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A Study of Haemoglobin, Body Mass Index, and Waist-Hip ratio in Ist year MBBS Students in DBVP RMC

Rohini Antre[1], M C Tayde[2], A. N. Badwe[*3] and Tanvi Mandlik[4]

[1] PG Student (Medical Physiology), Department of Physiology
DBVP Rural Medical College, Pravara Institute of Medical Sciences, Loni, Tq: Rahata, Dist: Ahmednagar – 413 736 India
[2]Professor & Head, Professor, Department of Physiology, DBVP Rural Medical College,
Pravara Institute of Medical Sciences (DU), Loni, Tq: Rahata, Dist. Ahilyanagar – 413 736 India
[3]Professor, Department of Physiology, DBVP Rural Medical College, Pravara Institute of Medical Sciences (DU),
Loni, Tq: Rahata, Dist. Ahilyanagar – 413 736 India
[4]UG Student, College of Pharmaceutical Sciences, Pravara Institute of Medical Sciences (DU),
Loni BK, Tq: Rahata, Dist: Ahilyanagar – 413 736 India

Abstract

Objective: This study aims to investigate the relationships between haemoglobin levels, body mass index (BMI), and waist-hip ratio (WHR) in first-year MBBS students at DBVP RMC.

Material & Methods: 200 healthy Ist year MBBS students of Dr. Babasaheb Vikhe Patil, Rural Medical College, Loni were selected for this study. Anthropometric parameters such as age, height, weight, body mass index (BMI) & waist-hip ratio (WHR) were recorded as per standard protocol. Haemoglobin was estimated by Sahli's Method. All obtained results were tabulated, and for each recorded parameter mean and standard deviation (SD) were calculated. To find level of significance change the data was analyzed by applying Student t- test. The P values less than 0.05 ($P<0.05$) were considered as statically significant. Pearson's correlation coefficients were used to determine the relationship between haemoglobin levels, BMI, and WHR. Regression analysis was used to examine the predictive relationship between the variables

Results: The average age between males and females is very similar, indicating that the groups are comparable in terms of age. Males have a slightly higher average BMI than females. These results suggest that there is a significant difference in body composition within the male group (unpaired t- test, $P<0.05$). Males have a slightly higher average WHR than females, indicating a tendency towards more abdominal fat distribution. No statistically, significant difference in WHR was observed. Males have a significantly higher average Hb concentration than females (unpaired t- test, $P<0.05$), which is expected due to physiological differences. The correlation between age and haemoglobin as continuous variable between males and females indicated significant effect of age on haemoglobin with a positive correlation. Similarly, correlation between BMI and haemoglobin as continuous variable between males and females indicated significant effect of BMI on haemoglobin with a positive correlation. However no significant correlation between waist hip ratio and haemoglobin was observed.

Conclusions: This study provides valuable insights into the anthropometric and haematological profiles of first-year MBBS students. The identified gender-based differences and correlations underscore the importance of targeted health interventions and further research to optimize the well-being of future medical professionals.

Keywords: Haemoglobin, BMI, WHR.

***Correspondence Info:**
Dr. A. N. Badwe
Professor,
DBVP Rural Medical College,
Pravara Institute of Medical Sciences, Loni,
Tq: Rahata, Dist: Ahilyanagar – 413 736

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1. Introduction

The assessment of health indicators, such as haemoglobin levels, Body Mass Index (BMI), and Waist-Hip Ratio (WHR), plays a pivotal role in understanding the physiological and metabolic state of individuals. Among medical students, particularly those in their formative first year MBBS, these parameters not only reflect physical health but also provide insights into lifestyle patterns and nutritional adequacy during a challenging academic phase.
Low haemoglobin levels indicate anemia, which can lead to fatigue, weakness, and impaired cognitive function [7]. This is especially relevant in a demanding academic environment in medical college like Dr Balasaheb Vikhe Patil, Rural Medical College (DBVP RMC), Loni.

BMI is used to categorize individuals as underweight, normal weight, overweight, or obese. It is an indicator of overall health and risk for various chronic diseases. Stress, irregular eating habits, and sedentary lifestyles associated with medical college can affect BMI.

