Assessment of Body Mass Index and its Associated Nutritional Factors Among Undergraduate Medical Students in Tamil Nadu, India: A Cross-Sectional Study

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ABSTRACT

BACKGROUND: Dietary habits and physical activity play an important role in maintaining a healthy body mass index. Studies among medical students worldwide report high burden of underweight (10 to 20.5%) and obesity (11.7 to 23.1%). This study was conducted to assess the nutritional status among undergraduate medical students of a medical college in Tamil Nadu, India and to examine the association of nutritional status with dietary practices and physical activity.

METHODS: A cross sectional study was conducted among undergraduate medical students (final year MBBS, Part I) of a medical college in Tamil Nadu, India. A standardized, semi-structured questionnaire was used to collect data on dietary habits and physical activity. Body weight and height was recorded using standard methods and body mass index (BMI) was calculated. BMI 18.5 to 22.9 kg/m^2 was defined as normal, < 18.5 kg/m^2 as underweight, ≥ 23 to 24.9 kg/m^2 as overweight and ≥ 25 kg/m^2 as obese. Appropriate statistical tests were used for analysis.

RESULTS: Eighty-five students (56.7%) were in the normal BMI range, 15 students (10%) underweight, 36 students (24%) overweight and 14 students (9.3%) were obese. Factors such as fruit intake, duration of physical activity, sleep and sedentary behavior had significant association with nutritional status ($p < 0.05$).

CONCLUSION: The frequency of underweight and overweight is high among medical students. This study reinforces the need for creating awareness among this population regarding positive effects of normal nutritional status and adoption of healthy lifestyle habits.

Keywords: Nutritional status; Medical Students; Risk Factors; Diet; Physical Activity

INTRODUCTION

Indians have higher proportion of visceral body fat and thus an elevated risk of diseases such as diabetes and cardiovascular diseases at relatively lower body mass index (BMI) than non-Indians [1, 2, 3]. The Guidelines on Assessment and Management of Cardiovascular Risk for Medical Officers prescribes a lower BMI cut-off for overweight (≥ 23 kg/m^2) and obesity (≥ 25 kg/m^2) in India to ensure early identification of those at cardiovascular risk [4, 5].

It is generally expected that medical students would practice healthy dietary habits and physical activity compared to non-medical students. But studies have found that despite adequate knowledge, medical students exhibit poor dietary practices and low physical activity [6, 7, 8, 9, 10].

Boo et al, Gopalakrishnan et al and Ganasegaran et al have reported a prevalence of 30.1%, 35.9% and 24.3% overweight respectively among medical students in Malaysia [11, 12, 13]. Studies among medical students in India report prevalence of overweight in the range of 11.7% to 23.1% [14, 15, 7]. Although the burden of overweight and obesity among the medical students appears to be lower compared to the general population, it is nevertheless a substantial burden considering that, health personnel including medical students have an important role in promoting healthy lifestyles among the

general population [16-20].

There is paucity of studies investigating the nutritional status among medical students in Tamil Nadu. This study was conducted to evaluate the nutritional status of undergraduate medical students of a medical college in Chennai, the capital city of Tamil Nadu state in India and the association with dietary practices and physical activity. It was conducted as part of a preparatory training for a community health education program on non-communicable diseases organized in our field area utilizing medical students.

METHODS

This was a descriptive, cross sectional study carried out among the undergraduate medical students of Madras Medical College, Chennai city in Tamil Nadu, between September 2011and October 2011. The sample size was calculated using the formula $4pq/d^2$, where the prevalence (p) was 30.1% based on a study among medical students (Malaysia) by Boo et al, which used the same BMI cut-offs [11]. The required precision of the estimate (d) was set as 10%. The sample size was calculated as 90. However, the entire batch of 150 students in their final year, Part I, MBBS was included in the study. This population was selected as they had been exposed to clinical phase of training and had received reasonably adequate medical education on the adverse effects of overweight, obesity and the required preventive measures. The study was conducted after approval by the Institutional Ethics Committee.

