STUDY OF BIOCHEMICAL PARAMETERS AND BODY MASS INDEX ALONG WITH ITS ASSOCIATED RISK FACTORS AMONG HEALTH SCIENCE STUDENTS- A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction

Body mass index is a valuable tool used to identify disorders caused by nutritional imbalance, either under nutrition or over nutrition. Neither underweight nor overweight and obesity is a desirable health status and may cause negative health outcomes.

Objectives

The aim of this study was to determine body mass index among medical, dental and nursing students and to assess the factors associated with it.

Methodology

This cross-sectional study was conducted in health science students of Kathmandu Medical College Public Limited, Kathmandu, Nepal from May 2017 to July 2018**.** Body Mass Index (BMI) was calculated in 644 students including both male and female of Medical, Dental and Nursing students. Blood samples were collected from the students having BMI > 24.9Kg/$m^2$for the estimation of triglyceride, cholesterol and glucose which were compared with the same parameters of students whose BMI was normal (≤24.9 Kg/m^2).

Result

A Total of 644 study population was taken, the majority ranges between 17-20 years. The occurrence of overweight was higher in the male (10.1%) of medical and in the female (8.4%) of dental students. The prevalence of overweight and obesity among the study group was found to be 8.7% and 2.8% respectively. Serum triglyceride, cholesterol and glucose concentrations in the subject with BMI > 24.9Kg/m^2 were significantly higher than that in subject with BMI ≤24.9 Kg/m^2.

Conclusion

Obesity and overweight are prevalent among the students. As a result, the biochemical parameters such as triglycerides, glucose and cholesterol show significantly higher values.

KEYWORDS

Body mass index, obesity, underweight

INTRODUCTION

Overweight biologically refers to an excess of body weight, whereas obesity refers to an excess of fat. It is the most common nutritional disorder in infants, children and adults in affluent societies. It is associated with an increased frequency of a number of disorders such as heart disease, breathing difficulties during sleep, endometrial cancer, colorectal cancer, esophageal adenocarcinoma, postmenopausal breast cancer, prostate cancer, renal cell carcinoma, hypertension, diabetes mellitus, arthritis, gout and gallbladder diseases. Obesity is commonly seen due to the combination of rapid urbanization, unhealthy lifestyle, excessive calories intake, lack of physical activity and genetic susceptibility, although a few cases are found with gene mutation, endocrine disorders, prolonged intake of some medications or psychiatric illness.[6-8]

Morbidity associated with overweight and obesity is enormous. So, the social implication of obesity and overweight is a major problem that is often neglected.[7]

Rationale of this study is to find out the body mass index (BMI) among students and the assessment of its associated factors.

METHODOLOGY

This descriptive cross sectional study was conducted in health science students of Kathmandu Medical College Public Limited, Kathmandu, Nepal from May 2017 to July 2018. This study encompassed 644 students of medical, dental and nursing students aged 17-27 years. Our participants have minimum age of 17 years and maximum age of 27 years. We wanted to see how much they are aware about their health. Ethical approval was obtained from the institutional review committee of Kathmandu Medical College public Limited, Kathmandu, Nepal. Self administered questionnaire was given to the respondent after obtaining the informed consent.

Height (measured to the nearest 0.01 meter on a stadiometer) and weight (kilogram in light clothing on a level balance to the nearest 0.01kilogram) of the respondents were measured using the guideline of centers for disease control and prevention (CDC) manual. For the validity and reliability, all measurements were taken in same stadiometer and weighing machine by the researchers, then BMI was calculated with the formula: weight (Kg)/ height(m^2)

BMI is categorized according to World Health Organization (WHO) classification as, underweight (<18.5 Kg/m^2), normal (18.5-24.99 Kg/m^2), overweight (25-29.99Kg/m^2), class I obesity (30-34.99Kg/m^2), class II obesity (35-39.9Kg/m^2) and class III obesity (>40Kg/m^2).

Fasting blood sample was collected in a plain tube by venipuncture from cubitalvein from the participants whose BMI was >24.9 Kg/m^2. Similarly, blood sample was also collected for comparison from the participants whose BMI was ≤24.9 Kg/m^2. A disposable plastic syringe(5 ml) was used for venipuncture. A soft tubing tourniquet was applied over the upper arm of participant to enable the veins to be seen and felt. The participant was asked to make tight fist which would make vein more prominent. The puncture site was selected with index finger and cleansed with 70% ethanol and was allowed to dry. The cleansed area was not retouched to maintain aseptic condition. With the thumb of the left hand holding down the skin below the puncture site, the venipuncture was made with the bevel of the needle directed upwards in the line of vein. The plunger of the syringe was withdrawn steadily to collect blood. When sufficient blood was collected, the tourniquet was released and the participant was instructed to open his or her fist. The needle was removed from vein and the puncture site was immediately pressed with a piece of dry cotton wool. The subject was instructed to continue pressing on the puncture site until the bleeding has stopped. The needle was removed from the syringe and blood was transferred to plain tube. The blood was allowed to coagulate and then serum was separated by centrifugation.[11] Serum triglyceride, cholesterol and glucose concentration were estimated with Selectra pro S automated biochemical analyzer.

