	1-3 meals/week	258	60.8
	4-6 meals/week	50	11.8
	Rarely	93	21.9
Frequency of soft drink per week	at least 1 can/day	36	8.5
	1-3 cans/week	142	33.5
	4-6 cans/week	49	11.6
	Rarely	197	46.5
Hours of exercise per week	less than 1 hour	57	13.4
	1-2 hours	73	17.2
	4-3 hours	52	12.3
	5-6 hours	42	9.9
	more than 6 hours	28	6.6
	I don’t exercise	172	40.6
Studying hours per week	less than 1 hour	13	3.1
	1-2 hours	35	8.3
	4-3 hours	92	21.7
	5-6 hours	74	17.5
	more than 6 hours	210	49.5

Table (3) shows the distribution of GPAs as varies significantly across the different BMI categories. For instance, within the underweight category, there is a notable prevalence of individuals with GPAs falling below 3, accounting for 0.5% of the total sample. This trend is consistent across the subsequent BMI categories, with the percentage of individuals with GPAs less than 3 gradually decreasing as BMI increases. Conversely, as BMI shifts towards the obese category, there is a corresponding increase in the proportion of individuals with GPAs above 3, reaching a peak of 26.4% in the obese category for GPAs on a scale of 5. Furthermore, it is noteworthy that the distribution of GPAs on a scale of 4 follows a similar pattern, albeit with differing percentages. The prevalence of lower GPAs is more pronounced in this scale, particularly evident in the underweight category where 2.8% of individuals have GPAs falling below 2.25. This trend continues to shift towards higher GPAs as BMI increases,

with the obese category accounting for 16.7% of individuals with GPAs above 3. However, no significant association was found between BMI of participants and their GPAs.

Table (3): Knowledge of participants of online nutritional applications and tele-dietetics (n=424).

		BMI				Total (N=424)	P value
		underweight	normal	overweight	obese		
GPA Out of 5	(Less than 3	0	2	1	0	3	0.818
		0.0%	0.5%	0.2%	0.0%	0.7%	
	(3 - 3.24)	1	2	2	5	10	
		0.2%	0.5%	0.5%	1.2%	2.4%	
	(3.25 - 3.49)	1	6	2	6	15	
		0.2%	1.4%	0.5%	1.4%	3.5%	
	(3.5 - 3.74)	2	6	3	1	12	
		0.5%	1.4%	0.7%	0.2%	2.8%	
	(3.75 - 3.99)	9	13	9	7	38	
		2.1%	3.1%	2.1%	1.7%	9.0%	
	(4 - 4.24)	11	16	10	15	52	
		2.6%	3.8%	2.4%	3.5%	12.3%	
	(4.25 - 4.49)	8	13	9	12	42	
		1.9%	3.1%	2.1%	2.8%	9.9%	
	(4.5 - 4.74)	16	22	11	20	69	
		3.8%	5.2%	2.6%	4.7%	16.3%	
	(4.75 - 5)	22	45	25	20	112	
		5.2%	10.6%	5.9%	4.7%	26.4%	
	'The GPA used in my university is out of 4	17	27	12	15	71	
		4.0%	6.4%	2.8%	3.5%	16.7%	
GPA out of 4	(2 - 2.24)	0	2	0	0	2	0.296
		0.0%	2.8%	0.0%	0.0%	2.8%	
	(2.25 - 2.49)	0	1	1	0	2	
		0.0%	1.4%	1.4%	0.0%	2.8%	
	(2.5- 2.74)	2	2	1	0	5	
		2.8%	2.8%	1.4%	0.0%	7.0%	
	(2.75 - 2.99)	2	5	4	2	13	
		2.8%	7.0%	5.6%	2.8%	18.3%	
	(3 - 3.24)	1	0	0	2	3	
		1.4%	0.0%	0.0%	2.8%	4.2%	
	(3.25 - 3.49)	1	3	2	2	8	
		1.4%	4.2%	2.8%	2.8%	11.3%	
	(3.5 - 3.74)	4	1	3	1	9	
		5.6%	1.4%	4.2%	1.4%	12.7%	
	(3.75 - 4)	7	13	1	8	29	
		9.9%	18.3%	1.4%	11.3%	40.8%	

Discussion:

Obesity and academic performance are two important factors that can have a significant impact on an individual's overall well-being. Several studies have been conducted to explore the association between obesity and grade point average (GPA) among college students. The main objective of this study is to determine the association between BMI and GPA among College students in Saudi Arabia.

