**DISSERTATION SUBMITTED FOR THE MASTER'S DEGREE**

**IN**

**MEDICAL PHYSIOLOGY**

**TITLE**

# "STUDY OF ANAEMIA AMONG MEDICAL STUDENTS AND ITS CORRELATION WITH THEIR BMI"


**SUBMITTED BY**

**Dr. SHUBHANGI PANDEY**


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**DEPARTMENT OF MEDICAL PHYSIOLOGY**

**INTEGRAL INSTITUTE OF MEDICAL SCIENCES & RESEARCH**

**INTEGRAL UNIVERSITY LUCKNOW- 226026, U.P.**

# STUDY OF ANAEMIA AMONG MEDICAL STUDENTS AND ITS CORRELATION WITH THEIR BMI

## DISSERTATION

## SUBMITTED TO INTEGRAL UNIVERSITY

In Partial Fulfillment of The Requirements of Degree of Master of Science In Medical Physiology

By

DR. SHUBHANGI PANDEY

Enrollment Number: 2100104040

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I hereby declare that this dissertation entitled **"Study of Anaemia among medical students and its correlation with their BMI"** is a bonafide & genuine research worked carried out by me under the guidance of **Dr. Gauhar Hussain**, Professor, Department of physiology and under the co-supervision of **Dr. Ausaf Ahmad,** Associate Professor, Department of Community Medicine and **Dr. Priyanka Singh,** Professor, Department of pathology.

**Date** **Signature of the candidate**

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This is to certify that the dissertation entitled **"Study of anaemia among medical students and its correlation with their BMI "** is a Bonafide & genuine research work carried out by Shubhangi Pandey, under the guidance of **Dr. Gauhar Hussain**, Professor, Department of Physiology and under the co-supervision of **Dr. Ausaf Ahmad**, Associate Professor, Department of Community Medicine and **Dr. Priyanka Singh** Professor, department of Pathology, in partial fulfillment of requirement for the degree of Master of Science in Medical Physiology. The research methods and procedures described have been done by the candidate and result observed by the Guides periodically.

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This is to certify that **Dr.Shubhangi Pandey**, student of M.Sc. MEDICAL PHYSIOLOGY; Integral University has completed her dissertation entitled **"Study of anaemia among medical students and its correlation with their BMI"** successfully. She has completed this work from the department of Physiology, Integral Institute of Medical Sciences and Research, Integral University under the guidance of **DR. GAUHAR HUSSAIN**. The dissertation was a compulsory part of her M.Sc. degree. I wish her good luck and bright future.

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# Acknowledgement

I would like to express my heartfelt gratitude towards my guide, **Dr. Gauhar Hussain**, for his invaluable support and guidance throughout the course of this dissertation. His insightful feedback, patience, and encouragement were instrumental in shaping my research project and helping me to achieve my goals.

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# CONTENTS

# LIST OF ABBREVATIONS USED

**IUGR:-** INTRA UTERIN GROWTH RETARDATION

**Hb:-** HAEMOGLOBIN

**RBCs:-** RED BLOOD CELLS

**G6PD:-** GLUCOSE -6- PHOSPHATE DEHYDROGENASE

**MCV:-** MEAN CORPUSCULAR VOLUME

**MCHC:-** MEAN CORPUSCULAR HAEMOGLOBIN CONCENTRATION

**BMI:-** BODY MASS INDEX

**HCL:-** HYROCHLORIC ACID

**WHO:-** WORLD HEALTH ORGANISATION

# INTRODUCTION

Anaemia is a concerning global public health issue that affects both developed and developing nations. It has an impact on both individual health and the nation's social and economic growth. It negatively affects growth and development, weakens the immune system and increases morbidity, particularly in pregnant women and children. Young people in the second decade of life are in a period of intense growth and are exposed to major physical and psychological changes.[1]

There are many different causes of anaemia, including nutritional deficiencies (such as those in iron, folic acid, and vitamin B12), inherited conditions (such as thalassemia and sickle cell anaemia), environmental toxins (such as lead), infections (such as malaria), and socioeconomic conditions (such as low maternal education levels and low household income). Age and gender demographic factors, autoimmune hemolytic anaemia, malabsorption (achlorhydria), which can be chronic (cancer), and iron deficiency are also present. DEFICIENCY OF IRON is the most typical cause of anaemia.[2]

Since the World Health Organisation estimates that 468 million non-pregnant women and 293 million children are anaemic, anaemia is a global health concern. Of those, 50% are iron deficient and are suffering. Inadequate iron

consumption, infections, significant blood loss, and impaired mucosal iron absorption are the causes of iron deficiency anaemia.[3]

According to the third national family health survey, which was conducted in 2005–2006, anaemia was prevalent in 24% of men and 55% of women between the ages of 15 and 49. Because of their limited calorie consumption, higher monthly losses, and increased iron requirements throughout puberty, adolescent girls are at a significant risk of acquiring a deficit.[4]

The primary causes of iron deficiency anaemia in teenage girls are rapid development, hormonal changes, the advent of menstruation, and malnutrition brought on by alterations in dietary patterns.[5]

Students at colleges place a high priority on personal cleanliness because they spend the majority of their time in public settings or in close proximity to other people. Anaemia may develop from parasite infections that are favoured by poor hygiene habits.[6]

Despite being an illness that is easily curable and avoidable, anaemia is nonetheless strongly linked to pregnancy. The underlying causes of the prevalence of anaemia during pregnancy may be decreased and low intake and increased demand, excess demand in the case of multigravida women,

altered metabolism, and background traits like low socioeconomic status, illiteracy, and early marriage associated with increased susceptibility to infectious diseases like hookworm infestations.[7]

Red blood cells include the protein haemoglobin, which is iron-rich and aids in the transport of oxygen from the lungs to other tissues. Therefore, a decrease in this iron protein prevents the correct delivery of oxygen to tissues and organs, leading to weariness, headaches, and shortness of breath. Anaemia is accelerated by schistosomiasis, malaria, sickle cell hemoglobinopathy, and thalassemia. Negative consequences include maternal and newborn mortality, IUGR, and heart failure are hastened by anaemia brought on by iron shortage. Obviously, those who are childbearing age, adolescent girls, and youngsters are more at risk in poor nations.[8]

1.2 billion people live on earth.Children, teenagers, young people, and pregnant women have higher iron requirements than adults, and iron insufficiency can result from inadequate iron consumption or persistent blood loss. Detecting an iron deficit requires.[9]

# REVIEW OF LITERATURE

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# HAEMOGLOBIN

Erythrocytes (RBCs) have an oxygen-binding protein called haemoglobin in their cytoplasm. Hb is synthesised by erythrocyte precursors, however this ability is lost in adult erythrocytes.[19]

Adult males typically have blood haemoglobin concentrations of 15.5 g/dL (range: 14–18 g/dL) and adult females typically have concentrations of 14 g/dL (range: 12–15.5 g/dL).

