Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2020, 9(3): 64-73

Does BMI Affect Academic Performance? Study among Undergraduate Medical Students of Saudi Arabia and India

Feras Almarshad[1] and Mohammed Bhilal B[2*]

[1] Department of Internal Medicine, College of Medicine, Shaqra University, Saudi Arabia

[2] Department of Anatomy, College of Medicine, Shaqra University, Saudi Arabia

**Corresponding e-mail: dr_beo@yahoo.co.in*

ABSTRACT

Objective: *To study whether BMI as a single influencing factor has any impact on college student academic performance.* ***Methods:*** *540 (214 females, 326 males) university-level undergraduate medical students from the region of India and Saudi Arabia were studied for one year. Their BMI was calculated and compared with academic aggregate marks.* ***Results:*** *The majority of the students had normal BMI. On comparing grades of underweight, overweight, and obese students with normal weight students we found that there was no significant difference in their academic performance (p=0.899). Gender-wise comparison also showed an insignificant relationship between BMI and academic performance (females p=0.539, males p=0.622).* ***Conclusion:*** *Weight did not show any influence on academic performance when the BMI alone is compared with the academic performance of the students for a short duration (one year), irrespective of gender (male/female).*

Keywords: BMI, Academic performance, University students, India, Saudi Arabia

Abbreviations: BMI: Basal Metabolic Index; WHO: World Health Organization; SD: Standard Deviation

INTRODUCTION

The word "Obesity" is considered as a taboo among the medical fraternity. When physicians hear the word "overweight" or "obesity" the first few thoughts which cross their mind are diabetes, hypertension, cardiovascular risks, cancer, comorbidities, and mortalities associated with obesity [1]. Numerous published studies have established, confirmed, and validated this fact. If we refer and cite such studies, multiple issues of a journal would be required to publish the references and citations alone. Henceforth, there is no doubt that increased BMI has a direct relationship with morbidity and mortality [2]. The world health organization states that obesity in the world has tripled from 1975 to 2016 and 1.9 billion adults were overweight in 2016 among whom 650 million were obese [3]. But there is little research evidence on the relationship between BMI and academic performance. Some researchers as follows have found either a positive or negative impact of BMI on academic performances. A research study says that better BMI could have a positive impact on academic performance [4], Research study on school children points out that obesity has negative effects on academic performance [5], another study on school children showed a partial correlation between BMI and academic performance [6], A study on American college students showed that normal BMI students had better academic performance than overweight students [7]. But many research studies as follows correlate either a weak or no relationship between BMI and Academic performance. A study on Nigerian university students shows a weak or negative relationship between BMI and academic performance [8], while another study on schoolboys in the middle east region has ascribed that academic performance is not influenced by BMI [9], another research study on Nigerian university students states that BMI and academic performances are unrelated henceforth no basis for students to be judged on body mass profile [10], A study on Indian medical students showed BMI is not associated with cognition implying that BMI and academic performance are far apart in correlation [11].

When we carefully analysed all the above-mentioned studies as well as many other studies correlating BMI and academic performance, we found a compelling pattern which showed that academic performance has always been

correlated with BMI as one of the factors in a multifactorial approach. This approach made it complex to either understand or correlate academic performance with BMI. On more literature review we found that seldom studies had compared academic performance and BMI as a unifactorial correlating approach.

There was a million-dollar question still unanswered "Does a normal BMI student academically perform better than underweight, overweight or obese students when no other factor is weighed in?" this question kept repeatedly haunting us in our journey of literature review. This haunting fact made us ask ourselves a question "Does BMI directly influence our academic performance?" we get multiple hypotheses (yes, no, maybe, maybe not) as answers. This question drove us to the scientific journey of finding answers. The journey of literature review helped us in narrowing down our objective of comparing and correlating the academic performance with BMI as a single influencing factor rather than attaching multiple strings (learning environment, socioeconomic status, and psychological factors) to it.

METHODOLOGY

This study included 326 male and 214 female (n=540) university-level undergraduate medical students from the region of India and Saudi Arabia. The anthropometric measurements (height and weight) of the students were recorded in metric indices using manual scales. The BMI of the students was calculated using the formula [12].

$$BMI = \frac{weight\ in\ kilogram\ (kg)}{height\ in\ metre\ square\ (m^2)}\ kg/m^2$$

Based on the WHO classification of BMI [13] the students were classified into four groups underweight, normal weight, overweight, and obese (Table 1). Distribution of BMI in total population, male population, and female population was compared and studied.

