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Relationship of obesity and physical activity with academic performance among Indian dental students

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Abstract. *Background and aim:* Dentistry curriculum is laborious, strenuous, and stressful and has little leisure time due to numerous academic activities. We aimed to evaluate the association of Academic Performance (AP) with physical activity (PA) and obesity. *Methods:* We performed a multicentric web-based survey through WhatsApp-based study groups among Indian dental students. A self-reported questionnaire that had information on age, sex, height, weight, current year, PA, and AP was used. PA was assessed using the International Physical Activity Questionnaire – short form which. is an open-ended 7-day recall questionnaire with 7 items (vigorous, moderate, walking, and sitting PA and the number of days, hours, and minutes spent on each activity). AP was recorded based on the average marks obtained in the previous academic year. Body Mass Index (BMI) was calculated by the formula weight (Kg)/ height (meters)^2. Dental students who had not appeared in any of the examinations and were absent from the academic curriculum were excluded. *Results:* A total of 575 students were included out of which the majority were female (n=449). The majority of the participants had normal BMIs (59.1%) and were moderately physically active (n=246). Students with normal BMIs had higher mean AP scores than obese. Also, moderate and high PA students had higher mean AP scores than low PA students. Students with moderate and high PA had significantly higher estimates of AP when compared to low PA students after adjusting for year of study, BMI, and sex. *Conclusions*: PA has a positive association with AP among dental students. (www.actabiomedica.it)

Key words: dentistry, students, academic achievement, physical activity

Introduction

Dentistry involves a laborious, strenuous, and stressful curriculum. Dental students are expected to acquire knowledge about diverse medical and dental subjects, clinical competencies, and interpersonal and communication skills. It has to be noted that the dentistry curriculum in India is demanding and has very little leisure time due to numerous academic activities that have to be completed within the stipulated timelines as per the framework of the regulatory bodies (1). Even during the training years, it involves prolonged long static procedures and can lead to musculoskeletal disorders.

Studies have reported that many dental students perceive stress (2–5), burnout (6), and musculoskeletal disorders (7–9) which might influence the overall quality of life and Academic Performance (AP). To avoid

the early onset of these detrimental issues and maintain good health and well-being (10), it is prudent that they maintain optimum physical activity (PA). It was shown that PA was associated with AP (11–13).

A variety of methods have been developed to evaluate PA among individuals which include questionnaires, activity trackers, mobile applications, anthropometric measures (weight, height, body mass index), etc. All these methods have their advantages and limitations. Activity trackers and mobile applications record the physical activity in real time, and help to motivate individuals and goal setting. However, they are costly, data obtained may not be comparable to different devices, requires compliance from the individual to wear or carry the device during the physical activity. Also, the type of activity that the individual is performing may have to be pre-selected to efficiently capture the data. Anthropometric measurements are indicators of body composition and proxy measures of physical activity and may not reflect the true physical activity of the individuals. Instruments like global physical activity questionnaire (n=16 items) and international physical activity questionnaire long form (n=27 items) are widely used to assess physical activity which have comprehensive assessment. However, these questionnaires are lengthy and time consuming. To overcome this international physical activity questionnaire-Short Form (IPAQ-SF) was developed to obtain internationally comparable data on health–related physical activity (14,15). It was shown to be a valid and reliable tool across diverse population groups (16,17).

Previous studies have been conducted to evaluate the PA of dentists (18–20) and dental students, (21) PA, and stress among dental students (13) factors affecting AP among students (11–13,22,23). Studies that evaluated the association of AP with PA and obesity among Indian dental students are scant.

Aims

With this background, we aimed to evaluate the association of AP with PA and obesity among Indian dental students. The objectives of the study were to evaluate the association of AP with PA (IPAQ-SF) and obesity (body mass index). The null hypothesis was that there would be no association between PA and obesity with AP.

Patients and methods

Instrument and participants

We performed a multicentric web-based survey through Whatsapp-based study groups among Indian dental students. The link for the survey form in English was made available through WhatsApp from August to September 2023.