The molecular weight of haemoglobin, a globular molecule, is 68,000. It is made up of the protein globin and the haem pigment, which contains iron.

The Hb contains the protein globin, which is made up of four polypeptide chains. Each of the following four polypeptide chains makes up haemoglobin A (HbA).

Two chains with 141 amino acid residues each and two chains with 146 amino acid residues apiece. As a result, adult-normal haemoglobin A is denoted by the symbol HbA(22).

The haem is an iron-porphyrin complex known as iron-protoporphyrin IX, meaning it is made up of an iron atom and a porphyrin nucleus.

Porphyrins are tetrapyrroles because their nucleus is made up of four pyrrole rings with the atomic numbers I, II, III, and IV. Four methine bridges (=CH) connect the pyrrole rings together. The letters,,, and are written next to the carbon atoms of methine bridges.

The pyrrole ring is joined to eight side chains at the locations 1 through 8. The following are the side chains that are present: - Two vinyl (CH CH2)

side chains at positions 2 and 4; - Four methyl (H3C) side chains at positions 1, 3, 5, and 8; - Two propionic acid (CH2 CH2 COOH) side chains at positions 6 and 7.[20]

The ferrous (Fe2+) type of iron can be found in haemoglobin. Each pyrrole ring has an iron atom bonded to the nitrogen atom. A loose bond is available on the iron (Fe2+).

Each of the four polypeptide chains that make up globin is connected to one of the four units of haem that make up a Hb molecule. Since each Hb molecule contains four haem units, it also contains four iron atoms, each of which is capable of transporting four molecules of oxygen (a total of eight atoms).

# ANAEMIA

Anaemia is a set of conditions in which the blood's Hb concentration is below the range that is normal for the subject's age and sex. It is not a singular disease. Therefore, Hb concentrations below 13 g/dL for adult men, 11.5 g/dL for adult females, 15 g/dL for newborns, and 9.5 g/dL at 3 months of age are considered anaemic.[15]

Low Hb levels in anaemia are typically, but not always, related with low RBC count (less than 4 million/L).

Mild anaemia is defined as having a haemoglobin level between 8 and 10 g/dL, moderate anaemia is defined as having a level between 6 and 8 g/dL, and severe anaemia is defined as having a level below 6 g/dL.

## CLASSIFICATION

Whitby's taxonomy of aetiology: Depending on the underlying cause, there are several types of anaemia.

A. Anaemias with a deficit  a lack of iron causes anaemia  Megaloblastic anaemia (pernicious anaemia) brought on by a vitamin B12 deficiency Megaloblastic anaemia brought on by a folic acid deficiency  Anaemia can also be brought on by a lack of protein and vitamin C.

B. Haemorrhagic anaemias, often known as blood loss anaemias, include acute post-haemorrhagic anaemia caused by accidents and chronic post-haemorrhagic anaemia.

C. Anaemias with hemolysis. These are generally rare and happen under circumstances where RBC oxidation is elevated. These include:

1. Hereditary haemolytic anaemias, such as those caused by Glucose 6-phosphate dehydrogenase (G6PD) deficiency, Thalassemia, Sickle Cell Anaemia, and Hereditary Spherocytosis.

2. Acquired hemolytic anaemias, such as immunohaemolytic anaemia (caused by antibodies against RBCs), hemolytic anaemia brought on by direct toxic effects (such as those caused by malaria, snake venom, toxic effects of drugs and chemicals, etc.), hemolytic anaemia in splenomegaly, and hemolytic anaemia in paroxysmal nocturnal hemoglobinuria.[14]

Aplastic anaemia is one. It happens as a result of the bone marrow's inability to create RBCs.

B. Anaemia brought on by a persistent illness. Infections that last a long time, cancers, chronic lung disorders, and other conditions exhibit it.

Wintrobe's classification of morphology The anaemias can be divided into the following categories based on the mean cell volume (MCV), or cell size, and the mean corpuscular haemoglobin concentration (MCHC), or the haemoglobin saturation of RBCs:

1. Anaemias with normal cytochrome n. Normal MCV (78-94 m3 or 78-94 L) and normal MCHC (30-38%) are characteristics of these. Acute post-haemorrhagic anaemia, hemolytic anaemias, and aplastic anaemias all exhibit this morphological pattern.

2. Hypochromic microcytic anaemias. These are distinguished by decreased MCV ( 78 m3) and diminished MCHC ( 30%). Examples of these anaemias

include thalassemia, chronic post-haemorrhagic anaemia, and iron deficiency anaemia.

3. Anaemia with macrocytic normochromic cells. Increased MCV (> 94 m3) and typical MCHC (30-38%) are its defining characteristics. Examples include megaloblastic anaemia (pernicious anaemia) caused by a vitamin B12 deficit and megaloblastic anaemia caused by a folic acid deficiency.

# BODY MASS INDEX [23]

The metric currently in use for determining anthropometric height/weight features in adults and grouping (categorising) them is body mass index (BMI). Additionally, it is frequently employed as a risk factor for the emergence or prevalence of a number of health problems. Furthermore, it is frequently employed in formulating public health strategies.