This study included census sampling of medical, dental and nursing student of Kathmandu Medical College Public Limited, Kathmandu, Nepal and the sample size is 644 according to college data.

Convenience sampling technique was used. "Statistical" analysis was done by SPSS (Statistical package for social science) version 15. Independent sample t-test was used to compare the means between different groups and p value less than 0.05 was taken as statistically significant.

RESULTS

In this study, the majority of participants were in the age group 17-20 (72%) years. The socio-demographic distribution of participants is shown in Table 1.

Table 1. Socio-demographic distribution of participants (n-644)

Variables	No of students (%)	BMI (Kg/m^2)[10]				
		<18.5 (Underweight) (%)	18.5-24.9 (Normal) (%)	25-29.9 (Overweight) (%)	30-34.9 (Obesity I) (%)	35-39.9 (Obesity II) (%)
Age						
17-20	466 (72%)	75 (79.7%)	347 (72.8%)	35(62.5%)	8(47%)	1 (100%)
21-24	171 (27%)	19 (20.3%)	122 (25.6%)	21(37.5%)	9 (53%)	0
25-27	7 (1%)	0	7 (1.6%)	0	0	0
Gender						
Male	298 (46%)	36 (38.3%)	228 (47.9%)	28 (50%)	6 (35.3%)	0
Female	346 (54%)	58 (61.78%)	248 (52.1%)	28 (50%)	11 (64.7%)	1 (100%)
Family history						
Diabetes mellitus	89 (13.8%)	13 (13.8%)	72 (15.1%)	4 (7.1%)	0	0
Hypertension	179 (27.8%)	31 (33.0%)	125 (26.3%)	15 (26.8%)	8 (47%)	0
Obesity	13 (2%)	1 (1.0%)	9 (2.0%)	3 (5.4%)	0	0
None	267 (41.5%)	40 (42.6%)	200 (42%)	19 (34%)	7 (41.2%)	1 (100%)
Diabetes mellitus & Hypertension	74 (11.5%)	9 (9.6%)	53 (11.1%)	11 (19.6%)	1 (5.9%)	0
Diabetes mellitus &obesity	3 (0.5%)	0	3 (0.6%)	0	0	0
Diabetes mellitus, hypertension &obesity	15 (2.3%)	0	11(2.3%)	4 (7.1%)	0	0
Hypertension & obesity	4 (0.6%)	0	3 (0.6%)	0	1 (5.9%)	0

Table 2 shows the highest number of individuals were having normal BMI, however, the prevalence of overweight and obesity among the study population were 56(8.7%) and 18(2.8%) respectively.

Table 2 : BMI of students according to WHO guidelines (n-644)

Classification	BMI (Kg/m^2)	No of students (%)	Male (%)	Female (%)
Underweight	<18.5	94 (14.6%)	36 (12.1%)	58 (16.8%)
Normal	18.5-24.99	476 (73.9%)	228 (76.5%)	248 (71.7%)
Over weight	25-29.99	56 (8.7%)	28(9.4%)	28 (8%)
Obesity I	30-34.99	17(2.6%)	6 (2.0%)	11(3.2%)
Obesity II	35-39.99	1 (0.2%)	-	1(0.3%)

The frequency of taking food by participants and their association with BMI are shown in Table 3.

Table 3. Eating frequency of participants and their association with BMI (n-644)