Each student's average aggregate marks (all courses or modules) of that academic year was calculated. Based on aggregate marks students were grouped under five grades of academic performance namely Grade V to Grade I (Table 2). Students with less than 60% aggregate marks were considered Grade V which was the lowest grade i.e. Grade V students showed poor academic performance. Students with more than or equal to 90% aggregate marks were considered Grade I which was the highest grade i.e. Grade I students showed excellent academic performance. Distribution of students according to academic performance into grades was studied in total population, male population, and female population. The academic grades of students within the normal BMI category was considered as optimum academic grades. Academic grades of underweight, overweight, and obese students were compared with the academic grades of their normal counterparts. Such comparison was done in total population, male population, and female population.

Statistical Analysis

Statistical analysis such as standard deviation was calculated for height, weight, BMI of each category, and aggregate marks of students. To understand the relationship between BMI and academic performance, Pearson's Chi-Square (2 sided) with Yate's correction and likelihood ratio was used. SPSS software was used for statistical analysis.

RESULTS AND DISCUSSION

The total population of 540 students had a mean height of 164.8 cm (SD ± 10.04), mean weight 65.9 kg (SD ± 17.2), and mean BMI 24.07 kg/m^2 (SD ± 5.06). While 214 female students had a mean height of 155.03 cm (SD ± 5.85), mean weight 56.44 kg (SD ± 11.59), and mean BMI 23.44 kg/m^2 (SD ± 4.37). 326 male students had a mean height of 171.26 cm (SD ± 6.34), mean weight 72.04 kg (SD ± 17.55), and mean BMI 24.49 kg/m^2 (SD ± 5.43) (Table 3).

Among the 540 students, 297 (55%) had normal weight, 132 (24.44%) students were overweight, 61 (11.30%) students were obese and 50 (9.26%) were underweight (Chart 1), an almost similar pattern followed in gender-wise distribution. Of the total 214 female 126 (58.88%) had normal weight 47 (21.96%) were overweight 19 (8.88%) were obese and 22 (10.28%) were underweight (Chart 2). While of the 326 male students 171 (52.45%) students had normal weight, 85 (26.07%) were overweight, 42 (12.88%) were obese and 28 (8.59%) were underweight (Chart 3).

The aggregate mean marks of 540 students were 66.94% (SD ± 10.08), while the mean marks of 214 females were 66.25% (SD ± 8.06), and 326 males were 67.39% (SD ± 11.2). Students with normal BMI scored a mean aggregate

of 66.85% (SD ± 10.18), with females scoring 66.89% (SD ± 7.92) and males scoring 66.82% (SD ± 11.58). Students with underweight BMI scored a mean aggregate of 67.42% (SD ± 9.02), with females scoring 66.93% (SD ± 7.63) and males scoring 67.81% (SD ± 10.11). Students with overweight BMI scored a mean aggregate of 66.72% (SD ± 10.23), with females scoring 65.54% (SD ± 8.24) and males scoring 67.37% (SD ± 11.18). Students with obese BMI scored a mean aggregate of 67.47% (SD ± 10.29), with females scoring 63.02% (SD ± 8.74) and males scoring 69.48% (SD ± 10.4).

When the mean aggregate marks of underweight, overweight, and obese students were compared with the optimum normal weight group we found a striking similarity in the mean marks which was within the standard deviation of normal weight group. The difference in mean marks of normal BMI students, when compared with any of the abnormal BMI group, was ≤ 0.62% (Table 4). Similar result with a slightly higher difference of ≤ 3.87% and ≤ 2.66% was observed in females and males respectively, which was well within the standard deviation of normal weight group.

The academic performance of the students showed a constant pattern in the total student population as well as in female and male groups (Charts 4 and 5). The trend was Grade IV range had the highest number of students followed by Grade III, Grade V, Grade II, and Grade I range had the least number of students (Chart 6). Academic grading of students grouped under different BMI categories showed that the highest number of students scored in Grade IV range, followed by Grade III, Grade V, Grade II and least number of students scored in Grade I range irrespective of BMI status (Charts 6-9) or gender (Charts 10-13).

To understand the relationship between BMI and academic performance, we tabulated the total number of students in each academic grade according to their BMI status (Table 5). On comparing grades of underweight, overweight, obese students with normal weight students we found that there was no significant difference in their academic performance (p=0.899). Such comparison was further done gender-wise (Tables 6 and 7), which also showed an insignificant relationship between BMI and academic performance (females p=0.539, males p=0.622).

