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A Study on Prevalence of Overweight, Obesity, and Assessment of Lipid Profile, Fasting Blood Glucose Levels in First Year Health Science Undergraduate Students

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BMI,
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Fasting blood glucose,
Health Science students,
Prevalence,
Waist-Hip ratio,
Blood pressure,
Medical students,
Bio-markers.

ABSTRACT:

Introduction- Obesity is a major public health problem worldwide, a significant risk factor for metabolic disorders, affecting mostly adults of middle age but recently, also the young adults, mainly the college students. Lifestyle-related risk factors are prone to increase the burden of cardiovascular diseases. Thus, the study was carried out in health science students who are more prone to develop lifestyle diseases because of their busy schedules and less time for extracurricular activities.

Aims and Objectives- This research was done among First-year Health Science students with the aim to study the prevalence of obesity, assessing the values of lipid profile, fasting blood glucose (FBG), and their correlation.

Methods- This study was conducted among 385 first-year Health Science students of a Health Science University, Belagavi. The BMI was calculated by measuring the weight (in kg) and height (in meters) of students. FBG and lipid profile were estimated using enzymatic methods. Blood pressure (BP) was measured using a calibrated digital sphygmomanometer. Hip and waist circumference were calculated using standard guidelines. Obesity was assessed using BMI and waist circumference.

Results- Among 385 students, 46 (11.9%) were underweight (BMI below18.5 kg/m2), 163 (42.3%) were normal weight (BMI 18.5 to 22.9 kg/m2) and 60 (15.6%) were overweight (BMI 23 to 24.9 kg/m2) and 88 (23%) were obese I (BMI 25 to 29.9Kg/m2), 22 (5.7%) were obese II (BMI 30 to 34.9 Kg/m2), 6 (1.6%) were Obese III (BMI 35 Kg/m2and above). The mean values of various parameters in all students were as follows: BMI- 22.91± 4.43 kg/m2, W/H ratio - 0.83±0.07, systolic BP-115.72± 14.62 mmHg, diastolic BP-75.87±9.83 mmHg, fasting blood glucose- 89.62 ± 16.84 mg/dl, serum cholesterol- 140.4 ± 35.7 mg/dl, LDL- 87.4 ± 27.9 mg/dl, HDL- 41.7 ± 8.68 mg/dl and triglycerides - 94.10 ± 51.58 mg/dl. The mean values of W/H ratio, blood pressure, cholesterol, LDL, and triglycerides were higher (showing positive correlation), and the mean value of HDL was slightly lower (showing negative correlation), in overweight and obese BMI groups compared to normal weight BMI students.

Conclusions- A high prevalence of overweight, obesity was seen among the health science students and it was associated with, higher values of blood pressure, waist-hip ratio, triglyceride, and lower values of HDL. Therefore, it was concluded that since health science students will be the future health providers, it is essential to adopt healthy lifestyles at a young age.

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INTRODUCTION

Obesity is a major public health problem worldwide and is the fifth leading risk factor for global death,[1-2] resulting in the increased risk of type 2 diabetes, many forms of cancer, fatty liver disease, hormonal disturbances, hypertension, cardiovascular disease (CVD), and increased mortality.[2-5] Overall, 23% of the world's adult population is overweight, and 9.8% are obese3. In India, the prevalence of obesity varies from 10-50%. [4.] Obesity mostly affects adults of middle age, but recently, there has been an increased incidence of obesity among young adults, mainly college students. [5]

Body mass index (BMI) is commonly used to measure obesity and, accordingly, the World Health Organization (WHO), classifies a person with a BMI≥25 kg/m2 as overweight, BMI ≥ 30 kg/m2 as obese, and a BMI ≥ 40 kg/m2 as extremely obese. [6] Due to increased body fat accumulation and ethnic differences, the WHO has recommended lowering the BMI cut-off levels for Asian people to 23 kg/m2 for overweight and 25 kg/m2 for obesity. [2]

Lipids and lipoproteins are well-known risk factors for the development of ischemic heart disease. Increased levels of triglyceride, cholesterol, and LDL are documented as risk factors for atherosclerosis.[7] The blood level of HDL, in contrast, bears an inverse relationship between the risk of atherosclerosis and coronary heart disease; that is, the higher the level, the smaller the risk.[8,9] An association of lipid profiles with obesity and BMI has been reported.[10] Waist circumference is increasingly being accepted as the best anthropometric indicator of abdominal adiposity and metabolic risk. [11]

Obesity is one of the modifiable risk factors for type 2 diabetes. The mechanism by which obesity induces insulin resistance is poorly understood. Several biological products (free fatty acids, leptin, adiponectin, TNF-alfa, and resistin) secreted by adipocytes modulate the insulin secretions. [12] The Weight of the body and insulin action may be responsible for insulin resistance. [13] It is assumed that there is a positive correlation between serum sugar levels and BMI.[12]

The lifestyle of a health science student is characterized by intense sedentariness, owing to time spent in lecture halls and libraries. The associated stress and erratic sleeping habits during the period of training make them vulnerable to metabolic syndrome.[14-16] Chronically elevated levels of perceived stress affect cortisol levels and have been associated with increased risk for central obesity. [17] Health science students are the future doctors, health leaders, and role models to the community. So, there is a need to study the prevalence of overweight and obesity and the association between lipid profile and fasting glucose levels.

