ORIGINAL ARTICLE

Frequency of ABO Blood Groups and its Relationship with Body Mass Index in Students of a Medical College in Lahore

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ABSTRACT

Background: Blood group systems correspond to the presence or absence of antigens on the surface of the RBCs (Red Blood Cells) in an individual. Likewise, one's BMI is the ratio of that individual's height to weight. Both variables have been linked to several metabolic disorders individually. However, their association with one another is of significant importance as plenty of work is being conducted on the issue with variable results, and there remains much more to be uncovered.
Aims: To identify frequency ABO blood groups and its relationship with Body Mass Index (BMI) among students of a medical college in Lahore.
Place & duration of study: Department of Physiology, CMH Lahore Medical College and Institute of Dentistry from January 10th to March 11th, 2020
Method: A cross-sectional study was conducted on 114 participants from 150 students of first year after taking written informed consent. BMI was calculated by estimating height and weight. Blood groups (ABO) were determined by traditional glass-slide method. The data was compiled and analyzed using SPSS version 25.
Results: Out of 114 total students, 67 (58.8%) were males and 47 (41.2%) were females. B positive was found to be the most common blood group amongst the students (41.2%) followed by A positive (22.8%) and O positive (17.5%). Among female students, B positive was most common, and A negative and AB negative were the least common, while B positive was the most common blood group among male students.
Mean BMI was 22.3±3.7.
BMI of 67.5% students was within normal range and 11.4% were underweight while 18.4% were overweight and 2.6% obese. No significant association between the participants' blood groups and Body Mass Index was observed ($p = 0.335$).
Conclusion: B positive was the most common blood group, while A negative and AB negative were the least common among students. Majority students are having normal BMI, and there is no association found between blood groups and Body Mass Index.
Keywords: ABO, Blood groups, BMI, Medical students

INTRODUCTION

Blood is responsible for the delivery of hormones, oxygen and nutrition to each and every cell of body[1]. The term "blood group" refers to the complete blood group system comprising (the presence or absence of) antigens on the surface of the red blood cells whose specificity is controlled by a series of allelic genes or linked genes. Blood group type refers to the precise pattern of reactions to testing antisera in that specific system[2].

Many types of blood groups were established in the 20th century, but ABO, as well as Rhesus (Rh), are the most significant blood groups. Human blood groups were discovered for the first time by Karl Landsteiner at the University of Vienna in 1901[3]. The Rh blood group was founded in 1941 by Weiner and Landsteiner. ABO blood groups, as well as Rhesus, are significant for blood transfusions. With respect to organ transplantation and blood transfusions, blood grouping is of extraordinary genetic and therapeutic significance. The basic constituents of blood, antigens, can be used in forensics, genetics, and anthropological studies[4]. The ABO gene is autosomal, and its locus is present on chromosome 9. Blood group frequency varies across continents. Blood category O is the most prevalent in general, while AB is rare[5].

ABO is essential as well as practical for transplantation and transfusion among 33 blood group systems. Any human being whose age is above six months possess specific antibodies (anti-B as well as anti-A) in their serum which are of clinical significance. Group B blood contains antibodies against group A blood, while group A blood contains antibodies against group B blood. Although there are no antigens present in blood group O, it contains antibodies from both blood groups A and B[6].

Body Mass Index (BMI) is an affordable and simple screening technique which categorizes weight: underweight, healthy weight, overweight, and obesity. BMI does not specifically quantify body fat, but with more precise body fat measurements, BMI is moderately correlated. In addition, BMI seems to be as closely associated with different metabolic and disease outcomes as these more direct body fat measurements are. BMI is the weight of a person in kilograms divided by the square of the height in meters[7].