The sample size was calculated based on the prevalence of PA of 60% (23), the sample size was estimated to be 369 with a power of 95% and 5% precision. A design effect of 1.5 was considered to account for the clustering which yielded a sample size of 554. This was inflated to 582 to account for incomplete responses (5%).

We prepared a structured self-reported questionnaire in English using Microsoft Forms. It had information on age, sex, height, weight, current year of study in dentistry, PA (assessed by the IPAQ-SF) (14,15), and AP. IPAQ-SF is a self-reported open-ended 7-day recall questionnaire. It consists of 7 items that evaluate vigorous, moderate, walking, and sitting. These activities are recorded based on the number of days spent in each type of activity along with the number of hours and minutes spent on such activity. Only values of 10 or more minutes of activity were included. It is also recommended that all Walking, Moderate, and Vigorous time variables exceeding 180 minutes are truncated to 180 minutes. Participants who responded as 'don't know' or 'refused" or data missing for time or days were excluded. Also, participants in which the total of all Walking, Moderate, and Vigorous time variables is greater than 960 minutes should be excluded from the analysis based on the assumption that an average of 8 hours per day is spent on sleeping. METs were calculated for walking, moderate, and vigorous activities as per the IPAQ guidelines (14,24). Walking MET-minutes/week was calculated by multiplying 3.3 with the number of walking minutes and walking days. Similarly, moderate MET-minutes/week was

calculated by multiplying 4.0 with moderate-intensity activity minutes and the number of days of moderate activity. Vigorous MET-minutes/week were calculated by multiplying 8.0 with vigorous intensity activity minutes and number of days of vigorous activity. Total PA was calculated by summing the walking, moderate, and vigorous MET-minute/week scores. Participants were labelled "High" if the vigorous-intensity activity on at least 3 days achieving a minimum total PA of at least 1500 MET-minutes/week or 7 or more days of any combination of walking moderate-intensity, or vigorous-intensity activities achieving a minimum total PA of at least 3000 MET-minutes/week. If three or more days of vigorous-intensity activity of at least 20 minutes per day five or more days of moderate-intensity activity and/or walking of at least 30 minutes per day or five or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum Total PA of at least 600 MET-minutes/week then participants were labelled as "moderate" physical activity. Participants not meeting high or moderate PA were categorized as "low" physical activity.

AP was recorded based on the average marks obtained in the previous academic year. Body mass index was calculated by the formula weight (Kg)/ height (meters)^2 (25). We invited dental students currently pursuing dentistry in India through WhatsApp-based study groups from various dental colleges and universities. Dental students who have not appeared in any of the examinations were excluded. Students who have been absent from the academic curriculum due to various reasons were also excluded.

Statistical analysis

All the analysis was conducted using Jamovi version 2.3 (https://www.jamovi.org.). A p-value of <0.05 was considered statistically significant. Age was categorized as the median split. The academic year was categorized as preclinical and clinical years. BMI was categorized as underweight (<18.5), normal (18.5-24.9), overweight (25-29.9), and obese (30 and above). PA was categorized as low, moderate, and high. The distribution of AP scores was non-normal and non-parametric tests like the Mann-Whitney U test and Kruskal Wallis ANOVA with Dwass-Steel-Critchlow-Fligner pairwise comparisons were done to compare the significant differences concerning age, sex, academic year, BMI and PA. We performed Generalized linear model to evaluate the significant predictors for AP obtained in Bivariate analysis. Estimated Marginal means of AP scores were computed and post-hoc Bonferroni comparisons were performed concerning BMI and PA.

Ethical considerations

The study protocol was approved by the Kasturba Hospital and Kasturba Medical College institutional ethics committee (IEC2: 199/2023). Prior informed consent was sought from all the participants in English.