AIMS AND OBJECTIVES-

This research was done among First-year Health Science students with the aim to study the prevalence of overweight, and obesity and to assess values of the lipid profiles, fasting blood glucose (FBG) and the correlation.

MATERIALS AND METHODS

This cross-sectional study was conducted on 385 first-year undergraduate Health Science students aged 18 to 19 years, at a University, Belagavi. The study excluded students who were younger than 18 and older than 19, along with individuals taking glucocorticoids, antidepressants, and antipsychotics. Furthermore, students with any identifiable systemic illness, those who

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refused to participate, as well as students who tested positive for COVID-19 or were experiencing post-COVID-19 symptoms, were not included in the study.

After getting ethical clearance from the Institutional Review Board Committee and obtaining informed consent from the students, the following parameters were studied.

- Anthropometric measurements – Height, Weight, Body Mass Index (BMI), and Waist-Hip Ratio were calculated as per WHO standards.

  - Height (in meters)- measured with the help of a stadiometer.

  - Weight (in kg) - measured by a calibrated Digital weighing machine.

  - Body Mass Index (BMI) was calculated as

  BMI= Subject's weight in Kg / Subject's height in m^2

  - Waist Hip Ratio- Waist circumference was measured at the midpoint between the lower margin of the last palpable ribs and the highest point of the iliac crest. Hip circumference was measured around the widest portion of the buttocks, with the tape parallel to the floor.

- Blood Pressure - measured with the help of a calibrated Digital Sphygmomanometer.

- Biochemical analysis- 4 to 5 ml of peripheral venous blood sample was collected under aseptic precautions from the antecubital vein in the early morning, after a minimum of 12 hours of fasting, in a supine position. Analysis of Fasting Blood Glucose and Lipid Profile was done by International Federation of Clinical Chemistry (IFCC) approved enzymatic methods processed Auto-analyzer Erba-200.

After completing the anthropometric, blood pressure measurements, and blood investigations from 385 first-year undergraduate Health Science University students, the collected data were coded and entered in Microsoft Excel, and the data were analyzed. BMI was calculated, and parameters like W/H ratio, Blood pressure, Lipid profile, and fasting blood glucose were studied for correlation.

RESULTS

Among 385 students, 46 (11.9%) were underweight (below 18.5 kg/m2), 163 (42.3%) were normal weight (18.5 to 22.9 kg/m2) and 60 (15.6%) were overweight (23 to 24.9 kg/m2) and 88(23%) were obese I (25 to 29.9Kg/m2), 22 (5.7%) were obese II (30 to 34.9 Kg/m2), 6 (1.6%) were Obese III (35 Kg/m2and above), as shown in Table1, Graph 1 & 2.

Table 1: Showing the number, distribution, and percentage of Undergraduate Health Science Male and Female students with different BMI

BMI Classification (Kg/m2)	**NUMBER**	**PERCENTAGE** (%)	**BMI (MEAN ± SD)** in Kg/m2
Underweight (BMI <18.5)	46 (F-30,M-16)	11.9	16.42 ± 0.96
Normal weight (BMI 18.5 to 22.9)	163 (F-112,M-51)	42.3	20.40 ± 1.36
Overweight (BMI 23-24.9)	60(F-39,M-21)	15.6	24.01 ± 0.52
Obese I (BMI 25-29.9)	88 (F-48,M-40)	23	27.73 ± 2.71