ABO blood group and BMI have been individually appraised as risk factors for certain diseases. Many studies have shown ABO blood groups to be a risk factor for the

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prevalence of several diseases including rheumatic diseases[8], thyroid diseases[9], and even malaria[10]. Likewise, imbalanced BMI can contribute to cardiovascular disorders[11], Alzheimer's disease[12], diabetes mellitus[13], and so on. Studies have been conducted to examine whether carrying a specific blood group antigen influences one's BMI. There were different conclusions from these studies with some of them clearly showing that blood groups do influence one's BMI[14,15,16]. Imbalanced BMI itself can further influence one's overall physical and mental health; hence, from a statistical perspective, it may be important to examine the relationship between the ABO blood antigen and BMI[15].

The aim of carrying out the research was to determine the distribution of ABO blood groups in First Year MBBS students and to discover any significant relationship between blood groups and Body Mass Index.

MATERIALS AND METHODS

The study was carried out after receiving ethical approval at CMH Lahore Medical College and Institute of Dentistry in the Department of Physiology over a period of two months from the 10th of January, 2020 to the 11th of March, 2020.

The study was carried out on medical students of first year. Out of 150 students, informed written consent was obtained from 114 students for their participation in the study. The remaining students did not give their written consent hence were excluded from the study. Non-probability convenience sampling was done. The grouping of blood by traditional glass-slide method was performed in the Physiology Practical Laboratory.

After cleaning and sterilizing the finger with 70% ethyl alcohol swab, the finger was pricked with the assistance of sterile lancet and drops of bloods were positioned on a glass slide. Then, on the blood drops already mounted on the glass slides, drops of anti-sera (anti-A and anti-B) were dropped separately. Using separate glass rods, a drop of blood from each subject was combined separately with each anti-serum. Blood groups were estimated on the basis of clumping or agglutination[17]**.**

Height and weight of the students were measured barefoot, using a stadiometer and an analogue weighing scale. BMI was calculated consequently.

$$BMI = \frac{\text{Weight(Kg)}}{[height(m)]^2}$$

According to WHO, BMI is divided into four groups as follows:

<18.5 kg/m^2= underweight, 18.5-24.9 kg/m^2 = normal, 25.0-29.9 kg/m^2= overweight, >30 kg/m^2= obese

The data collected was analyzed using SPSS version 25. Categorical variables were presented as frequency and percentages. To evaluate the magnitude of the disparity between classes, the Chi-square test was used. A p-value of approximately 0.05 was considered significant. The study was assessed by the Ethical Review Board at CMH Lahore Medical College and Institute of Dentistry and declared satisfactory. Reference number: 460/ERC/CMHLMC Dated 07-02-2020. Cleared by Dr. Muhammad Ashraf Chaudhry.

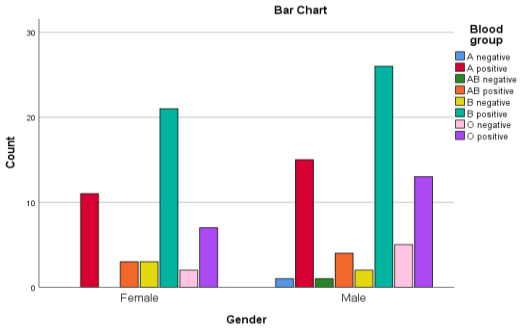
RESULTS

Out of 114 participants, 67(58.8%) were males and 47(41.2%) were females. Among both male and female participants, B positive was the most common blood type (41.2%). The gender wise frequency and percentage of each blood group is shown in Table 1a and Fig 1a.

Table 1a: **Gender wise distribution of blood groups amongst undergraduate medical students**

		Blood group								Total
		A-	A+	AB-	AB+	B-	B+	O-	O+	
Gender	F	0	11	0	3	3	21	2	7	47
	M	1	15	1	4	2	26	5	13	67
Total		1	26	1	7	5	47	7	20	114

Fig. 1a: Gender wise distribution of blood groups amongst undergraduate medical students