Results

A total of 586 dental students responded to the survey link. Eleven dental students were excluded due to lack of consent (n=3) and incomplete responses (n=8) yielding a sample size of 575. Most of the participants were female (n=449). The mean age and BMI were 22(SD: 1.6) and 23.18 (4.49) respectively. The majority of the participants had normal BMI (59.1%) followed by overweight (21.2%), underweight (12.2%) and very few were obese (7.5%). Most of the participants were interns (36.7%). The overall MET score was 1192.58 (SD: 983.59; Median: 924; Min-Max: 0-4986). Many of the participants were moderately physically active (n=246) followed by low PA (n=208).

Factors that might influence the AP were analyzed. It was seen that there was no significant difference in the mean AP scores concerning age group (*P=0.175*). However, females scored significantly higher mean AP scores than males (*P=0.001*). Also, students in clinical years had higher AP scores than pre-clinical students (*P=0.004*). Concerning the BMI, there was a significant difference in the mean AP scores (*P=0.004*). Post-hoc tests showed that students with normal BMIs had higher mean AP scores than obese. Similarly, there was a significant difference in the mean AP scores concerning PA (*P<0.001*). Post-hoc tests showed that moderate and highly physically

active students had higher mean AP scores than low physically active students (Table 1).

We performed Generalized linear models to evaluate the significant predictors of AP obtained in Bivariate analysis. Moderate and highly physically active students had significantly higher estimates of AP when compared to low physically active students after adjusting for year of study, BMI, and sex. Also, Obese students had significantly lower estimates of AP when compared to normal BMI students after adjusting for year of study, BMI, and sex (Table 2).

Post-hoc Bonferroni test showed that the estimated marginal means of AP scores were significantly higher for moderate and high physically active students when compared to low physically active students. Similarly, the estimated marginal means of AP scores were significantly higher than normal BMI students when compared to obese students (Table 3 and Figure 1).

Table 1. Characteristics of the students and distribution of the average percentage of marks (Academic performance) as per demographic variables, body mass index, and physical activity.

	Average Percentage of Marks		P-value
	Mean±SD	N	
Age in years†			
≤22	67.22±4.85	355	0.175
>22	67.87±4.47	220	
Sex†			
Male	66.22±4.67	126	0.001
Female	67.82±4.67	449	
Year†			
Pre-clinical	66.52±5.57	230	0.004
Clinical	68.1±3.93	345	
Body mass index‡			
Underweight	67.13±4.84	70	0.004 Normal > Obese
Normal	67.91±4.52	340	
Overweight	67.27±4.73	122	
Obese	65.08±5.26	43	
Physical activity‡			
Low	66.41±4.27	208	<0.001 Moderate, High > Low
Moderate	68.26±5	246	
High	67.67±4.53	121	

†Mann-Whitney U test; ‡Kruskal Wallis ANOVA with Dwass-Steel-Critchlow-Fligner pairwise comparisons

Table 2. Generalized linear model with Academic performance as dependent variable.

Effect	Estimate	SE	95% CI	P-value
Intercept	66.323	0.277	65.78-66.87	<0.001
Physical activity (Ref: Low)				
Moderate	1.922	0.425	1.09-2.76	<0.001
High	1.693	0.531	0.65-2.73	0.002
Clinical - Preclinical	1.613	0.385	0.86-2.37	<0.001
Female - Male	1.610	0.470	0.69-2.53	<0.001
BMI (Ref: Normal)				
Underweight	-0.729	0.590	-1.89-0.43	0.217
Overweight	-0.909	0.479	-1.85-0.03	0.058
Obese	-2.459	0.734	-3.9- -1.02	<0.001

Dependent variable: Academic performance; CI: confidence interval.

Table 3. Estimated marginal means of average percentage of marks (academic performance) concerning physical activity and BMI.