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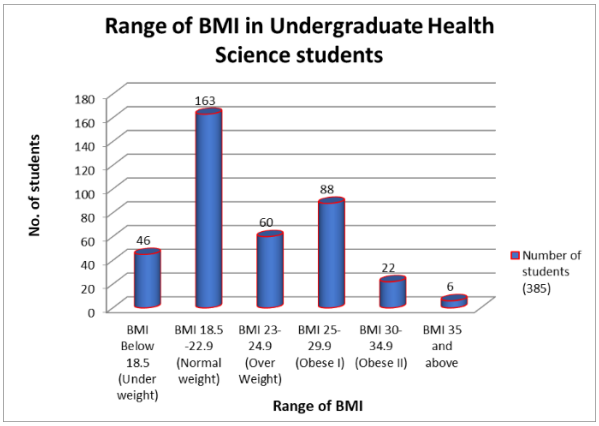
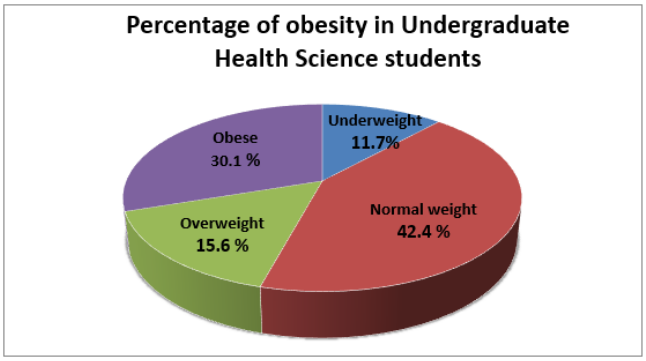
Obese II (BMI 30-34.9)	22 (F-11,M-11)	5.7	31.92 ± 1.30
Obese III (BMI 35-39.9)	6 (F-05,M-01)	1.6	36.42 ± 1.06



Graph 1: Showing the number of Undergraduate Health Science students having different BMI



Graph 2: Showing the percentage of obesity in Undergraduate Health Science students

The mean values of various parameters in 385 students were as follows: mean BMI was 22.91± 4.43, mean W/H ratio was 0.83±0.07, mean systolic BP was115.72± 14.62, mean diastolic BP was 75.87±9.83, mean fasting blood glucose was 89.62 ± 16.84, mean serum cholesterol was 140.4 ± 35.7 mg/dl, mean LDL was 87.4 ± 27.9 mg/dl, mean HDL was 41.7 ± 8.68 mg/dl and mean triglycerides were 94.10 ± 51.58 mg/dl. (as shown in Table 2).

The mean values of W/H ratio, blood pressure, cholesterol, LDL, and triglycerides were higher, and the mean value of HDL was slightly lower in overweight and obese BMI group students compared to the normal weight BMI group students (as shown in Table 3).

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Table 2: Values of BMI, W/H ratio, Blood Pressure, Fasting Blood Glucose, Cholesterol, LDL, HDL, and triglycerides in all 385 students (Range, Mean, ±SD)

Variables	Range	Mean	Standard Deviation
BMI (kg/m2)	14 to 37.7	22.91	± 4.43
W/H ratio	0.68 to 1	0.83	± 0.07
Systolic BP (mm Hg)	61 to 157	115.72	± 14.62
Diastolic BP (mm Hg)	53 to 109	75.87	± 9.83
Fasting Blood Glucose (mg/dl)	53 to 125	89.62	± 16.84
Cholesterol (mg/dl)	38 to 264	140.38	± 35.71
LDL (mg/dl)	33 to 188	87.36	± 27.58
HDL (mg/dl)	18 to 74	41.68	± 8.68
Triglycerides (mg/dl)	22 to 274	94.10	± 51.58

Table 3: Values of BMI, W/H ratio, Blood Pressure, Fasting Blood Glucose, Cholesterol, LDL, HDL, and triglycerides, in various BMI groups (Mean ±SD) among the 385 students

Variables	Underweight (11.9%) BMI -below 18.5kg/m2	Normal weight (42.35%) BMI - 18.5-22.9kg/m2	Overweight (15%) BMI-23-24.9kg/m2	Obese Class-I (23%) BMI- 25 - 29.9kg/m2	Obese Class-II (5.7%) BMI - 30-34.9kg/m2	Obese Class-III (1.6%) BMI - 35 and above
BMI (kg/m2)	16.42 ± 0.95	20.40 ± 1.30	24.01 ± 0.52	22.60 ± 4.2	31.92 ±1.30	36.42 ± 1.1
W/H ratio	0.83± 0.06	0.83 ± 0.06	0.83 ± 0.06	0.83 ± 0.06	0.88 ±0.09	0.95 ± 0.05
Systolic BP(mm Hg)	114.8± 12.13	114.75 ± 14.4	114.94 ± 14.4	115.19 ± 14.2	128.8±10.16	136.83 ±8.09
Diastolic BP(mm Hg)	75.41± 9.76	75.41 ± 9.8	75.42 ± 9.73	75.52 ± 9.8	86.82 ±9.96	87.33 ±1.49
Fasting Blood Glucose (mg/dl)	88.67 ± 9.23	88.67 ± 16.23	89.11 ± 16.51	89.43 ± 16.62	91.86±17.81	73.5 ± 5.32
Cholesterol(mg/dl)	139.81 ± 35.7	139.81 ± 36.21	140.2 ± 33.10	140.02 ± 36.1	148.9± 24.1	136.8 ± 7.7
LDL(mg/dl)	86.86 ± 24.73	86.86 ± 27.2	87.5 ± 36.3	86.77 ± 27.4	92.68±25.84	87 ± 3.2
HDL(mg/dl)	41.91 ± 10.12	41.91 ± 8.61	41.9 ± 9.19	41.87 ± 8.7	40.82 ± 7.55	34.3 ± 6.6
Triglycerides (mg/dl)	92.79 ± 21.23	92.79 ± 52.13	104.2 ± 58.05	92.90 ±51.61	103.9±44.06	126.5± 22.7