Due to its widespread acceptability in categorising certain categories of body mass as a health issue, the BMI has been helpful in population-based investigations. Being overweight has long been a significant psychosocial concern for people. Palaeolithic statuettes of incredibly obese women are a vivid example of it. This shows that, at least among women, having a "full figured" was highly valued. In contrast, neither male nor female obese people are ever depicted in tomb wall paintings, stellae, or statues from ancient Egypt, indicating that there, being overweight was not regarded as a desirable quality. The same can be said of artefacts from other Middle Eastern cultures at that time.

At the cultural level, there is also a certain level of fatness that is usually regarded as being unacceptable fat; in other words, there is an ill-defined threshold at which a person is judged to be "fat" or "obese." It is based on the idea that something is "you can't define it but you know it when you see it" however. Along with the person's age, the location of the extra fat also matters. Being "overweight" when one becomes older is much more acceptable than when one is younger. The buildup of fat in some body parts is considerably more acceptable than in others, especially in women. For

instance, the buildup of belly fat would be viewed as less acceptable than the accumulation of fat in the peripelvic, thigh, and breast areas. Thus, although being statistically "fat," a person with an appropriate figure would just be described as "chubby" or "pleasingly plump."

## WHO CLASSIFICATION OF BODY MASS INDEX

| Classification | BMI ($kg/m^2$) | Risk of comorbidities |
|---|---|---|
| Underweight | <18.5 | Low (but risk of other clinical problems increased) |
| Normal range | 18.5–24.9 | Average |
| Overweight (preobese) | 25.0–29.9 | Mildly increased |
| Obese | ≥30.0 | |
| Class 1 | 30.0–34.9 | Moderate |
| Class 11 | 35.0–39.9 | Severe |
| Class 111 | ≥40.0 | Very severe |

DR Sameer Timilsina et al, (2015) performed a cross-sectional study based on 391 individuals were enrolled in a sectional study based on the status of anaemia among undergraduate students at a medical institution in central Nepal. According to the findings, 44.7% of males were anaemic and 55.3% were not. Additionally, 67.7% of females were not anaemic while 32.3% were. In the analysis of BMI, 46.2% underweight students were anemic & 53.8% underweight students were non-anemic,40.1 % normal weight students were anemic & 59.9% normal weight students were non anaemic,30.9% over weight students were anemic and 69.1% over weight students were non anemic and 13.4% obese students were anemic & 86.6% obese students were non anemic.[4]

Dr Renu Yadav et al.,(2017)performed a cross sectional study of link between body mass index and the occurrence of anaemia among Nobel Medical College medical students, 150 students were recruited in the study. The result showed that among males 46% were Only 42.1% were anaemic to a modest degree, while 11.6% were moderately anaemic. No severely anemic students were discovered to be anaemic. 1.8% of severely anaemic females and 9.1% of moderately anaemic females & 41.8% were mildly

anemic. A non-significant negative correlation between total medical student haemoglobin concentration and body mass index was identified. (-0.112) (0.171) [3]

Kanchana R et al., (2013) did the study on regarding the prevalence of anaemia among MBBS first-year students. 150 medical students were recruited for this study. The result showed that among males 42% of people had anaemia, while 58% did not. Among females 79% of people were not anaemic, while 21% were. . Severity of anemia in males - Mild 50%, Moderate 50%. Severity of anemia in female –Mild 75%, Moderate 25%. In the analysis of BMI 15% underweight students were anemic and 85% underweight students were non anemic. 100% normal weight students were anemic & 0% students were non anemic. 27% overweight students were anemic & 73% overweight students were non anemic.[5]

Yasemin I et al., (2011) did the study on Anaemia prevalence and risk factors in adolescents 1120 kids, ages 12 to 16, 672 girls and 448 guys. The findings revealed that 63 out of 1120 (5.6%) children had anaemia. Anaemia affected 8.3% of the females and 1.6% of the males. IDA was identified in 37 (59%) individuals, and combined iron deficiency and vitamin B12 deficiency anaemia in 26 (41%) patients

**Research question?**

Is there any correlation between BMI and anemia?

## STASTICAL HYPOTHESIS

THE NULL HYPOTHESIS (H0)

states that there is no association between anaemia and BMI.

A SECONDARY HYPOTHESIS (H1)

There is a link between anaemia and BMI.

# AIM AND OBJECTIVES

## AIM:

The current investigations aims to examine anaemia in medical students and how it relates to their BMI

## OBJECTIVES:

To study gender difference in the prevalence of anaemia.

To correlate haemoglobin status with BMI.

METHOD AND MATERIALS

**TYPE OF STUDY-** A cross-sectional study is the type of investigation.

LOCATION OF STUDY:

The study has been performed in the department of physiology at IIMS&R, Lucknow.

**STUDY PERIOD:** 6 months.

**SUBJECT SELECTION:** Number of subjects will be selected from undergraduate students attending department of physiology and observing the inclusion and exclusion standards.

**INCLUSION CRITERIA:**

1. Age group between 18-30 years.

2.Undergraduate students attending the medical college.

# METHODS AND MATERIAL

**EXCLUSION CRITERIA :**

1.Age Outside The Limit

2.Any Student Not Giving Consent

**ESTIMATION OF SAMPLE SIZE**

n= Z2 p (1-p)/d2……..(12)

Where, sample size =n,

P=46.25% ……(6)

95% confidence level yields a Z score of 1.96 and an error margin (d) of 10%.

Calculated sample size =95

Non-response =10%

**Final sample size=115**

# COLLECTION OF DATA

At Integral Institute of Medical Sciences and Research, a cross-sectional research of participants completing their practicum in the laboratory of hematocrit was conducted. The selection of diagnosed subjects was based on the inclusion and exclusion standards.

The students' blood was then drawn using a sterile needle, and the blood's haemoglobin level was calculated using Sahli's hemoglobinometer method. The WHO's criteria were then used to determine the anaemia severity.

Each student was required to complete a Performa that asked for demographic information, dietary preferences, and BMI data.

General information includes biodata, To estimate socioeconomic status, information on parent income, employment, and education is gathered.