	Mean	SE
Physical activity		
Low	65.1	0.38
Moderate	67.0	0.36
High	66.8	0.44
BMI		
Normal	67.3	0.28
Underweight	66.6	0.56
Overweight	66.4	0.43
Obese	64.9	0.69

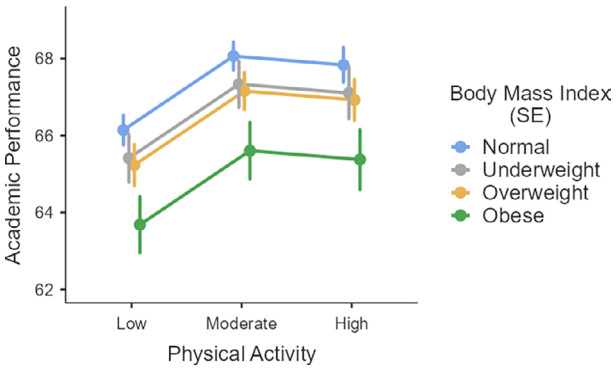

Figure 1. Distribution of estimated marginal means of academic performance in low, moderate, and high physical activity groups as per the BMI.

Conclusion

Good Health and well-being are one of the Sustainable developmental goals of all United Nations Member States including India (10). Also, WHO has recommended that 150 minutes/week of moderate PA is required (26). Dentistry curriculum is stressful and might limit the student's time allocated for optimum physical activity. Our study evaluated the relationship of obesity, and PA with AP among dental students.

There was a substantial variation in the assessment of PA and AP in the literature. Studies have used various methods like fitness scores (13), administrative records (23,27), PA questionnaires (12), and generic questions like housework and waking time (11). We have used IPAQ-SF questionnaire that helps to obtain internationally comparable data on health–related physical activity. Similarly, AP was measured as grade point average (11,12,23,27) and average scores (13). Grade point average was not implemented in the Indian dental curriculum. Hence, we have used average marks obtained in the previous examinations.

PA was low in almost 1/3rd of the participants (36.17%) which was similar to the pre-COVID-19 pandemic findings of Al-Mhanna et al among Indian (30%), Cambodian (31%) and Saudi (35%) dental students. However, they reported a higher prevalence of physical inactivity during the COVID-19 pandemic (76%) (21).

Findings of this study show that moderate and high physically active students had significantly higher estimates of AP when compared to low physically active students after adjusting for year of study, BMI, and sex. Ardila and Gómez-Restrepo. in their matched case-control study showed a strong association between physical inactivity and low Academic achievement among ethnic minority dental students of Columbia (27). Another report by Ardila and Gómez-Restrepo showed a protective effect of PA on low academic achievement among Colombian dental students (23). Al-Drees et al. showed a significant positive relation between PA and AA among medical students. Elmagd et al. showed a significant positive moderate correlation between Academic achievement and PA only among Emirates dental students (12). Hou et al. assessed physical fitness using seven parameters and found that it can contribute to academic achievement among Chinese dental students (13). However, Alsabih et al. reported no association between academic achievement and PA among Saudi healthcare students (11).

There were certain limitations in this study. Due to the online survey design, a random selection of participants was not feasible. However, we have included the design effect in the sample size calculation and inflated the sample size to overcome the disadvantages of clustering. The possibility of a lack of response from students with low AP and PA cannot be ignored. Social desirability bias could have occurred due to the self-reported nature of PA, weight, height, and AP scores. Non-inclusion of grade point average for academic performance limited direct comparisons with other studies.

Within the limitations of the study, we conclude that PA has a positive association with AP among dental students. Further studies are needed to evaluate the role of PA during the years in dental curriculum among dental students would give better insight. Administrators and policymakers should emphasize the importance of PA and make provisions in the curriculum to incorporate the same. Students should engage in various extracurricular activities to increase their physical activity. This can have a multitude of benefits increased awareness for physical activity, reduction of stress and burnout (28), improvement in physical fitness (29), decrease in obesity (29), maintenance of appropriate posture during dental procedures (30), reduction in musculoskeletal problems (31), and improved the overall quality of life (32) among dental students.

Data Availability Statement: The data used in this study can be accessed at Mendeley Data (Pentapati, Kalyana (2023), "Relationship of obesity and physical activity with academic performance among Indian dental students", Mendeley Data, V1, doi: 10.17632/d95khn8z34.1).

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Conflict of Interest: All authors declare that there is no conflict of interest.

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