The participants were explained the purpose of study and the questionnaire. The participation was voluntary. They were given an information sheet and a written consent was obtained from all participants. Complete confidentiality was ensured. A standardized, pretested questionnaire was used to collect the following data from the students: age, gender, hostel resident or day scholar, parental history of obesity and chronic diseases, dietary habits, physical activity and sedentary habits. The weight of the students was measured with light clothing without shoes using a portable weighing scale to the nearest 0.5 kilogram (kg). Height was measured in meter (m) using portable stadiometer with heels, buttocks, occiput against the wall and head in Frankfurt plane to the nearest 0.5 centimeters' (cm). All 150 students completed the questionnaire and anthropometric measurements. Following the completion of the study, a health education program was arranged for students stressing adverse effects of overweight, adoption of healthy dietary and lifestyle practices, before involving them in the community program.

BMI was calculated as weight in kilograms divided by height in square meters (kg/m^2). Based on BMI cut-offs for Indians, BMI 18.5-22.9 kg/m^2 was categorized as normal weight, BMI < 18.5 kg/m^2 as underweight, BMI ≥ 23-24.9 kg/m^2 as overweight and BMI ≥ 25 kg/m^2 [4, 5].

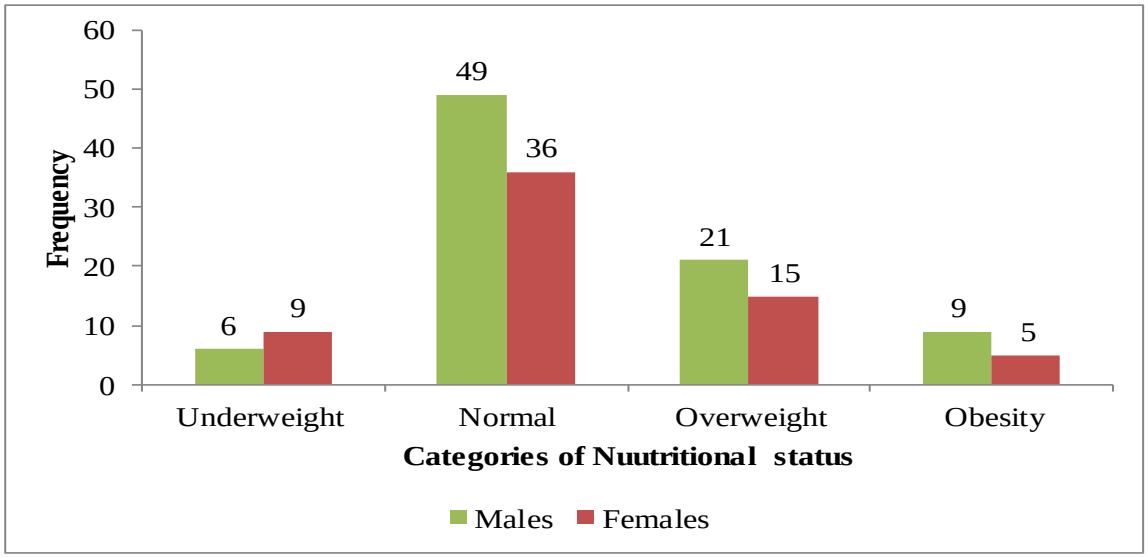
The data was entered in Microsoft Office Excel and statistical analysis was done using SPSS for Windows, Version 12.0. Descriptive statistics were expressed as mean with standard deviation for continuous variables and frequency with percentage (%) for categorical variables. Chi-square test was used for the analysis of categorical variables. Fisher's exact test was used when any of the cells had values less than 5. The responses under dietary habits, physical activity and sedentary habits were classified as categorical variables based on Dietary Guidelines for Indians (2011) by National Institute of Nutrition, Hyderabad and Global recommendations on Physical activity for Health by WHO [20, 21]. A p-value of < 0.05 was considered to be statistically significant.

RESULTS

Of the 150 students, 85 (56.7%) were males and 65 (43.3%) were females (Figure 1). Seventy percent were hostel residents. The mean BMI of the study group was 21.84 kg/m^2 with a standard deviation (SD) of 2.55 kg/m^2.