Students were instructed to measure their height and weight in order to evaluate their nutritional status using the BMI in accordance with the WHO-recommended cut-off.

**PROCEDURE OF Hb ESTIMATION: PRINCIPLES OF SAHLI'S METHOD:**

The determined amount of Hb is transformed to acid hematin, which when diluted gives blood a golden brown colour, by diluting hydrochloric acid. Acid hematin content, which in turn depends on Hb concentration, determines how intense the colour is. Direct vision is used to match the colour of the solution (i.e., its hue and depth) against glass rods that have a golden brown tinge after it has been diluted with water. The measurements are made in g%.

1-Sahli (Sahli-Adams) Hemoglobinometer (Hemometer) is the equipment and materials.

A. The collection includes: 1. Comparator. It is a plastic rectangular box with a slot in the centre for the calibrated Hb tube. On either side of the slit, uniform, golden-brown glass rods are installed to match the colour and are non-fading. When doing direct visual colour matching, an opaque white glass (or plastic) is inserted behind the slot to give consistent illumination.
B. Haemoglobin tube, number 2. The square or round glass tube is calibrated on one side in percentage Hb (20-160%) in red and on the other side in g Hb% (2-24 g%) in yellow colour. The tube can be cleaned with a brush.
C. Haemoglobin pipette. The pipette is made of glass and has just one calibration mark: 0.02 ml (20 cmm, or 20 ml, or micro litres). Since there is no blood dilution, there is no bulb in this pipette (unlike cell pipettes).

D. The stirrer. It is a thin glass rod with a flat end that is used to mix and swirl diluted acid and blood.

E. Pipette Pasteur. It features a rubber teat and is made of an 8–10 inch glass tube that is pulled to a long, narrow nozzle. A regular glass dropper with a rubber teat would also do.

F. . Distilled water

2- A solution of decinormal (N/10), or 0.1 N, hydrochloric acid. 'Normal' HCl is created by mixing 36 g of hydrochloric acid (HCl) with 1 litre of distilled water. N/10 HCl solution is created by diluting it by 10 times.

3- supplies for skin pricking. • Sterile gauze and cotton swabs • Sterile lancet or needle • Methylated alcohol with 70% spirit.

# PROCEDURE

1. Use a dropper to add 8–10 drops of N/10 HCl to the Hb tube, or up to the 20% mark or 3 g, or just enough so that the tip of the pipette will be submerged, and then set the tube aside.
2. Get an aseptic finger prick and wipe away the first two drops of blood. Draw blood up to the 20 cmm mark (0.02 ml) until a huge drop of freely flowing blood has formed once more. Use a cotton swab to gently wipe away any blood that has adhered to the pipette's tip; do not contact the bore as this will cause blood to be sucked out by the capillary.
3. Without waiting, gently expel the blood from the pipette by placing the tip of the pipette in the acid solution's bottom. In order to completely remove the blood, rinse the pipette three to four times by drawing up and blowing away the clear upper portion of the acid solution. Prevent the mixture from foaming. Record the precise time.
4. Now remove the pipette from the tube by tapping it to the side of the tube to make sure no mixture is expelled. Using the flat end of the

stirrer, slowly move it up and down while spinning to combine the blood and acid solution.

5. Reinstall the Hb tube in the comparator, and then leave it alone for 6 to 8 minutes (or however long the manufacturer recommends). Hemolysis is the process by which the acid causes the red cells to burst, releasing their haemoglobin into the solution. The acid reacts with the haemoglobin and changes it into acid hematin, which takes on the colour of rich golden brown.
6. The colour is diluted and matched. The acid hematin solution must now be diluted with distilled water (ideally buffered water, if available) until it reaches the colour of the comparator's standard coloured glass rods.
7. Remove the Hb tube from the comparator and slowly pour in distilled water (or larger volumes depending on experience). Stir the liquid after each addition, then check the colour against the reference.
8. Hold the comparator against bright but diffused light at eye level and away from the face. Lower meniscus readings are done in coloured clear solutions.

Normal Values : The levels of haemoglobin in healthy adult Indians, particularly in the economically disadvantaged population, are lower than those recorded from wealthy nations. The lack of grade 1 proteins and other nutrients may be the cause. Following are the average levels and their ranges:

14.5 g/dl (13.5–18 g/dl) for males.

12.5 g/dl (11.5–16 g/dl) for females.

# DIGRAM OF SAHLI'S HEMOGLOBINOMETER

## MEASUREMENT OF BMI

HEIGHT MEASURE-

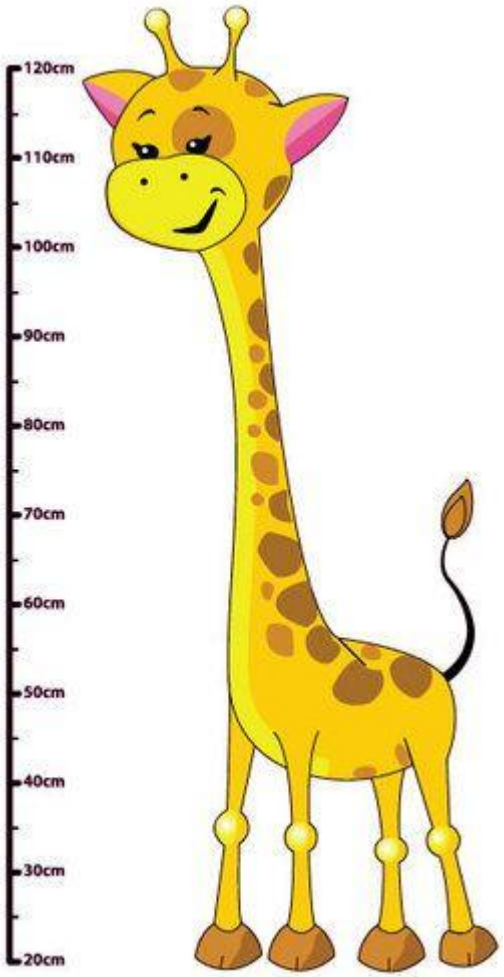
1. Firstly ,I, asked the subject to take off their shoes and socks.
2. Hair were kept flat.