Waist Hip Ratio (WHR) is a measure of abdominal obesity, which is a stronger predictor of cardiovascular disease and other health risks than BMI alone. Similar to BMI, WHR can be affected by lifestyle factors prevalent in medical students. Abdominal obesity has been linked to increased risk of metabolic syndromes

This study aims to evaluate and analyze the haemoglobin levels, BMI, and WHR of first-year MBBS students at DBVP RMC. By establishing the interrelationship between these metrics, the research seeks to identify trends and potential health concerns, emphasizing the importance of proactive health monitoring among young medical professionals.

This study aims to investigate the relationships between haemoglobin levels, body mass index (BMI), and waist-hip ratio (WHR) in first-year MBBS students at DBVP RMC.

2. Material and Methods

All first-year healthy MBBS students at DBVP RMC were included in this after Institute Ethical Committee approval, with written consent (Total 200, participated 102 males and 96 females).

Students with known chronic diseases that could affect haemoglobin levels, BMI, or WHR were excluded from the study.

2.1 Anthropometric measurements:

Height: Measured using a stadiometer, recorded in centimeters (cm).

Weight: Measured using a calibrated electronic weighing scale, recorded in kilograms (kg).

Waist circumference: Measured at the midpoint between the lower rib and the iliac crest, recorded in centimeters (cm).

Hip circumference: Measured at the widest part of the buttocks, recorded in centimeters (cm). Ensured standardized measurement techniques were used. These parameters were determined during their academic first term.

Body Mass Index (BMI) was determined by using formula as,

BMI = weight (kg) / height $(m)^2$.

Waist Hip Ratio (WHR) was determined by using the formula as,

WHR = waist circumference (cm) / hip circumference (cm).

2.2. Haemoglobin estimation was determined by using Sahli's Method

All obtained results were tabulated, and each recorded parameter and data were analyzed for each group by calculating mean and standard deviation (SD). To find level of significance change in the data was analysed by applying Student t- test. The P values less than 0.05 ($P<0.05$) were considered as statistically significant. Pearson's correlation coefficients were used to determine the relationship between haemoglobin levels, BMI, and WHR. Regression analysis was used to examine the predictive relationship between the variables.

3. Results

All subjects were grouped in different age groups and distributed as per their gender and anthropometric parameters (Table 1).

Table 1: Distribution of subjects in various age groups according to age and sex

Gender	18-19 (yrs)	19-20 (yrs)	20-21 (yrs)	Total
Males	61	32	9	102
Females	72	19	5	96
Total	133	51	14	198

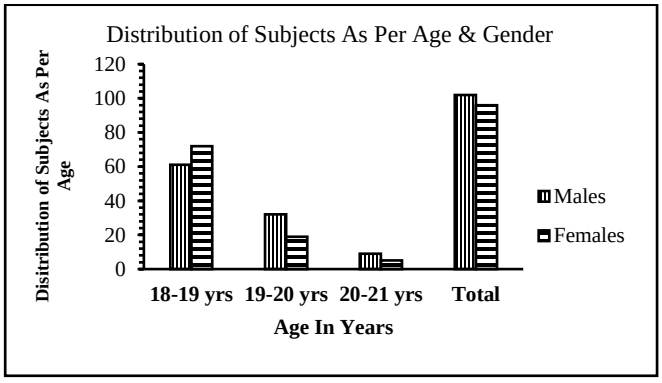

Figure 1: Distribution of study subjects as per age and gender

Table 2: Average age, BMI, Waist/Hip ratio & Hb concentration in selected age group for males and females

SN	Gender	Age (yrs)	BMI (Kg/m^2)	WHR	Hb G%
1	Male	19.29 ± 1.17	23.67 ± 10.92 *(p<0.05)	0.86 ± 0.06 *(p<0.05)	15.07 ± 7.70 *(p<0.05)
2	Female	19.02 ± 0.75	22.45 ± 3.26	0.82 ± 0.06	12.55 ± 0.67

*WHR: Waist Hip Ratio

The average age between males and females is very similar, indicating that the groups are comparable in terms of age. The standard deviations are relatively small, suggesting that the age distribution within each group is fairly consistent.

Males have a slightly higher average BMI than females (Table 2 & 3). The large standard deviation for the male BMI data suggests a very large spread of BMI values within the male population, indicating much greater variability than the female group. The female group has a much tighter grouping of BMI values. These results suggest that there is a significant difference in body composition within the male group (unpaired t- test, $P < 0.05$).