Table 1 WHO classification of BMI

Categories	BMI (kg/m^2)
Underweight	<18.5
Normal weight	18.5-24.9
Overweight	25.0-29.9
Obese	≥ 30

Table 2 Academic grading

Grade	Aggregate Marks	Interpretation
Grade I	≥ 90	Excellent
Grade II	80-80.9	Good
Grade III	70-70.9	Above Average
Grade IV	60-69.9	Average
Grade V	<60%	Fail (poor)

Table 3 Mean indices of studied population

Indices	Gender	Mean ± standard deviation (unit)
Height	Both	164.8 ± 10.04 cm
	Female	155.03 ± 5.85 cm
	Male	171.26 ± 6.34 cm

Weight	Both	65.9 ± 17.2 kg
	Female	56.44 ± 11.59 kg
	Male	72.04 ± 17.55 kg
BMI	Both	24.07 ± 5.06 kg/m^2
	Female	23.44 ± 4.37 kg/m^2
	Male	24.49 ± 5.43 kg/m^2

Table 4 Comparison of mean aggregate marks

BMI groups	Gender	Mean Aggregate Marks% ± Standard Deviation
Normal	Both	66.85 ± 10.18
	Female	66.89 ± 7.92
	Male	66.82 ± 11.58
Underweight	Both	67.42 ± 9.02
	Female	66.93 ± 7.63
	Male	67.81 ± 10.11
Overweight	Both	66.72 ± 10.23
	Female	65.54 ± 8.24
	Male	67.37 ± 11.18
Obese	Both	67.47 ± 10.29
	Female	63.02 ± 8.74
	Male	69.48 ± 10.4)
Total Population	Both	66.94 ± 10.08
	Female	66.25 ± 8.06
	Male	67.39 ± 11.2

Table 5 Distribution of total students (n=540)

BMI	Grade I	Grade II	Grade III	Grade IV	Grade V
Normal	0	24	88	124	61
Underweight	1	3	13	24	9
Overweight	1	12	36	56	27
Obese	0	6	18	25	12

Table 6 Distribution of female students (n=214)

BMI	Grade I	Grade II	Grade III	Grade IV	Grade V
Normal	0	3	45	54	24
Underweight	0	0	7	10	5
Overweight	0	1	11	27	8
Obese	0	0	3	12	4

Table 7 Distribution of male students (n=326)

BMI	Grade I	Grade II	Grade III	Grade IV	Grade V
Normal	0	21	43	70	37
Underweight	1	3	6	14	4
Overweight	1	11	25	29	19
Obese	0	6	15	13	8

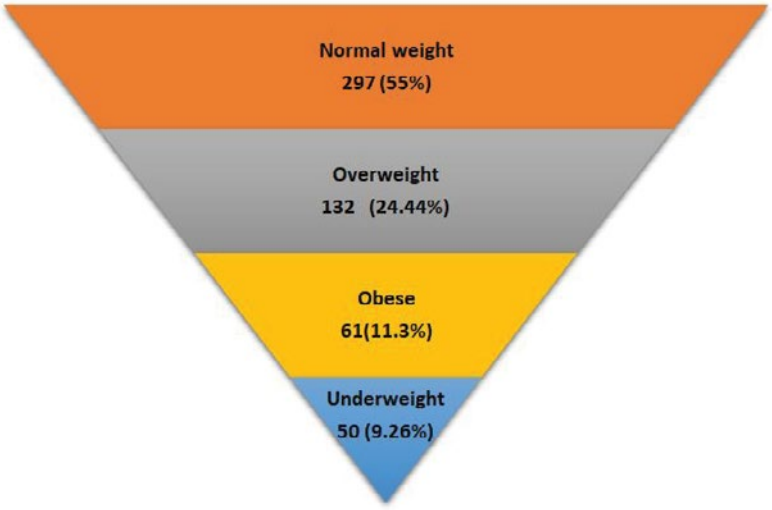

Chart 1 Distribution of weight among students (BMI categories)