3.Subject was asked to stand with his/her back against the wall & feet are joined. then stand up as straight as they can, touching the wall with their heels, back, shoulder, and head.

4. Then using the pencil a mark was made on the wall chart where the head was touching .

5. Measurment was noted.

# HEIGHT MEASURING WALL CHART



**WEIGHT MEASURE-**

1. Digital weighing machine was placed on a flat surface.
2. Subject was then asked to step on the weighing machine.
3. Subject stood on the machine still with both feet even and flat , without touching & holding on to anything ,as that would have affected the weight displayed by the scale.
4. Then, the digital weighing machine told exactly how much the subject weighed.
5. Number was recorded .
6. Subject was asked to step off the scale.

# DIGRAM OF WEIGHING MACHINE


BMI CALCULATIONS

BMI = WEIGHT (KG) / HEIGHT (M2)

# STATISTICAL ANALYSIS

- Statistical analysis was performed by using SPSS-25 trial version.
- Parameters Were Measured And Recorded As Mean ± SD
- Unpaired T Test Was Used For Comparison Between Two Groups
- Pearson's Coefficiant Was Used For Correlation Between Two Parameters
- Þ- Value<0.05 Was Considered As Significant
- cross tabulation has been used to see the association between different parameter.[3]

# OBSERVATION & RESULT

**Table 1: Descriptive study of study population**

| Characteristics of the study | Male (Mean±SD) | Female (Mean±SD) |
|---|---|---|
| **AGE (years)** | 20.15±1.92 | 19.85±1.35 |
| **WEIGHT(kg)** | 60.03±14.12 | 59.25±13.93 |
| **HEIGHT(cm)** | 160.90±19.64 | 160.20±20.02 |
| **BMI ($kg/m^2$)** | 23.18±5.01 | 23.10±5.11 |
| **HB(g/dl)** | 11.72±2.12 | 11.57±2.06 |

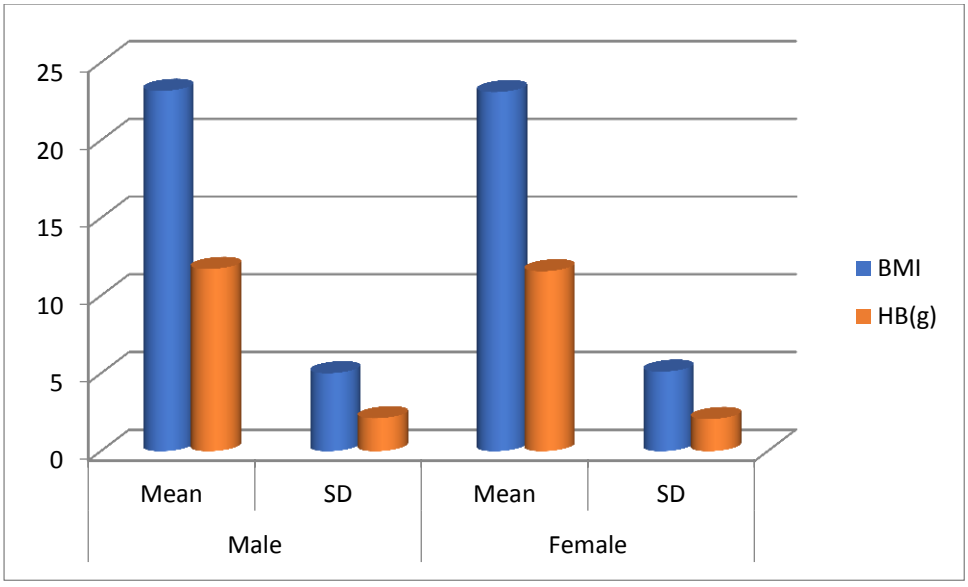



Fig.1: Figure Showing Mean and Std. of BMI and HB.

The table provided presents the characteristics of a study divided by gender, specifically comparing the means and standard deviations (SD) for various variables.

The mean age for females is 19.85 with a standard deviation of 1.35. The mean weight for males is 60.03 kilograms, with a standard deviation of 14.12. The mean height for males is 160.90 centimeters, with a standard deviation of 19.64. The mean body mass index (BMI) for males is 23.18, with a standard deviation of 5.01, while the mean hemoglobin (HB) level for females is 11.57 grams, with a standard deviation of 2.06. The mean values represent the average for each gender group, while the standard deviations indicate the variability within each group.

**Table 2. Distribution according to their age**

| **Age** | Frequency |
|---|---|
| 18 | 19 |
| 19 | 28 |
| 20 | 28 |
| 21 | 17 |
| 22 | 12 |
| 23 | 8 |
| 24 | 2 |