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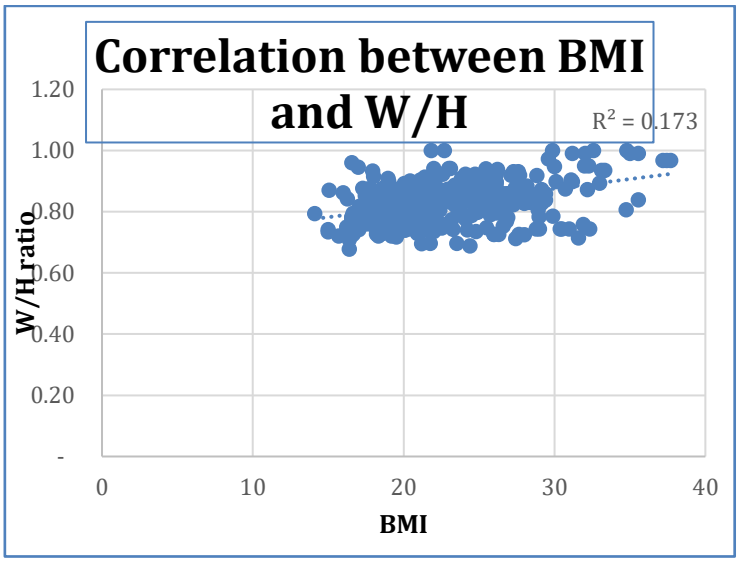
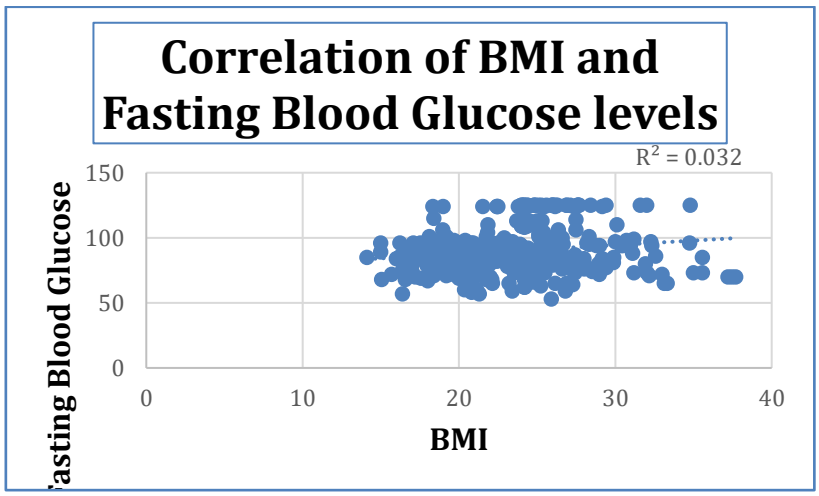
During data analysis, it was found that there was a positive correlation (Pearson correlation (r) =0.42) between BMI and W/H ratio amongst the students (as shown in Graph 3), with a p-value of 0.00000016, which was highly significant.



Graph 3: Scatter diagram showing the positive correlation between perceived BMI and W/H among all 385 students

Data analysis demonstrated that there was a weak positive correlation (Pearson correlation (r) =0.18) between BMI and Fasting blood glucose amongst the students (as shown in Graph 4), with a p-value of 0.00042, which was highly significant.



Graph 4: Scatter diagram showing the correlation between BMI and Fasting blood glucose among all 385 students

Data analysis also showed a positive correlation (Pearson correlation (r) =0.48) between BMI and Systolic BP among the students (as shown in Graph 5), with a p-value of 0.00000084, which was highly significant.