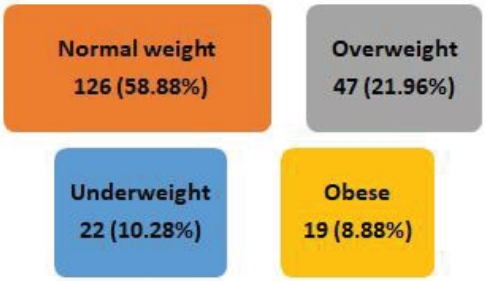

Chart 2 Distribution of weight among female students

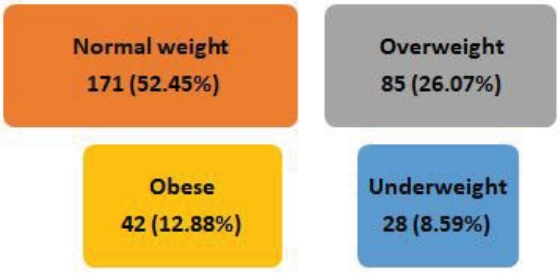

Chart 3 Distribution of weight among male students

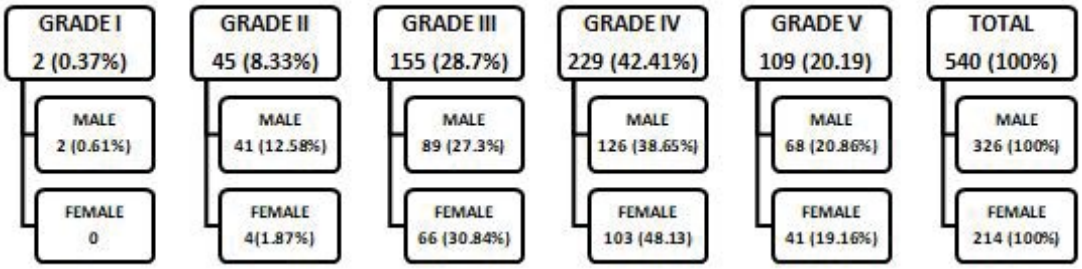

Chart 4 Academic grade wise distribution of students

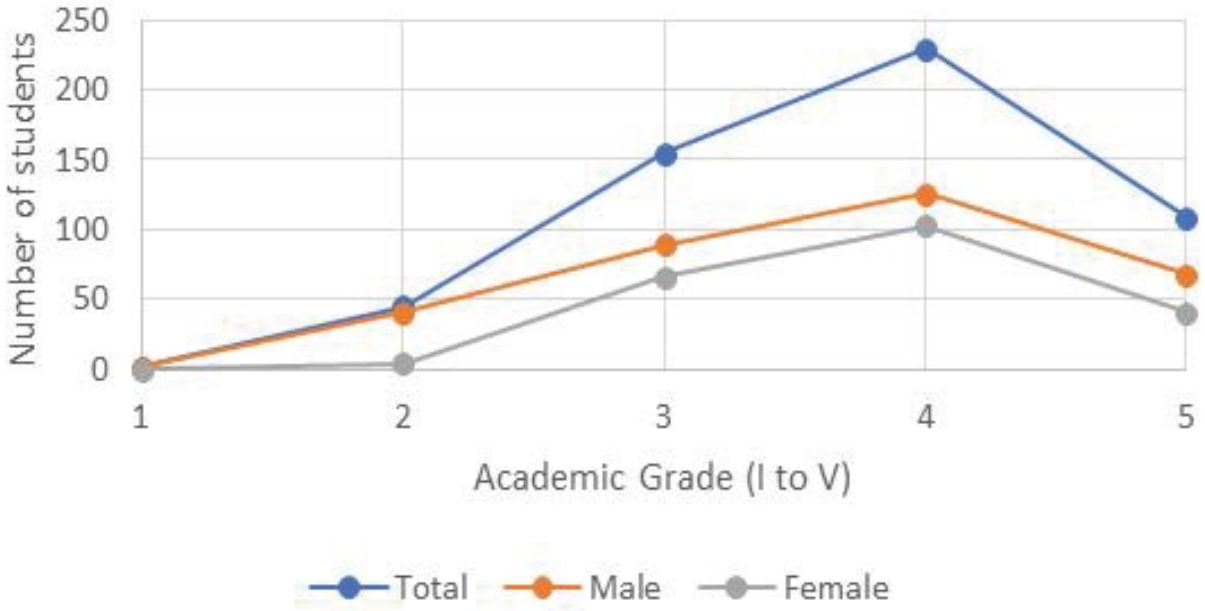

Chart 5 Trends in academic grades

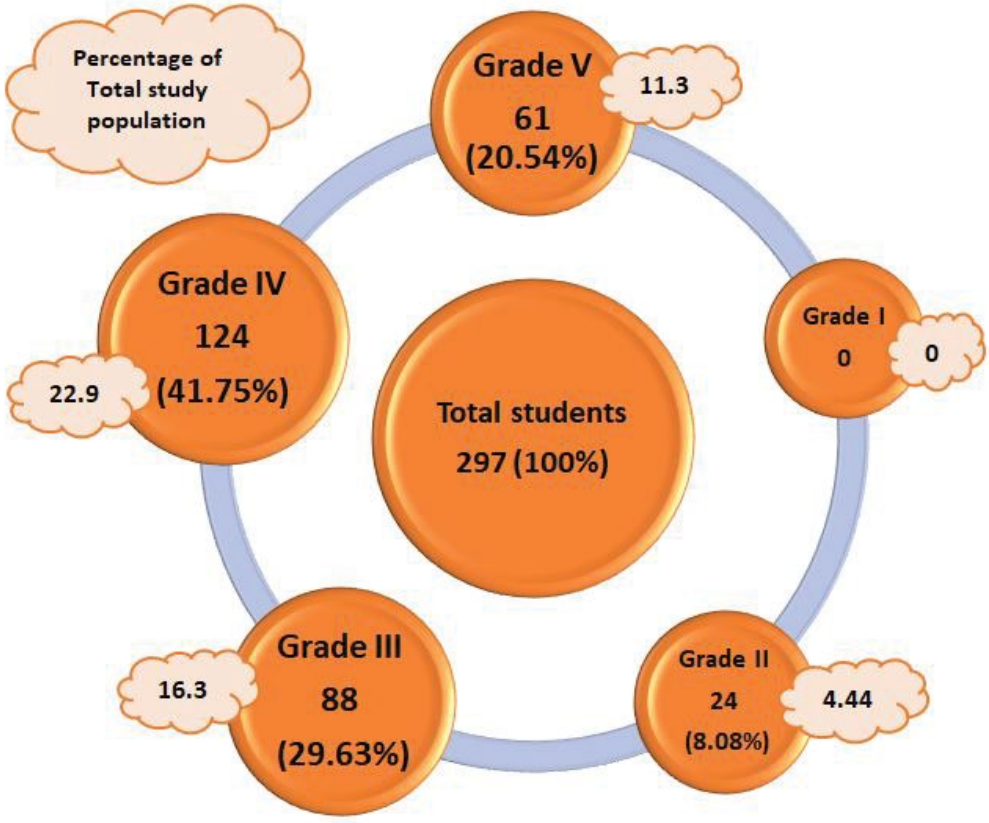

Chart 6 Academic grades of normal weight students

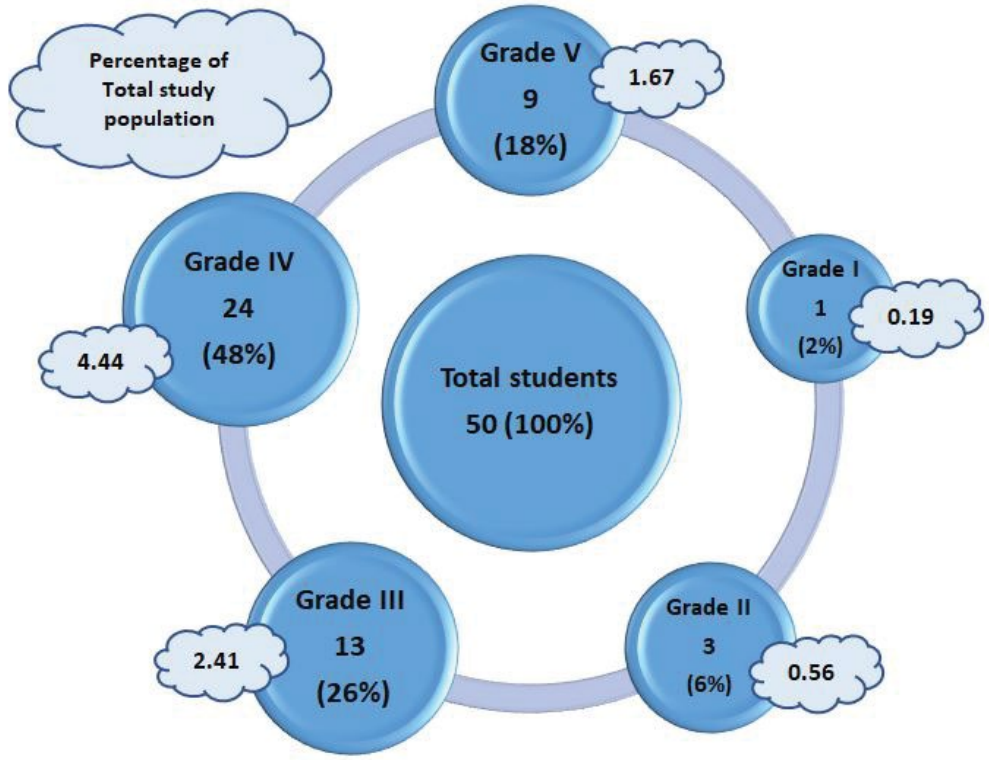

Chart 7 Academic grades of underweight students

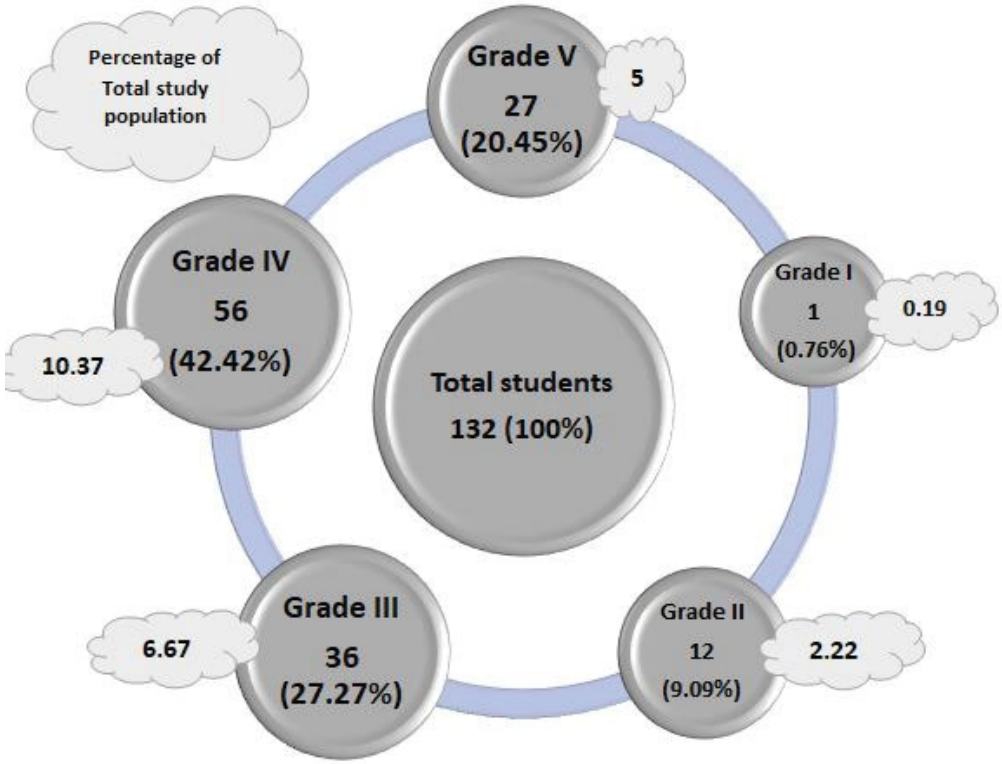

Chart 8 Academic grades of overweight students

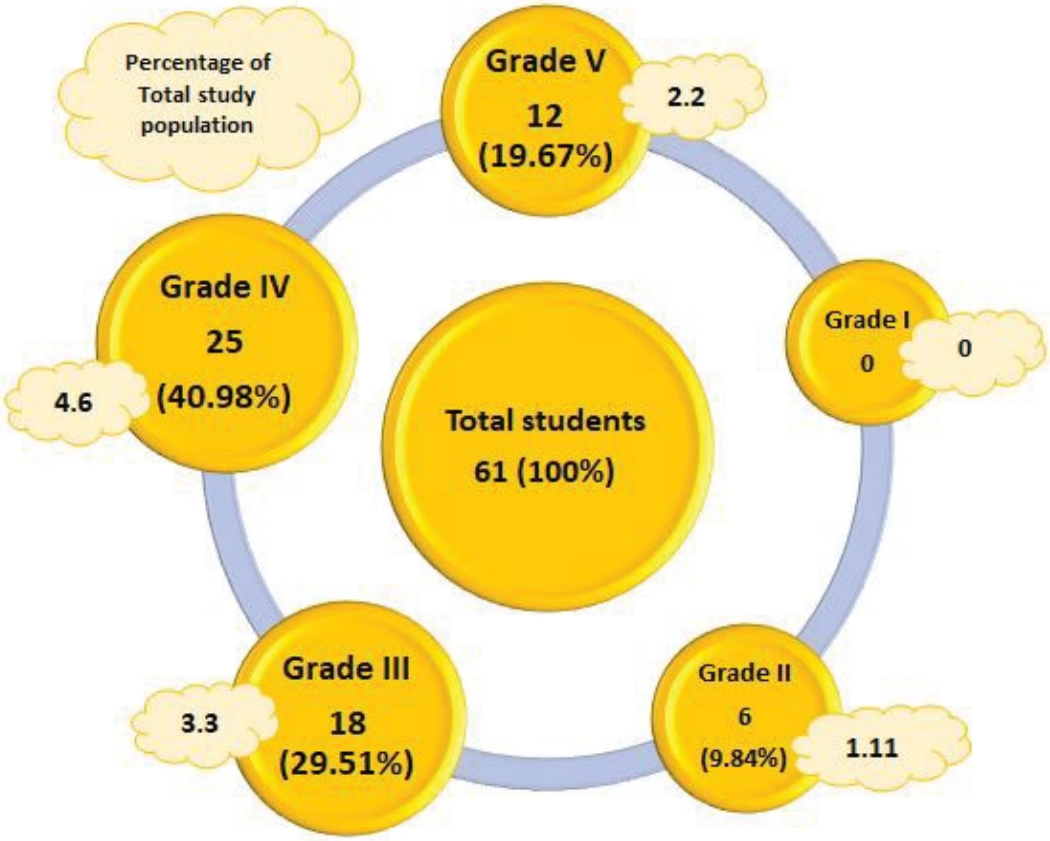

Chart 9 Academic grades of obese students

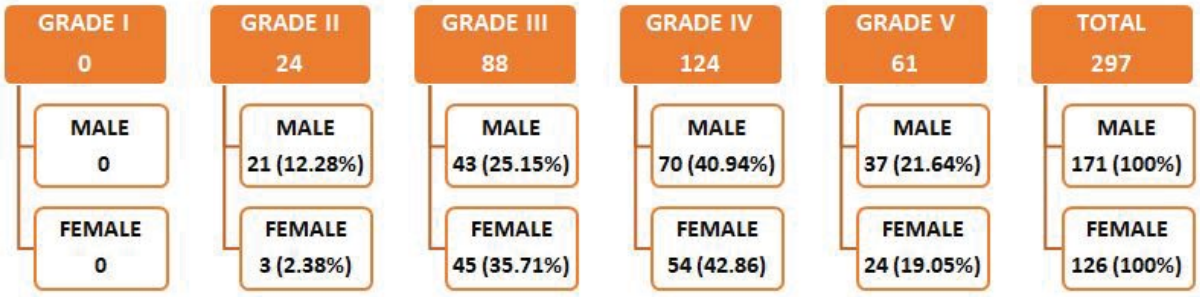