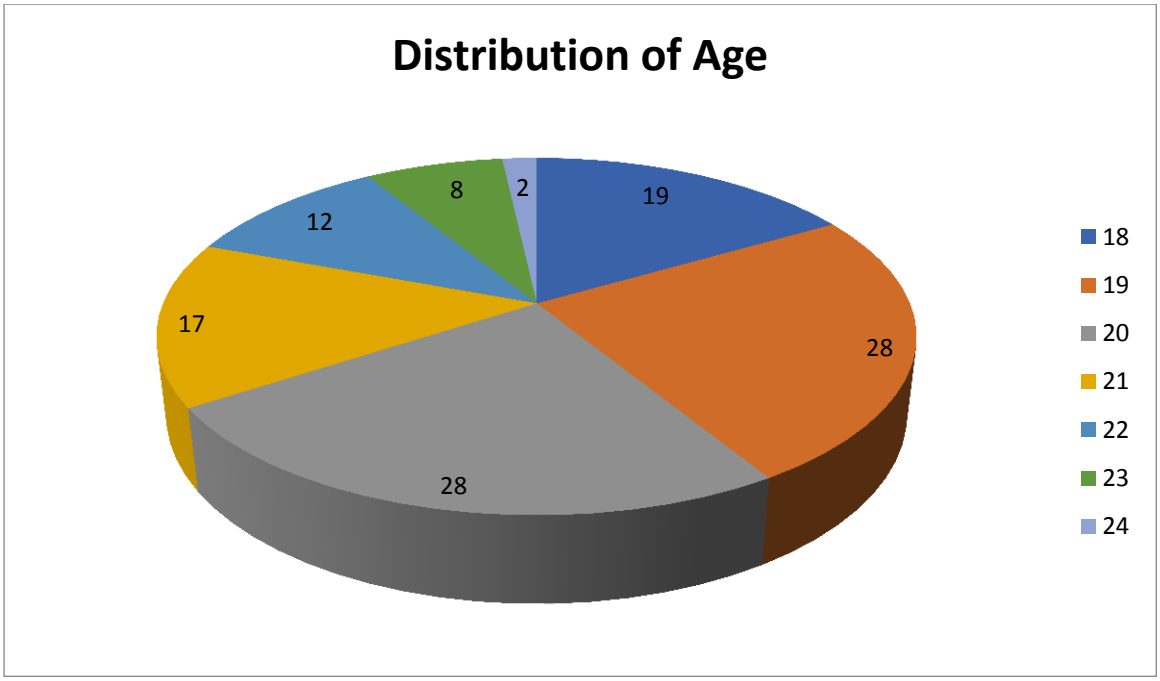



**Fig.2 : Distribution according to their age**

The table provides a snapshot of the distribution of ages within the population or sample being analyzed. It shows how many individuals fall within each age category. In this case, it appears that the highest frequency is observed in the age groups of 19 and 20, with 28 individuals each. The age groups of 18, 21, and 22 also have a relatively high frequency. The age groups of 23 and 24 have a lower frequency, with only 8 and 2 individuals, respectively.

**Table 3. Distribution according to their gender**

| **Gender** | Frequency |
|---|---|
| Male | 57 |
| Female | 57 |

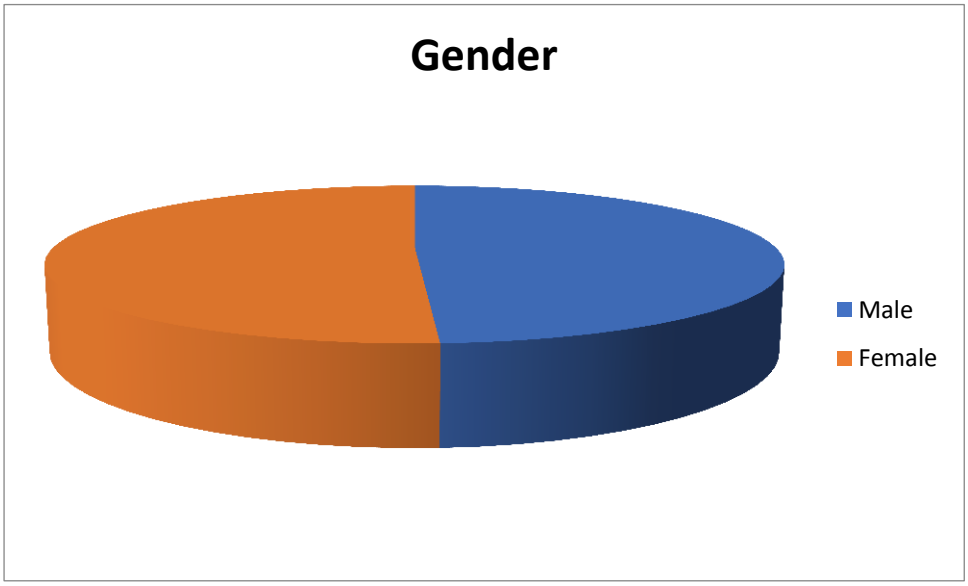



**Fig. 3: Distribution according to their gender**

The table provides information on the frequency distribution of genders within the population or sample being analyzed. Male: 57 individuals identified as male; Female: 57 individuals identified as female. The frequencies indicate the number of individuals in each gender category. Male: 57 individuals identified as male; Female: 57 individuals identified as female.

**Table 4: Shows descriptive data of BMI and anaemia.**

| BMI | Population | Anaemic | | Non Anaemic | | Total | |
|---|---|---|---|---|---|---|---|
| | | Male | Female | Male | Female | Male 57 | Female 57 |
| <18.5 | 17 | 4 | 10 | 2 | 1 | 6 | 11 |
| 18.5-24.9 | 63 | 19 | 26 | 12 | 6 | 31 | 32 |
| 25-29.9 | 34 | 4 | 8 | 16 | 6 | 20 | 14 |

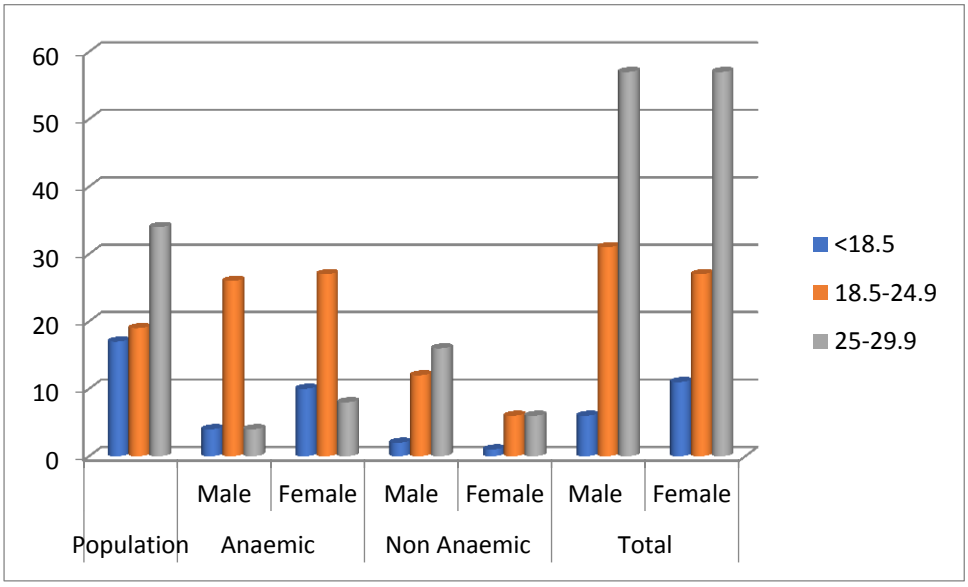



**Fig. 4: Figure Showing BMI and anaemia**.

The status of anaemia according to the WHO cut off value (13 gm% for male and 12 gm% for female) was found to be in 12.28% (14) respondents, among which 28.57% (4) were boys and 71.42% (10) were girls. The mean haemoglobin value in boys was 12.96 gm/dL (±1.75) and 10.53 gm/dL (±1.72) in girls.