According to our study results, there was no significant association between BMI and participants' GPA whether out of 5 or 4. In a previous Saudi study, students with a GPA above 90% had a mean BMI of 22.75±5.4, while those with a GPA below 90% had a mean BMI of 22.4±6.0. This suggests no significant difference between being overweight, obese, normal weight, or underweight. On the other hand, obese kids performed poorly in physics [14]. According to several research, obesity influences cognitive ability, and the possibility of being fat is impacted by nutrition quality (as nutrition quality declines, the risk of obesity increases), hence bad nutrition is related with poor academic performance [15]. In contrast, not all research have established a favourable relationship between BMI and academic performance; some indicate no relationship, while others reveal an inverse relationship [16, 17].

A study gave results comparable to our results reported that, obesity has no effect on academic performance in students from both colleges [18]. This finding is consistent with prior research, which found no link between academic performance and obesity [19, 20]. Obesity is not statistically related with poor academic performance in school-aged children, according to a rigorous and comprehensive systematic review conducted by Santana et al. [21], which included qualitative evaluations of the research. However, Taras's study [22] revealed that overweight and obesity are connected with poor academic performance. In Kuwait, a study found no variations in markers of academic achievement among individuals of different BMIs in both genders. The relationship between BMI and academic performance is not entirely established [23]. Some research found an unfavourable link between BMI and academic performance [24-26], whereas others found no relationships [27, 28].

Another study found a substantial link between obesity and academic performance, indicating that obesity may influence cognitive function [29]. This is supported by a recent study that discovered that generalised and visceral obesity were related with lower cognitive scores after accounting for cardiovascular risk factors, educational level, and vascular brain injury [30]. These issues have the potential to reduce pupils' talents and, as a result, academic accomplishment. Furthermore, a recent study discovered that obese people performed worse on tasks requiring memory, attention, and executive function [31]. This finding contradicts another study, which found that obesity had no effect on academic performance among students at Imam Mohammad Ibn Saud Islamic University's Colleges of Science and Medicine in Saudi Arabia [32].

It's important to note that correlation does not imply causation, and the relationship between obesity and GPA is likely to be complex and multifaceted. For example, obesity may be a symptom of underlying health issues or lifestyle factors that could also impact academic performance, rather than obesity itself directly causing lower GPAs.

Furthermore, it's crucial to approach this topic with sensitivity and avoid stigmatizing individuals based on their weight. Instead, efforts should be focused on promoting overall health and well-being, which can have positive effects on both physical and academic outcomes.

While the study provides valuable insights into the potential relationship between obesity and academic performance, it is important to acknowledge its limitations. One limitation is the cross-sectional design, which only allows for the observation of associations at a single point in time and does not establish causality. Additionally, the study's findings may be influenced by confounding variables such as socioeconomic status, dietary habits, and physical activity levels, which were not fully accounted for. Furthermore, the study's sample size and representativeness of the college student population in Saudi Arabia may also impact the generalizability of the results. Despite these limitations, the study serves as a starting point for further research on the topic.

The findings of the study suggest that there is a negative relationship between obesity and academic performance, highlighting the need for interventions to address the impact of obesity on students' educational outcomes. This has implications for public health policies and educational institutions in Saudi Arabia, as well as potentially in other countries with similar demographics. It also underscores the importance of promoting healthy lifestyles and providing support for students struggling with obesity to improve their academic success. Further research in this area could provide valuable insights for developing targeted interventions and support systems for students.

4. Conclusion:

There was no significant association between BMI and participants' GPA whether out of 5 or 4. More research is needed to better understand the mechanisms behind this association and to develop effective interventions to support the academic success of all students, regardless of their weight status.

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Ethical approval

Ethical approval was obtained from the research ethics committee of the Imam Abdulrahman Bin Faisal University with Application number: [IRB-2024-01-113]. An informed consent was obtained from each participant after explaining the study in full and clarifying that participation is voluntary. Data collected were securely saved and used for research purposes only.

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Conflict of interests

The authors declare that there are no conflicts of interest.

Informed consent:

Written informed consent was obtained from all individual participants included in the study.

Data and materials availability

All data associated with this study are present in the paper.

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