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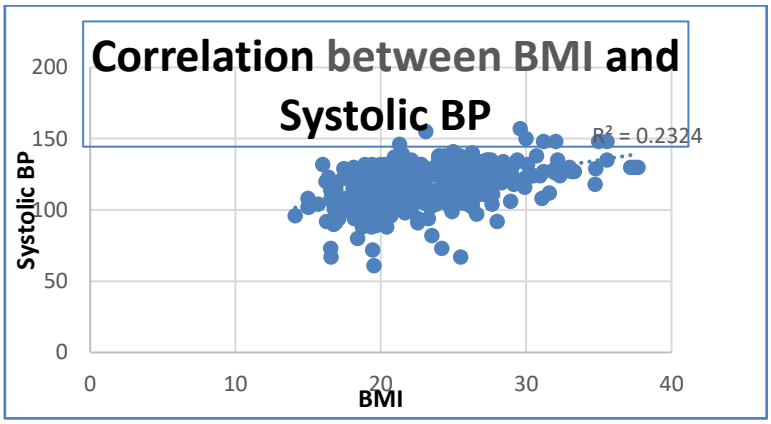
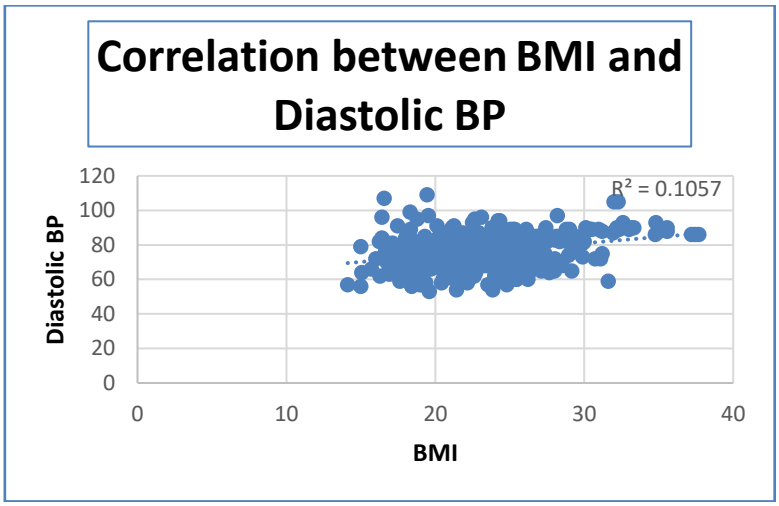


Graph 5: Scatter diagram showing positive correlation between BMI and Systolic BP among all 385 students

Data analysis also revealed a positive correlation (Pearson correlation (r) =0.33) between BMI and Diastolic BP among the students (as shown in Graph 6), with a p-value of 0.0000006, which was highly significant.



Graph 6: Scatter diagram Showing a positive correlation between BMI and Diastolic BP amongst the students

Data analysis showed a weak positive correlation (Pearson correlation (r) =0.12) between BMI and Cholesterol amongst the students (as shown in Graph 7), with a p-value of 0.02, which was significant.

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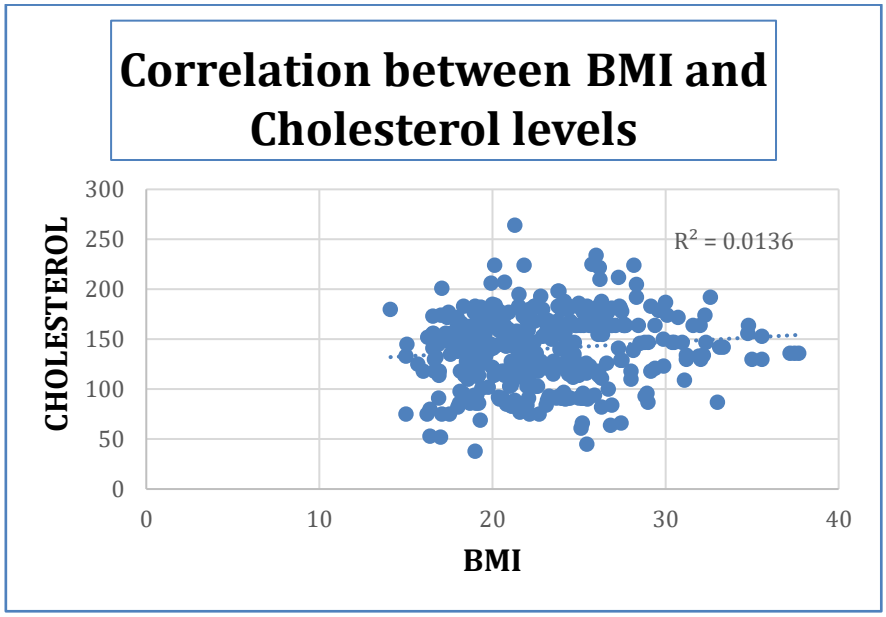
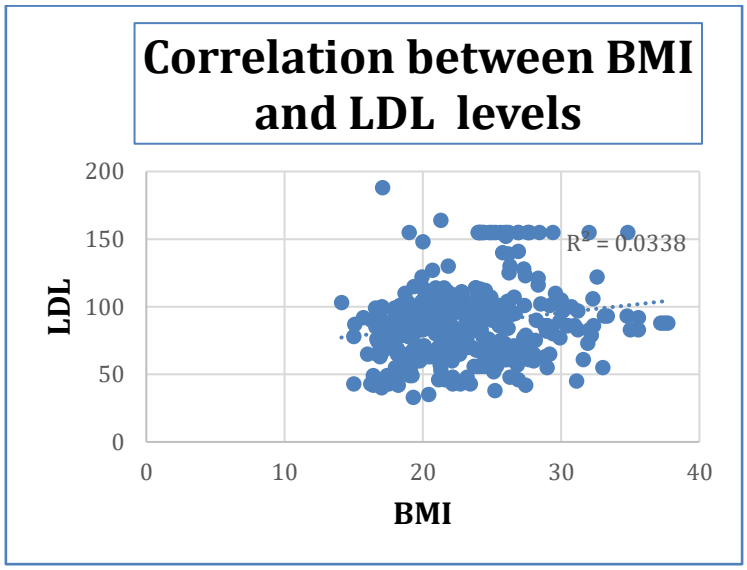