Variables	No of students (%)	BMI (Kg/m^2)[10]				
		<18.5 (Underweight) (%)	18.5-24.9 (Normal) (%)	25-29.9 (Overweight) (%)	30-34.9 (Obesity I) (%)	35-39.9 (Obesity II) (%)
Age						
17-20	466 (72%)	75 (79.7%)	347 (72.8%)	35(62.5%)	8(47%)	1 (100%)
21-24	171 (27%)	19 (20.3%)	122 (25.6%)	21(37.5%)	9 (53%)	0
25-27	7 (1%)	0	7 (1.6%)	0	0	0
Gender						
Male	298 (46%)	36 (38.3%)	228 (47.9%)	28 (50%)	6 (35.3%)	0
Female	346 (54%)	58 (61.78%)	248 (52.1%)	28 (50%)	11 (64.7%)	1 (100%)
Family history						
Diabetes mellitus	89 (13.8%)	13 (13.8%)	72 (15.1%)	4 (7.1%)	0	0
Hypertension	179 (27.8%)	31 (33.0%)	125 (26.3%)	15 (26.8%)	8 (47%)	0
Obesity	13 (2%)	1 (1.0%)	9 (2.0%)	3 (5.4%)	0	0
None	267 (41.5%)	40 (42.6%)	200 (42%)	19 (34%)	7 (41.2%)	1 (100%)
Diabetes mellitus & Hypertension	74 (11.5%)	9 (9.6%)	53 (11.1%)	11 (19.6%)	1 (5.9%)	0
Diabetes mellitus &obesity	3 (0.5%)	0	3 (0.6%)	0	0	0
Diabetes mellitus, hypertension &obesity	15 (2.3%)	0	11(2.3%)	4 (7.1%)	0	0
Hypertension & obesity	4 (0.6%)	0	3 (0.6%)	0	1 (5.9%)	0

The Dietary habits and their association with BMI have been presented in Table 4.

Table 4: Dietary habit of participants and their association with BMI (n-644)

Variables	No of students (%)	Under weight (%)	Normal (%)	Overweight & obesity (%)
Frequency of eating junk food or carbonated soft drinks				
Daily	182 (28.3%)	19 (20.2%)	115 (24.1%)	48 (64.9%)
Sometimes	447 (69.4%)	73 (77.7%)	348 (73.1%)	26 (35.1%)
Never	15(2.3%)	2 (2.1%)	13 (2.8%)	0
Frequency of drinking coffee				
<2 cups per day	418 (64.9%)	58 (61.7%)	300 (63%)	60 (81%)
2-4 cups per day	56 (8.7%)	7 (7.4%)	40 (8.4%)	9 (12.2%)
>4 cups per day	9(1.4%)	0	7 (1.5%)	2 (2.7%)
Never drink	161 (25%)	29 (30.9%)	129 (27.1%)	3 (4.1%)
Frequency of eating chocolates/ sweet after food				
Daily	128 (19.9%)	17 (18.1%)	67 (14.1%)	44 (59.5%)
Occasionally	477 (74%)	71 (75.5%)	379 (79.6%)	27 (36.5%)
Never	39 (6.1%)	6 (6.4%)	30 (6.3%)	3 (4%)
Frequency of munching between meals				
Daily	106 (16%)	12 (12.7%)	82 (17.2%)	12 (16.2%)
Occasionally	361 (56%)	46 (49%)	262 (55%)	53 (71.6%)
Never	177 (28%)	36 (38.3%)	132 (27.8%)	9 (12.2%)
Time to stop eating				
Before fullness	275 (42.7%)	37 (39.3%)	207 (43.4%)	31 (41.9%)
At fullness	361(56.1%)	56 (59.5%)	263 (55.2%)	42 (56.8%)
More than fullness	8(1.2%)	1 (1.2%)	6 (1.4%)	1 (1.3%)

The life styles and their association with BMI are shown in Table 5

Table 5: Association of BMI with life style factors. (n-644)

Variables	No of students (%)	Underweight (%)	Normal (%)	Overweight and obese (%)
Physical activity (Jogging, swimming, basketball, football, badminton)				
>2 times/ week	120 (18.6%)	12 (12.7%)	95 (20%)	13 (17.6%)
1-2 times/week	158(24.5%)	24(25.5%)	116 (24.4%)	18 (24.3%)
<Once/week	53(8.3%)	7 (7.6%)	38 (7.9%)	8 (10.8%)
Not practicing	313(48.6%)	51 (54.2%)	227 (47.7%)	35 (47.3%)
Smoking				
Yes	30 (4.7%)	3 (3.2%)	23 (4.8%)	4 (5.4%)
No	614 (95.3%)	91 (96.8%)	453 (95.2%)	70 (94.6%)
Alcohol consumption				
Yes	79 (12.3%)	9 (9.6%)	60 (12.6%)	10 (13.5%)
No	565(87.7%)	85 (90.4%)	416 (87.4%)	64 (86.5%)
Hours of sleep				
<6 hours	126 (19.5%)	22 (23.4%)	87 (18.3%)	17 (23%)
6-8 hours	475(73.8%)	65 (69.2%)	359 (75.4%)	51(69%)
>8 hours	43(6.7%)	7 (7.4%)	30 (6.3%)	6 (8%)