Chart 10 Gender wise grades variation in normal-weight students

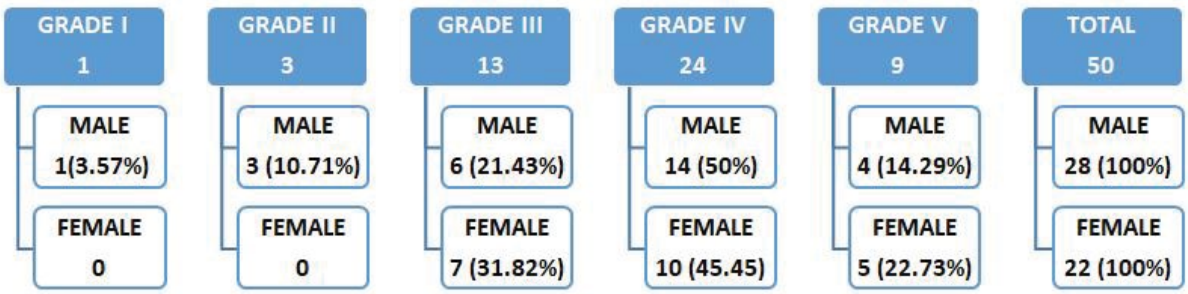

Chart 11 Gender wise grades variation in underweight students

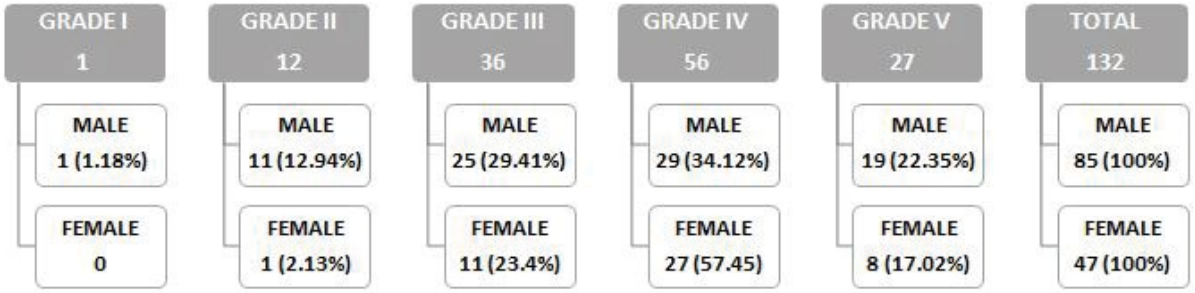

Chart 12 Gender wise grades variation in overweight students

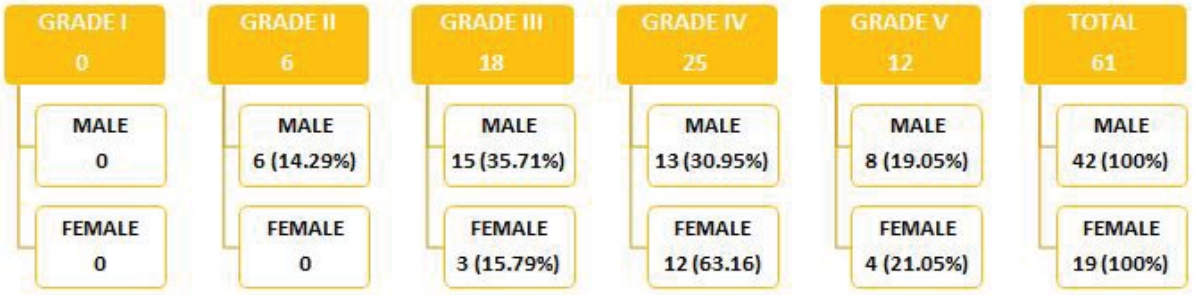

Chart 13 Gender wise distributions of grades in obese students

CONCLUSION

This study shows that the majority of the students who participated had normal BMI. In this study, we conclude that weight did not show any influence on academic performance when the BMI alone was compared with the academic performance of the students for a short duration (one year), irrespective of gender (male/female).

DECLARATIONS

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