The risk groups for dietary practices and physical activity, sleep and sedentary pattern were categorized based on recommended guidelines and the mean intake or activity pattern of the study group. Only 68% (102) of the students consumed fruits on at least 2 or more days a week and 80.7% (121) students consumed vegetables for more than 5 days in a week. The frequency of consumption of foods with high caloric and fat content was high among the study population. 39% consumed cheese, butter and fried foods more than once a week. 20% of the students consumed red meat at least once a week, 56% consumed chicken at least once a week and 62% consumed egg at least thrice a week. While the recommended intake of fish is at least three times a week, 68% of participants consumed fish less than once per week much lower than recommended. Close to 30% consumed aerated/ sweetened drinks and bakery products more than

Figure 1: Sex distribution among the categories of nutritional status



once a week. The overall physical activity was poor and sedentary behavior was high among the study population. Only 31 students (20.7%) practiced walking for at least 45 minutes per day and only 60 students (40%) undertook moderate to vigorous physical activity for at least 3 days a week. 69% (104) students slept for less than 7 hours per day and 36.7% (55) of the students reported sedentary behavior for more than 4 hours per day.

The distribution of nutritional status among the different subgroups of study participants are shown in Table 1.

Pair-wise comparisons were performed between normal nutritional status and the other categories for the variables showing significant associations. The results revealed that there was a statistically significant association between lesser fruit consumption and overweight ($p=0.02$). Lower duration of moderate to vigorous physical activity (< 3 days/week) was associated with increased prevalence of obesity and the association was significant ($p=0.008$). Statistically significant associations were also noted between overweight and sleep duration less than 7 hours ($p=0.002$) and sedentary duration of more than 4 hours ($p<0.001$).

DISCUSSION

Among the 150 students who participated in the study only 56.7% were in the normal BMI range, i.e. 18.5 to 22.9 kg/m^2. Fifteen students (10%) were underweight, 36 students (24%) were overweight and 14 students (9.3%) were obese.

This distribution of BMI among undergraduate medical students is similar to that reported by Kokila et al [22]. The prevalence of overweight and obesity is consistent with that reported by Boo et al (Malaysia) and Padamsree et al (Vizianagaram) [11, 23]. Chhaya et al (2012), in a similar population, has reported a higher proportion of underweight (13.6%), overweight (17.4%) and obesity (25.6%), compared to our study [8]. Previous studies by Joseph A et al (2006) and Gupta et al (2007) have reported a lower prevalence of overweight and obesity among medical students in Trivandrum (23.1% overweight and 1% obesity) and Kolkata (17.5% overweight and 3.4% obesity) respectively [15, 7]. Our findings in light of previous studies point to an increasing trend in the prevalence of overweight and obesity among medical students. The higher prevalence in our study could also be due to the use of WHO advised BMI criteria for Asians. Gore et al reports a higher prevalence of overweight (41.1%) using the same criteria [24]. Nevertheless, it is an issue of concern requiring appropriate action considering that one third of our study participants were overweight and obese and 10% are underweight.

In our study, an attempt was made to identify the frequency of intake of various food items and analyze the relationship with overweight. Evaluating the dietary practices, 32% had fruit intake for less than 2 days a week, 19.3% consumed vegetables less than 5 days a week, 39.3% of the students consumed cheese, butter and other fried local foods more than once a week. Similar poor dietary practices among students have been reported by Yahia et al, Ganasegaran et al, Gore et al, Singh et al, Rustagi

Table 1: Characteristics of study participants

Variable (N=150)	n	Distribution of Nutritional status*				χ^2	P
		Underweight (N = 15)	Normal (N=85)	Overweight (N=36)	Obese (N=14)		
Dietary practices							
Fruits < 2 days/week	48	2 (13.3)	22 (25.9)	17 (47.2)	7 (50)	9.782	0.02**
Vegetables < 5 days/week	29	3 (20)	20 (23.5)	6 (16.7)	0	4.626	0.20
Cheese & butter ≥once/week	59	4 (26.7)	39 (45.9)	10 (27.8)	6 (42.8)	4.624	0.20
Fried local foods ≥once/week	59	5 (33.3)	34 (40)	14 (38.9)	6 (42.8)	0.318	0.96
Red meat ≥once/week	31	3 (20)	18 (21.2)	8 (22.2)	2 (14.3)	0.373	0.97
Egg ≥ 3 times/week	93	10 (66.7)	55 (64.7)	21 (58.3)	7 (50)	1.464	0.69
Chicken ≥ once/week	84	5 (33.3)	52 (61.2)	22 (61.1)	5 (35.7)	6.772	0.08
Fish < once/week	102	10 (66.7)	56 (65.9)	24 (66.7)	12 (85.7)	2.187	0.55
Aerated drinks ≥ once/week	41	5 (33.3)	23 (27.1)	12 (33.3)	1 (7.1)	3.924	0.27
Bakery products ≥once/week	46	7 (46.7)	28 (32.9)	9 (25)	2 (14.3)	4.143	0.25
Physical activity and sedentary habits n (%)							
Walking <45 minutes/day	119	12 (80)	63 (74.1)	32 (88.9)	12 (85.7)	3.552	0.31
Moderate-vigorous physical activity <3days/week	90	11 (73.3)	42 (49.4)	25 (69.4)	12 (85.7)	10.28	0.02**
Sleep duration ≤7 hours/day	104	9 (60)	53 (62.3)	32 (88.9)	10 (71.4)	9.810	0.02**
Sedentary time >4 hours/day	55	4 (26.7)	21 (24.7)	23 (63.9)	7 (50)	18.44	<0.01**