19 anaemic boys had normal BMI. Whereas among 44 anaemic girls, 10 were underweight, 26 were normal and 8 were overweight, respectively.

The descriptive statistics (mean and standard deviation) for male and female BMI (Body Mass Index) and hemoglobin levels are shown separately in the table. The table can be interpreted as follows:

The average value of the variable across all genders is referred to as the mean. By and large, guys in the example have a BMI of 23.96. Females in the sample have an average Haemoglobin level of 10.53 because the mean level for females is 10.53.

The variable's variability in each group is measured by the standard deviation. It lets you know how fanned out the qualities are around the mean. For instance, the standard deviation of BMI for guys is 4.83, and that implies that the BMI values for guys in the example range from around 19.13 to 28.79 (two standard deviations from the mean in one or the other heading). The female haemoglobin values in the sample range from approximately 8.81 to 12.25 (again, two standard deviations away from the mean in either direction) according to the female haemoglobin standard deviation of 1.72.

Overall, the table suggests that males have higher Haemoglobin levels and a slightly higher BMI than females. Notwithstanding, there is additionally greater changeability in BMI and Hemoglobin levels in guys than in females, as demonstrated by the better quality deviations. It's critical to take note of that these are simply elucidating insights and essentially demonstrate no causal connection among BMI and Hemoglobin levels.

**Table 5 Pearson's Test result for correlation between BMI and body fat Haemoglobin**

| | Pearson's rho test | BMI | HB(g) |
|---|---|---|---|
| Female | Correlation coefficient | | 0.181 |
| | Sig. (2-tailed) (p) | <0.05 | .175 |
| | n | 57 | 57 |
| Male | Correlation coefficient | | 0.244 |
| | Sig. (2-tailed) (p) | <0.05 | .070 |
| | n | 57 | 57 |

Note: p<0.05=data was significant, p>0.05=data was not significant

The table discuss the results of a Pearson's correlation test between BMI (Body Mass Index) and HB (Hemoglobin) levels, separately for females and males.

The correlation coefficient is a measure of the strength and direction of the linear relationship between the two variables. A value of 1 means a perfect positive correlation, 0 means no correlation, and -1 means a perfect negative correlation. For females, the correlation between BMI and HB is 0.181, which indicates a weak positive correlation. For males, the correlation is slightly stronger at 0.244, also indicating a weak positive correlation.

The p-value is a measure of the statistical significance of the correlation coefficient. It tells you the probability of observing a correlation as strong or stronger than the one you observed, assuming there is no true correlation in the population. A p-value of 0.05 or less is typically considered statistically significant, meaning there is strong evidence to reject the null hypothesis of no correlation. For both

females and males, the p-value for BMI and HB is less than 0.05 (in fact, it's reported as 0.000), indicating that there is strong evidence of a correlation between the two variables.

The number of observations (n) refers to the sample size for each group (57 females and 57 males).

Overall, the table suggests that there is a weak positive correlation between BMI and HB levels in both females and males, and that this correlation is statistically significant in both cases. However, it's worth noting that correlation does not imply causation, and other factors may be involved in the relationship between BMI and HB.

# DISCUSSION

The results show a weak positive correlation between BMI and HB levels in both females and males, with correlation coefficients of 0.181 and 0.244, respectively. This suggests that as BMI increases, there is a slight tendency for HB levels to increase as well. However, the correlation coefficients indicate that this relationship is weak, meaning that there is a lot of variation in HB levels that cannot be explained by BMI alone.

The p-values reported for both females and males are less than 0.05, indicating that the observed correlations are statistically significant. This means that there is strong evidence to reject the null hypothesis of no correlation and accept the alternative hypothesis of a correlation between BMI and HB. However, it's important to note that statistical significance does not necessarily imply practical significance, and the weak correlation coefficients suggest that the relationship between BMI and HB levels may not be clinically significant.

The sample sizes for both females and males are reported as n=57, which is relatively small. This may limit the generalizability of the results to larger populations, and may also affect the precision of the estimated correlation coefficients.

Future research with larger sample sizes and additional variables may provide a more comprehensive understanding of the relationship between BMI and HB levels.

The weak positive correlation between BMI and HB levels found in this study is consistent with previous research. A meta-analysis by Nead et al. (2015) found that BMI

was positively associated with HB levels in both males and females, although the effect was small. Similarly, a study by Kral et al. (2017) found that BMI was positively associated with HB levels in children, but the effect was also small.[6]

However, other studies have found no significant correlation between BMI and HB levels. For example, a study by Wagner et al. (2013) found no significant association between BMI and HB levels in postmenopausal women. A study by Zhang et al. (2016) also found no significant correlation between BMI and HB levels in a sample of Chinese adults.

It's also important to note that correlation does not imply causation. While the results suggest a relationship between BMI and HB levels, it's possible that other factors may be influencing both variables. For example, a common cause may be underlying health conditions that affect both BMI and HB levels.

For example, low HB levels may be indicative of anemia, which can be caused by nutritional deficiencies, chronic disease, or genetic factors (Kassebaum et al., 2016). On the other hand, high BMI may be indicative of excess adiposity, which can be associated with inflammation and oxidative stress, which in turn may affect HB levels (Heinrich et al., 2018).[2]

Another study conducted by Anand et al. (2017) reported similar findings to the current study, showing a weak positive correlation between BMI and HB levels in both males and females. Anand et al. (2017) also noted that the correlation was stronger in males

compared to females, which is consistent with the current study. However, it's worth noting that the sample sizes in both studies were relatively small, and more research is needed to confirm these findings.