Graph 7: Scatter diagram showing a weak positive correlation between BMI and Cholesterol amongst the students

Data analysis showed a weak positive correlation (Pearson correlation (r) =0.18) between BMI and LDL amongst the students. (as shown in Graph 8), with a p-value of 0.000286, which was highly significant.



Graph 8: Scatter diagram showing a weak positive correlation between BMI and LDL amongst the students

Data analysis showed a negative correlation (Pearson correlation (r) = - 0.12) between BMI and HDL among the students (as shown in Graph 9), with a p-value of 0.03, which was significant.

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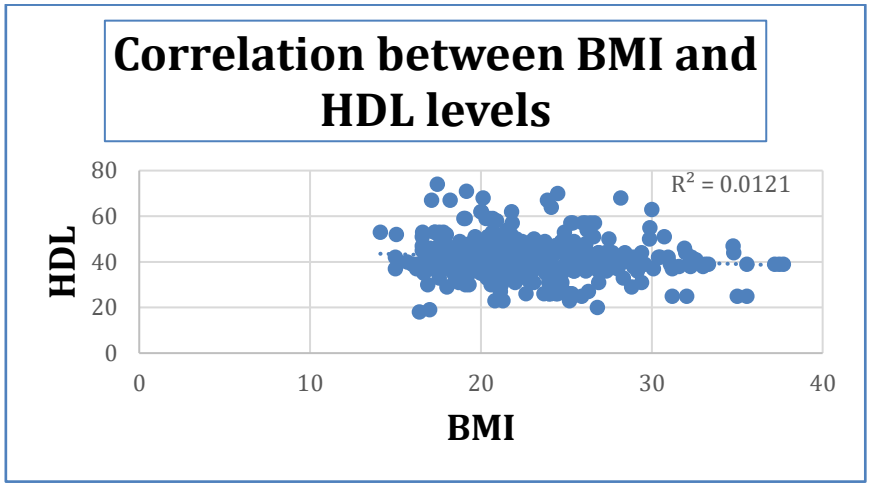
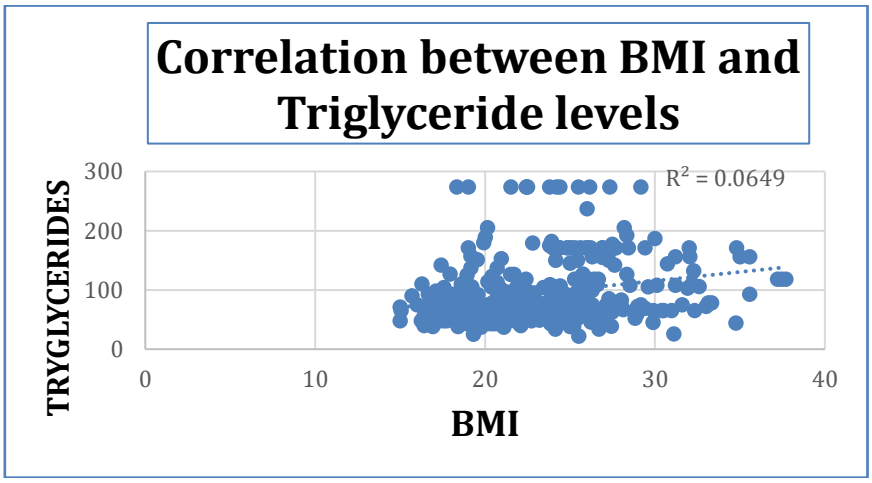


Graph 9: Scatter diagram showing a negative correlation between BMI and HDL amongst the students

Data analysis showed a positive correlation (Pearson correlation (r) =0.26) between BMI and Triglycerides among the students (as shown in Graph 10), with a p-value of 0.000000, which was highly significant.