* Percentage within parentheses
**P value less than 0.05.

et al, Goyal et al and Hingorjo et al in studies conducted in India and various other countries [13, 24 - 28, 31]. Dietary habits were not significantly associated with overweight in this study except for the frequency of fruit intake per week. A higher proportion of those overweight (47.2%) and obese (50%) had a lesser fruit intake compared to those with normal BMI (25.9%) and this association was statistically significant. However, the average fruit intake was much lower than the recommended intake with majority of the participants reporting only once or twice fruit intake per week. The intake of vegetables was also low. Boo et al, Chhaya et al and Ganasegaran et al have reported significant association between such unhealthy dietary practices and overweight [8, 11, 13].

The physical activity among these students was much lower than recommended. Moderate to vigorous physical activity for at least 3 days in a week was significantly associated with a lower prevalence of overweight. A higher proportion of those underweight (73.3%), overweight (69.4%) and obese (85.7%) had less than 3 days of moderate to vigorous physical activity per week compared to those with normal nutritional status (49.4%). This relationship was statistically significant. Similar association between the quality and duration of physical activity and increased BMI has also been reported by Kokila et al [22]. Gupta et al and Padmasree et al also reported a significant association of overweight and obesity with decreased physical activity [7, 23].

Lesser duration of sleep was found to be a risk factor for overweight and obesity. A significantly higher proportion of those overweight (88.9%) and obese (71.4%) were found to have sleep for less than 7 hours per day compared to those with normal BMI (62.3%) or underweight (60%). Decreased sleep duration was significantly related to occurrence of overweight.

Similar distribution was also identified with increased duration of sedentary behavior. A higher proportion of those overweight (63.9%) and obese (50%) spent more than 4 hours doing sedentary work compared to those with normal nutritional status (24.7%) or underweight (26.7%). Kokila et al also reports a similar association between increased sedentary behavior and overweight and obesity [22]. A significantly higher proportion of overweight was identified among students who sleep for less than 7 hours per day and those who spend more than 4 hours per day in sedentary activities in the form of watching television (TV), playing computer games and talking with friends. Sedentary lifestyle and poor sleep has been identified as important risk factors of obesity and the resultant cardiovascular adverse effects by various other studies also [29, 30]. TV viewing is generally associated with increased intake of energy dense

foods, increasing the obesogenic effect of sedentary behavior [29-31]. The students should be stressed about the importance of performing light activities in between long sedentary hours spent in reading.

Our study has a few limitations. The study was conducted only among final year, Part I students, so the trend of weight over the years could not be studied. The study population being a sample from one college in an urban area of Tamil Nadu may not be representative of all medical students of the state. However, our study confirms the high prevalence of both underweight and overweight among medical students and the role of unhealthy dietary practices and inadequate physical activity in poor nutritional status. A detailed dietary history including the quantity of food items was not taken.

CONCLUSION

The high occurrence of underweight, overweight and obesity with poor dietary practices and low physical activity levels among our study participants is an issue of serious concern. These observations show that medical students despite adequate knowledge are not motivated enough to modify their lifestyle behavior. The students should be encouraged to adopt healthy dietary practices and undertake moderate to vigorous physical activity and various outdoor sports activities. There is a need to undertake a larger study involving all the medical students, both undergraduates and postgraduates, to identify the trends in the prevalence of overweight and plan necessary action. Considering that lifestyle risk factors play an important role in overweight and obesity, there is a need for regionally and nationally representative prevalence studies of lifestyle risk factors among different groups of population.

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