Table 3: Distribution of the subjects as per the body mass index

Gender	BMI (Kg/m^2)			
	Thinness BMI (<18.49)	Normal BMI (18.5 to 24.09)	Overweight (BMI > 25)	Total
Males	8	25	69	102
Females	8	70	18	96
Total	16	95	87	198

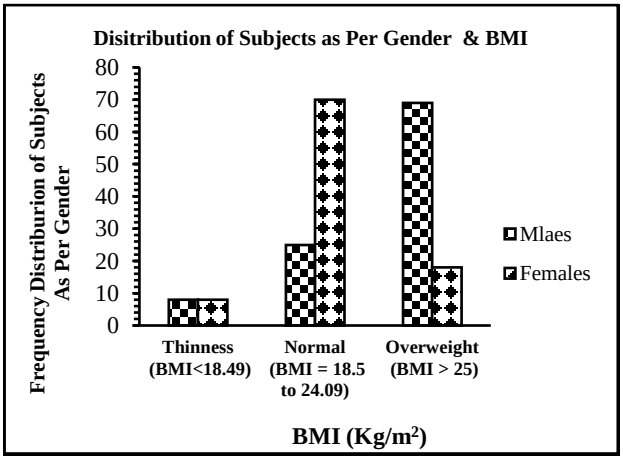

Figure 2: Distribution of subjects as gender and body mass index (BMI)

Males have a slightly higher average WHR than females, indicating a tendency towards more abdominal fat distribution (Table 3). Both groups have similar standard deviations, indicating comparable variability.

Table 4: Subject distribution as per Waist Hip Ratio (WHR)

Gender	WHR (0.7-0.8)	WHR (0.8-.9)	WHR (>0.9)	Total
Male	17	30.00	55	102
Female	38	51.00	7	96
Total	55	81.00	62	198

A WHR above 0.85 in females and 0.90 in males is associated with increased health risks, so the male group is close to that risk level. No statistically, significant difference in WHR was observed.

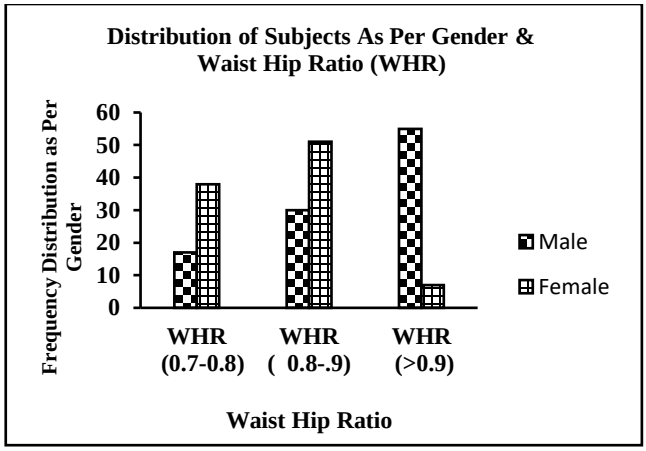

Figure 3: Distribution of subjects as per gender waist hip ratio for WHR

Males have a significantly higher average Hb concentration than females (Table 2, unpaired t- test, $P<0.05$), which is expected due to physiological differences. The standard deviation for the male group is very large. This indicates a wide range of haemoglobin values within the male population (Table 5). This could indicate that there is a subset of the male population that has very low haemoglobin values. The female group has a much narrow grouping of values.

Table 5: Haemoglobin variation in males and females

Gender	Males			Females		
Hb% G	< 14G %	14-18 G%	>18 G %	<12 G%	14-16 G%	>16 G %
Gender wise Distribution	0	97	5	0	96	0

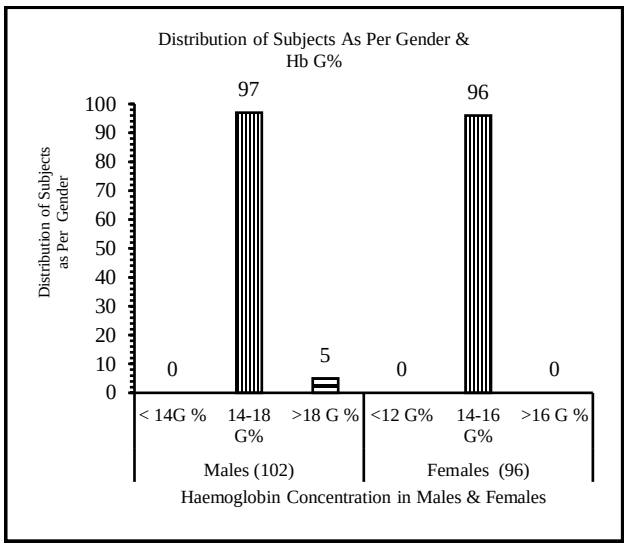

Figure 4: Distribution of subjects as per age and gender (Hb%)

The female group has a mean haemoglobin that is at the lower end of the normal range. This indicates that a significant portion of the female population may be anaemic.