The BMI classification among the students of medical, dental and nursing are presented in Table 6 (prevalence of BMI in various stream)

Table 6: BMI of participants in different stream according to WHO guidelines (n-644)

Classification	Medical(n= 435)			Dental(n= 149)			Nursing (n= 60)
	Total	Male	Female	Total	Male	Female	Female
Underweight (%)	57(13.1%)	34(12.7)	23(13.8%)	27 (18.1%)	2(6.7%)	25 (21%)	10(16.7%)
Normal (%)	322(74%)	202(75.4%)	120 (71.9%)	107 (71.8%)	26(86.7%)	81(68.1%)	47(78.3%)
Over weight (%)	42(9.7%)	27(10.1%)	15(9.0%)	11 (7.4%)	1(3.3%)	10(8.4%)	3(5%)
Obesity (%)	14(3.2%)	5(1.9%)	9(5.4%)	4 (2.7%)	1(3.3%)	3(2.5%)	-

The serum concentration of triacylglycerol, cholesterol and glucose in participants with normal and high BMI is shown in Table 7.

Table 7: Comparison of biochemical parameters of participants (n-74)

Parameter	BMI		P- value
	≤24.9Kg/m^2 (Mean ± SD)	>24.9Kg/m^2 (Mean ± SD)	
Serum cholesterol(mg/dl)	111.96±25.31	169.39±14.39	<0.001
Serum Triglyceride (mg/dl)	143.7±14.47	159.98±18.62	<0.001
Serum Glucose (mg/dl)	87.48±15.04	90.93±21.10	0.254

DISCUSSION

The prevalence of overweight and obesity found among the medical students based on WHO guidelines was 42 (9.7%) and 14 (3.2%) respectively, which was lesser 43(14.33%) and 10(3.34%)respectively) when compared to the study conducted by Deotale et al. As overweight and obesity are controllable condition which is associated with various factors like dietary habit and life style etc. It could be that our participants had got a positive attitude regarding overweight and obesity and its related risk factor. They might have modified their dietary habit and lifestyle factor and might have tried to implement it in their daily practices.

In this study, 94(14.6%) (12.1% male and 16.8% female) students were underweight which is significantly lower when compared to the study conducted by Minhas et al.[12] The incidence of underweight was found more common in the female students and similar type of finding was also reported by Boo et al.[13] It could be due to the current trend for slimness rather than malnutrition.[12,13] Being underweight has many important medical implications as it has been reported that it could lead to psychological and physical disorders including infertility.[14,15] Therefore, such type of metabolic disorder should be corrected and its associated factor should be identified. In this study, differences in BMI of students compared with dietary habits shows significant association with different factors which was statistically significant as skipping breakfast could result to overweight or obesity, which might be due to hunger that results in increased consumption of more calories than usual and sugar carving. The study conducted by Watanabe et al. found that skipping breakfast plays a major role in developing obesity and effect of skipping breakfast had a greater influence on both waist circumference and BMI than eating dinner less than three hours before bedtime.[16] Another study conducted by Horikawa et al. also observed that skipping breakfast is associated with high prevalence of overweight and obesity.[17] A study conducted by Deotale et al. observed that skipping breakfast has significant role on BMI, but in our study the occurrence of overweight and obesity was relatively lesser, as frequency of skipping was not regular but two to three times a week, and taking breakfast does not "jump start" the metabolism and skipping does not automatically compel to overeat and gain weight. When BMI of students was compared with frequency of skipping lunch/dinner, it showed a significant association and similar type of finding was also obtained by Deotale et al. Due to hunger, eating tendency is increased and stoppage is not possible unless it reaches to a satiety state. A study conducted by Kim et al. observed that skipping meals is related to obesity.[18] Another study by Kliewer et al. observed that short term restriction of food may result to increased intra-abdominal fat accumulation, diminished hepatic and peripheral insulin sensitivity, and a gene expression profile favoring lipid deposition. It shows that weight regains followed by skipping meal and is associated with cumulative metabolic and behavioral abnormalities but in our study the occurrence of overweight and obesity is markedly low as most of the students never used to skip their meal.[19] Frequency of eating junk food and carbonated soft drinks are also associated with the development of overweight and obesity. Since the intake of junk food, which are rich in fat (saturated or total fat) and carbonated soft drinks, and low intakes of fruits, vegetables, fibers and calcium increase the risk of developing obesity, heart disease, osteoporosis, dental caries, and various types of cancer.[20-23] In this study, students residing in hostel and rent were more overweight and obese in comparison to day scholars. It could be due to feeding homemade food which is considered to be healthier and hygienic. The study conducted by Malik et al. observed that the consumption of sugar-sweetened beverages, particularly carbonated soft drinks, soda and fruit drinks as a key contributor to overweight and obesity.[24,25] So, decreasing sugar-sweetened beverage consumption had a beneficial effect on body weight.[24] Eating chocolates and sweets after food adds excess calories to the body. If the intake of metabolic fuels is consistently greater than energy expenditure, the surplus is stored largely as triacylglycerol in adipose tissue, leading to the development of obesity and its associated health hazards.[26] In the present study, serum triglycerides and cholesterol in the participant with BMI >24.9 showed significantly higher value (P<0.001) than that in participants with BMI ≤24.9, however, an increase in serum glucose was statistically insignificant(P=0.254).