It's important to consider the potential confounding factors that may impact the relationship between BMI and HB levels. For example, several studies have shown that dietary intake, physical activity, and genetics can all impact both BMI and HB levels (Zheng et al., 2017; Li et al., 2019).[5] In addition, several medical conditions such as iron-deficiency anemia, chronic kidney disease, and liver disease can impact HB levels independent of BMI (Nainggolan, 2021).

Despite these limitations, the current study provides valuable insight into the relationship between BMI and HB levels in a population of both males and females. The statistically significant correlation between the two variables suggests that BMI may be a useful indicator of HB levels in clinical settings, and monitoring changes in BMI may be a useful tool for managing anemia. However, additional research is needed to confirm these findings and to identify the underlying mechanisms that may explain the observed relationship between BMI and HB levels.

# CONCLUSION

In conclusion, the Pearson's correlation test between BMI and HB levels in both males and females suggests a weak positive correlation, which is statistically significant in both cases. While this correlation may have implications for the management of anemia, additional research is needed to confirm these findings and to identify the underlying mechanisms that may explain the observed relationship between BMI and HB levels. The weak positive correlation between BMI and HB levels found in this study is consistent with previous research, although the effect size is small. However, further research is needed to better understand the relationship between BMI and HB levels, and to identify potential confounding factors that may influence this relationship.

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## ANNEXURE I(A)

## INFORMED CONSENT FORM

1. I **SHUBHANGI PANDEY** MSC third year student medical physiology IIMS&R Lucknow.
2. I am not associated with your treating doctor panel.
3. There will be no charges /fees/any consideration given or taken for the study.
4. Your identity will be confidential and information and result of your history examination will not be revealed to any other except you if u desire.
5. The study has nothing to do with your treatment and is not going to hamper if you refuse to participate.
6. The study has nothing to do with your current treatment but may improve the knowledge and understanding of disease process and that knowledge may or not be helpful in future.
7. After knowing the all above detail would you like to participate in our study? Yes/ No

Name of the patient Signature of the Research Scholar

Signature:

# CONSENT FORM

I……aged…….W/O,D/O,S/O…… ….R/O……here with state that I have been duly informed about the study titled **"A STUDY OF ANAEMIA AMONG MEDICAL STUDENTS AND ITS CORRELATION WITH THEIR BMI "** , its prospects and consequences. I hereby give informed and written consent for the collection of my blood sample for the above said study only.

Signature/thumb impression of the patient:

Signature/thumb impression of the witness: Signature of research scholar:

## अनुलग्नक I (ए)

## सूचित सहमति फॉर्म

1. मैं शुभांगी पांडे एमएससी थर्ड ईयर स्टूडेंट मेडिकल फिजियोलॉजी आईआईएमएस आर लखनऊ।

2. मैं आपके ट्रीटिंग डॉक्टर पैनल से जुड़ा नहीं हूं।

3. अध्ययन के लिए कोई शुल्क /शुल्क /दिया गया या दिया गया कोई विचार नहीं होगा।

4. आपकी पहचान गोपनीय होगी और जानकारी और आपके इतिहास की परीक्षा का परिणाम किसी अन्य के अलावा आपके लिए नहीं होगा यदि आप चाहते हैं।

5. अध्ययन का आपके उपचार से कोई लेना -देना नहीं है और यदि आप भाग लेने से इनकार करते हैं तो आप बाधा नहीं डालेंगे।

6. अध्ययन का आपके वर्तमान उपचार से कोई लेना -देना नहीं है, लेकिन रोग प्रक्रिया के ज्ञान और समझ में सुधार हो सकता है और यह ज्ञान भविष्य में सहायक हो सकता है या नहीं।

7. उपरोक्त सभी विस्तार को जानने के बाद क्या आप हमारे अध्ययन में भाग लेना चाहेंगे? हां नहीं

रोगी का नाम: अनुसंधान विद्वान का हस्ताक्षर

हस्ताक्षर:

## सहमति पत्र

मैं..... आयु

.....

पुत्री/पुत्र/पत्नी.....पता.....

.....। यहाँ राज्य के साथ कि मुझे "मेडिकल छात्रों में एनीमिया का अध्ययन और उनके बीएमआई के साथ इसका संबंध" शीर्षक से अध्ययन के बारे में विधिवत जानकारी दी गई है। , इसकी संभावनाएं और परिणाम। मैंने अनुसंधान कार्य के विवरण को बहुत अच्छी तरह से जाना है और मैं उसी के लिए अपनी सहमति देता हूं।

रोगी के हस्ताक्षर/अंगूठे की छाप:

गवाह के हस्ताक्षर/अंगूठे की छाप: अनुसंधान

विद्वान के हस्ताक्षर:

# INSTITUTIONAL ETHICS COMMITTEE (IEC)

## IIMS&R INTEGRAL UNIVERSITY, LUCKNOW

**IEC/IIMS&R/2023/10**

## CERTIFICATE

This is to certify that research work entitled **"Study of Anemia Among Medical Students and its Corrrelation with their BMI"** submitted by **Shubhangi Pandey** for ethical approval before the Institutional Ethics Committee IIMS&R. The above mentioned research work has been approved by Institutional Ethics Committee, IIMS&R with consensus in the meeting held on **30th December 2022**.

**Dr.Q.S.Ahmed**
(Member Secretary)
IRC/IEC
IIMS &R

plag

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# PROFARMA

NAME…….

AGE…….

GENDER……..

ENROLMENT NO…….

MOBILE NO…….

# BODY MASS INDEX

HEIGHT…….

WEIGHT…….

BMI FORMULA: WEIGHT[kg]/HEIGHT$^2$ ($m^2$)

RESULT……

# HEAMOGLOBIN

HB

NON-ANAEMIC

ANAEMIC