Graph 10: Scatter diagram showing a positive correlation between BMI and Triglycerides amongst the students

DISCUSSION

In India, cardiovascular disorders and obesity are both on the rise due to lifestyle-related illnesses, including metabolic syndrome. Therefore, it is critical to identify the risk factors associated with these illnesses promptly.[14] Students frequently show independence in adopting lifestyle decisions that may impact their health in the future.[19] During a cross-sectional survey of undergraduate medical students at a private medical college in Chennai, Rekha C. *et al.* found that more than 50% of the students were overweight or obese, which was significantly higher than the general population.[20] The prevalence of obesity among health science students was high (30%), making them

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more vulnerable to the dangers associated with obesity. Health science students had a higher risk of obesity because they often lead sedentary lifestyles due to their busy and time-consuming activities.[21]

BMI is a simple and widely used indicator of obesity. [2] In our study, we found that 11.9% of health science students were underweight,42.3% were normal, 15.6% were overweight, and 30.1% were obese. Our study's findings were consistent with those of similar studies.[14,21,26] M Swathi *et al.*, during their research on MBBS Phase I students, found that 37% of students were overweight or obese, 18% were underweight, and 45% were of normal weight. [22] According to Sonawane S *et al.*'s [23] cross-sectional surveys, the percentage of medical students at Dinero University who were overweight or obese was 36.8% and 11.1%, respectively. In a cross-sectional study by Ahmed A. *et al.* [24], 8.8% of the students were underweight, 46.5% were of normal weight, 25.4% were overweight, and 19.3% were obese. Chitnis P *et al.* [25] conducted cross-sectional research of first-year medical students and discovered that 9.36% were obese, 23.4% were overweight, 54.39% were of normal weight, and 12.87% were underweight. The findings of the prevalence of overweight and obesity in our study match with the findings of Krishna *et al.* [26] and Okati-Aliabad H *et al.* [21], respectively (as shown summarised in Table 4).

Table 4: Comparison of Prevalence of Overweight and Obesity in various studies

Author name and Study year	**Prevalence**	
	Overweight (%)	**Obesity (%)**
Chitnis P *et al.*[25](2013)	23.4	9.4
Shah T *et al.* [29] (2014)	22.4	9.5
Manojan KK[27] (2014)	24.6	25.7
W Y Abdel Wahed[28](2015)	23.5	14.5
Joseph N *et al.*[14] (2017)	-	37.
Ahmad A *et al.*[24] (2020)	25.4	19.3
Krishna *et al.*[26] (2021)	18.2	8.2
Sonawane S *et al.*[23] (2021)	36.8	11.1
Okati-Aliabad H *et al.*[21] (2022)	21.2	33.1
Ofori EK*et al.* [30] (2019)	31.7	21.7
Present Study (2024)	**15.6**	**30.1**

A higher prevalence of obesity and overweight has been identified as the main risk factor influencing the emergence of metabolic syndrome and contributes to several diseases, such as diabetes mellitus, dyslipidemia, cardiovascular disease, and hypertension. Through the adoption of healthy habits like regular exercise and consuming less fast food, this study may raise health science students' awareness of their own cardiovascular risk and encourage them to take action.[31]

In the present study, lipid profiles and fasting blood glucose levels were measured in all the different groups of students based on their BMI. Various BMI groups (underweight, normal, overweight, and obese) were compared with the mean

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values of serum total cholesterol, LDL, HDL, and triglycerides. It was found that cholesterol, LDL, and triglyceride levels were significantly higher in the overweight and obese BMI group as compared to normal-weight students. The value of HDL was slightly lower in the overweight and Obese BMI groups. The mean value of fasting blood sugar levels was high in overweight and obese students when compared to normal-weight students (as shown in Table 3). These findings match with the findings of previous studies. [11,14,22,32,33] (as shown in Tables 5). There was a significant correlation between BMI and waist-hip ratio, triglycerides, blood pressure, and HDL values with a highly significant p-value of <0.05 (as shown in Tables 6 and 7).