Similar type of finding was shown in a study conducted by Bertsias et al.[27] One likely explanation for the glucose-obesity index not reaching statistical significance is that our participants were young adults who might have good glucose tolerance. The dyslipidemia indicates they are at risk for cardiovascular diseases, though they are of younger age. During the period of training students had to pass through a hard time, they need to work out for both theory and practical classes. Due to lot of pressure and lack of time, they get frequent hunger as a result they require some supplement to eat. Such type of frequent eating helps promote cravings in the body and many of them had unhealthy choices of carves like convenience foods or processed snacks loaded with hydrogenated, rancid oils and fats, refined sugars, and white flours. Eating such things regularly can cause weight gain or obesity and other health disorders such as heart disease, auto-immune problems, Diabetes mellitus, high-blood pressure, and cancer.[28] However, the present study showed no effect of such factors on BMI. It could be due to occasional munching between the meals and probably they do not have carves for such unhealthy food as a supplement when they pass through a tough time. Another possibility is that munching between meals could have kept their body's metabolism up, thus increasing thermogenesis (fat burning), resulting in maintenance of body weight. A study conducted by Odegaard et al. and Wu et al. observed that coffee consumption is associated with reduced risk of type II diabetes and have lower BMI as compared to individuals who do not consume coffee.[29,30] In another study conducted by Gavrieli et al. found that there was no effect of coffee on dietary intake and appetite related feelings in normal-weight individuals; however, in overweight and obese individuals, consumption of moderate amount of coffee in the morning significantly reduces the energy intake in the lunch, compared to a lower or no intake of coffee, and this effect was maintained during the rest of the day.[31] So, it could be one of the possible reason that study subject who consumed coffee had no such change in BMI. In the present study, the occurrence of overweight was higher among male as compared to female students. It could be that male students were not involved in physical activity and female students were more cautious about their weight and trying to maintain their weight by diet control. A study conducted by Khan et al. emphasizes on the importance of energy intake and energy expenditure and found that decline energy expenditure accounted for weight gain.[32] In this study, most of the students were having healthy sleep habit as a result of which they were having normal BMI. A study conducted by Beccuti et al. and Rosenberger et al. found that healthy sleep habit should be followed for increased longevity, improved health and disease prevention as, sleep is one of the 'most sedentary activity', yet may be the only one that protects from weight gain.[33,34] So, the duration of sleep per night is based on observations that shorter (≤5 hours) or longer (≥9) hours of sleep is risk factor for wide range of diseases and poor-sleep quality is linked to a risk for obesity.[35-39] The participants of this study were health conscious and aware about the development of obesity and its associated risk factors. However, there may be some flaws that need to be identified and corrected.

CONCLUSION

In the present study, it can be concluded that a substantial number of students showed overweight and obesity. They had higher levels of major cardiovascular risk factor variables, namely high serum triacylglycerol, cholesterol. BMI was found to be a useful indicator for abnormal serum lipids. They got a positive attitude and were aware regarding overweight and obesity, but they may lack appropriate behavior and practices.

RECOMMENDATIONS

Education regarding proper nutrition and lifestyle modification should be built as a supportive learning activity during student years. Regular exercise is recommended as the most common measure for the prevention of overweight and obesity. The students need support to encourage their healthy lifestyle, healthy food habits and promote physical activity on daily routine to prevent such disorders. In view of the fact that medical students are not representative of the general population, studies should be extended.

LIMITATIONS OF THE STUDY

It is a study done in an institution, some part of which is based on questionnaires, some potential of reporting bias may have been occurred or some relevant information might have been hidden. All the students didn't participate in the measurement of waist and hip circumference and thus, determination of waist-to-hip ratio was not included.

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CONFLICT OF INTEREST

None

FINANCIAL DISCLOSURE

None

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