1. Flegal, Katherine M., et al. "Excess deaths associated with underweight, overweight, and obesity." *JAMA,* Vol. 293, No. 15, 2005, pp. 1861-67.
2. Must, Aviva. "Morbidity and mortality associated with elevated body weight in children and adolescents." *The American Journal of Clinical Nutrition,* Vol. 63, No. 3, 1996, pp. 445S-47S.
3. World Health Organization. "Obesity and overweight fact sheet." 2016.
4. Anderson, Angela S., and Deborah J. Good. "Increased body weight affects academic performance in university students." *Preventive Medicine Reports,* Vol. 5, 2017, pp. 220-23.
5. Heshmat, Ramin, et al. "Do overweight students have lower academic performance than their classmates? A pilot cross sectional study in a middle school in Tehran." *Journal of Diabetes and Metabolic Disorders,* Vol. 13, No. 1, 2014, p. 87.

6. Alswat, Khaled A., et al. "The association between body mass index and academic performance." *Saudi Medical Journal,* Vol. 38, No. 2, 2017, p. 186.

7. Franz, Douglas D., and Shingairai A. Feresu. "The relationship between physical activity, body mass index, and academic performance and college-age students." *Open Journal of Epidemiology,* Vol. 3, No. 1, 2013, p. 1-4.

8. M. Muhammad, A. A. Umar, and I. A. Atiku, "Relationship between body mass index and academic performance among students of basic medical sciences, bayero university kano, Nigeria." *Dutse Journal of Pure and Applied Sciences,* Vol. 4, No. 1, 2018, pp. 349-59.

9. Abdelalim, Ahmed, et al. "Childhood obesity and academic achievement among male students in public primary schools in Kuwait." *Medical Principles and Practice,* Vol. 21, No. 1, 2012, pp. 14-19.

10. Atare, U. Franz, and A. T. Nkangude. "Body mass index and academic performance of undergraduate university students." *Asian Journal of Management Sciences and Education,* Vol. 3, No. 1, 2014, pp. 105-12.

11. Agarwal, Shivani, et al. "Effect of body mass index on physical self-concept, cognition and academic performance of first year medical students." *The Indian Journal of Medical Research,* Vol. 138, No. 4, 2013, p. 515.

12. Keys, Ancel, et al. "Indices of relative weight and obesity." *Journal of Chronic Diseases,* Vol. 25, No. 6, 1972, pp. 329-43.

13. Seidell, Jacob C., and Katherine M. Flegal. "Assessing obesity: Classification and epidemiology." *British Medical Bulletin,* Vol. 53, No. 2, 1997, pp. 238-52.