Our results were consistent with other studies like Tejaswini B *et al.*, [11] Joseph N *et al.*[14], M. Swathi[22], Basit KA *et al.*[32,] and Ofori EK *et al.* [30] (as shown in Table 5). Obesity is typically linked to dyslipidemia, or an unfavorable lipid profile, which includes a decrease in HDL and an increase in blood cholesterol, T.G., and LDL. [34] Lipid Profile is a simple, widely available, and inexpensive blood test. Dyslipidemia indicates an increased risk of cardiovascular disease. [35] Therefore, overweight and obese students should be recommended to undergo lipid profiling to detect cardiovascular disease risk at an early age. These students should be motivated to take preventive measures like maintaining a healthy lifestyle, enhancing physical activity, ensuring adequate sleep, managing stress, and avoiding junk foods. [22]

Table 5: Comparison between values of (Mean ± SD) of various parameters in various studies

Author Name and Study year	Mean ± SD of Various parameters							
	BMI (kg/m2)	**Cholesterol (mg/dl)**	**LDL (mg/dl)**	**HDL (mg/dl)**	**Triglyc-erides (mg/dl)**	**Fasting Blood Glucose (mg/dl)**	**Systolic BP (mm Hg)**	**Diastolic BP (mm Hg)**
Present study	**22.91± 4.43**	**140.38± 35.71**	**87.36± 27.58**	**41.7± 8.7**	**94.10± 51.6**	**89.62± 16.84**	**115.72± 14.62**	**75.87± 9.83**
Tejashwini V B *et al.*[11] (2021)	22.9 ± 5.4.	147.36 ± 24	84.52 ±32.8	19.76± 7.87	95.23 ±26.8	---	-	_
Joseph N *et al.*[14] (2017)	_	151 ± 34.6	95 ± 29.3	48.2 ± 10.8	73.2 ± 30.7	_	_	75.30 ± 10.48
Basit KA *et al.*[31] (2015)	20.36± 2.83	156.84 ± 24.18	1.28 ± 12.62	51.28 ± 12.62	77.78 ± 38.34	76.92 ± 6.11	110.70± 12.53	_
Shah F J *et al.* [32] (2018)	24.7 ± 6.2	_	_	_	_	126.23 ± 25.56	_	_

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Table 6: Comparison between Correlation (r) values of BMI and various parameters found in previous studies

Study	BMI with WC	BMI with SBP values	BMI with DBP values	BMI with HDL levels	BMI with TG levels	BMI with Fasting Blood Glucose
Present study (2024)	**0.01**	**0.48**	**0.33**	**-0.12**	**0.26**	**0.48**
Joseph N *et al.*[14] (2017)	0.68	0.271	0.211	-0.281	0.271	_
Shah F J *et al.* [32] (2018)	_	_	_	_	_	0.625

Table 7: Comparison between P values of BMI and various parameters found in previous studies

Study	BMI with WC	BMI with Systemic BP	BMI with Diastolic BP	BMI with Chols -terol	BMI with HDL	BMI with LDL	BMI with Triglyce rides	BMI with Fasting Blood Glucose
Present study (2024)	**0.00000016**	**0.00000084**	**0.0000006**	**0.02**	**0.03**	**0.000 29**	**0.000000**	**0.00042**
Tejashwini V B[11] (2021)	-	-	-	0.28	0.545	0.43	0.04	-
M Swathi *et al.* [22] (2023)	-	-	-	<0.05	0.51	-	<0.05	-
Joseph N *et al.*[14] (2017)	<0.001	-	-	-	0.000 8		0.011	-
Shah F J *et al.* [32] (2018)	_	_	_		_		_	0.000

CONCLUSION

The prevalence of obesity is significantly higher among those studying Health Science. This higher prevalence may be caused by unhealthy lifestyles and a lack of awareness, so changing their lifestyles, health education, and more preventive measures will help to lower the prevalence of obesity and cardiac risks.

Health science professionals may possess knowledge regarding physical activity and nutrition, but they may not be able to put it into practice. Students should be motivated to engage in physical activities such as sports. Additionally, lifestyle modification and improved dietary habits from the early stages of health science school will result in physicians practicing and advocating for

healthy eating habits. The future of a nation's healthcare system lies in the hands of health science students; therefore, it is essential to assess their mental and physical well-being to improve their productivity and overall quality of life.

There is a positive correlation between values of BMI and fasting blood glucose, triglycerides, blood pressure, and waist-hip ratio. There is a negative correlation between the values of BMI and HDL among the students. All health science students should have their BMI checked regularly so that overweight and obese students can be found early and the appropriate steps can be taken to lower their risk of Cardiovascular diseases. Obesity can be prevented and treated with the aid of early screening, diagnosis, and intervention.

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