Regression analysis was used to examine the predictive relationship between the variables. The correlation between age and haemoglobin as continuous variable between males and females indicated significant effect of age on haemoglobin with a positive correlation. Pearson coefficient value in males was recorded as 0.241 with a P value of <0.05 and in females Pearson's coefficient was recorded as 0.182 with a P value of < 0.05.

The correlation between BMI and haemoglobin as continuous variable between males and females indicated significant effect of BMI on haemoglobin with a positive correlation. Pearson coefficient value in males was positive but, non-significant and in females Pearson's coefficient was recorded as 0.273 with a P value of < 0.05.

However no significant correlation between waist hip ratio and haemoglobin was observed.

4. Discussion

This study investigated haemoglobin levels, BMI, and WHR in first-year MBBS students, revealing notable gender-based differences and correlations. The comparable average age between male and female participants ensured a homogeneous study population, minimizing age-related confounding factors.

The significantly higher average BMI observed in male students ($p < 0.05$) aligns with existing literature indicating gender-specific variations in body composition [2]. The wider distribution of BMI values in males, as evidenced by the large standard deviation, suggests greater heterogeneity in body composition within this group. This variability could be attributed to differences in lifestyle, physical activity, and dietary habits, which indicates further investigation.

While males exhibited a slightly higher average WHR, indicating a tendency towards abdominal obesity, the difference was not statistically significant. However, the average WHR in males approached the clinically relevant threshold (0.90), highlighting a potential risk for increased cardiovascular morbidity [3]. The similarity in WHR variability between genders suggests comparable patterns of abdominal fat distribution.

The significant difference in haemoglobin levels ($p < 0.05$), with males demonstrating higher concentrations, is consistent with established physiological norms [1]. The wider range of haemoglobin values in males suggests potential variability in iron status, while the lower average haemoglobin in females raises concerns about potential iron deficiency and anaemia. One of the studies has reported that, the decrease in haemoglobin levels in females is associated with, rise in level of free oestrogen, which may cause suppression of erythropoiesis in females [8]. These findings underscore the importance of routine haemoglobin screening and nutritional counselling for female medical students.

Similarly it is observed in our study that, haemoglobin values are higher in males with more BMI value than females. However, this increase in haemoglobin is associated with increase in testosterone concentration to adult level, with an increase in erythropoiesis and Hb values [9].

Regression analysis revealed a significant positive correlation between age and haemoglobin levels in both genders. This suggests that as, students progress through their early adulthood, haemoglobin levels tend to increase. Similarly, a significant positive correlation between BMI and haemoglobin was observed, indicating that students with higher BMI also exhibited higher haemoglobin concentrations. This could be attributed to factors such as increased blood volume in individuals with higher body mass.

However, no significant correlation was found between WHR and haemoglobin or between BMI and WHR. This suggests that in this population, abdominal fat distribution and overall body mass do not significantly influence each other or haemoglobin levels. The lack of correlation between WHR and haemoglobin is interesting, as there are studies that show correlations between abdominal obesity, and certain blood markers. Future studies may look at additional blood markers [10].

Limitations and Future Directions

This study is limited by its cross-sectional design, which precludes the establishment of causal relationships. Furthermore, the study population was limited to first-year MBBS students at a single medical college, potentially limiting generalizability. Future studies should consider a longitudinal design, a larger and more diverse population, and the inclusion of other relevant variables, such as dietary habits, physical activity levels, and socioeconomic factors. Additionally, further examination of iron storage indicators would provide more information regarding the presence of iron deficiency within the groups studied.

5. Conclusion

This study provides valuable insights into the anthropometric and haematological profiles of first-year MBBS students. The identified gender-based differences and correlations underscore the importance of targeted health interventions and further research to optimize the well-being of future medical professionals.

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