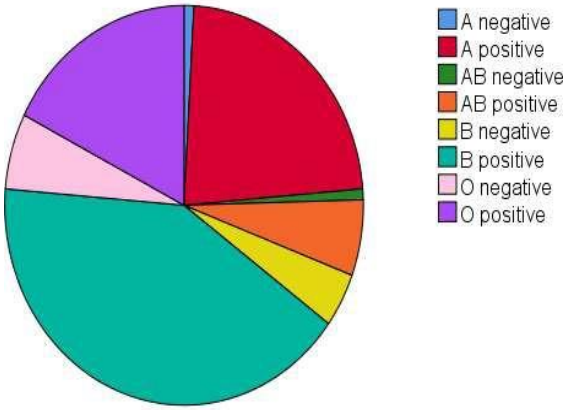


The overall frequency and percentage of each blood group is shown in Table 1b and Fig 1b.

Table 1b**:** Blood groups of undergraduate medical students

Blood group	Frequency (no. of students)	%age
A negative	1	0.9
A positive	26	22.8
AB negative	1	0.9
AB positive	7	6.1
B negative	5	4.4
B positive	47	41.2
O negative	7	6.1
O positive	20	17.5
Total	114	100.0

Fig. 1b: Frequency of blood groups of undergraduate medical students



BMI of majority of the students (67.5%) was within normal range. Table 2a and Fig 2a show the gender wise frequency and percentages of students within different BMI groups.

Fig 2b show the overall frequency and percentages of students within different BMI groups

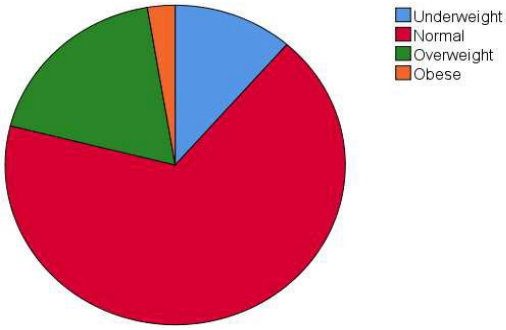


Table 2a: Gender wise distribution of BMI in undergraduate medical students

Gender	BMI Group				Total
	Underweight	**Optimum**	**Overweigt**	**Obese**	
Female	8	29	8	2	47
Male	5	48	13	1	67
Total	13	77	21	3	114

Fig 2b: Gender wise distribution of BMI in undergraduate medical students

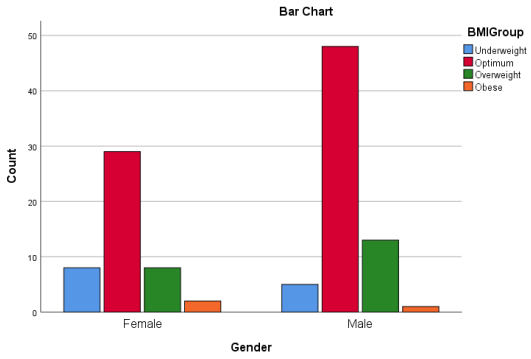


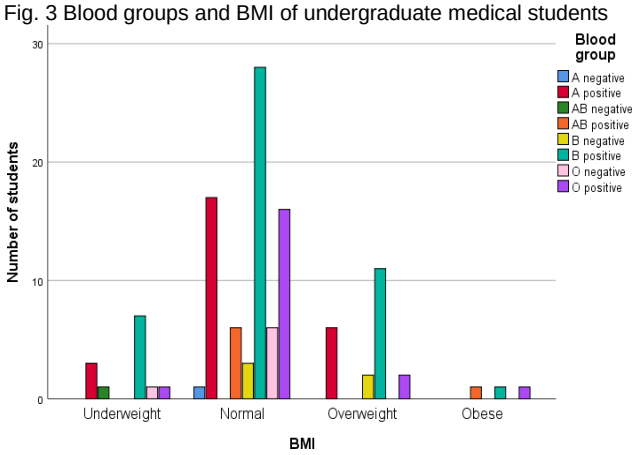
Table 2b and Fig 2b show the overall frequency and percentages of students within different BMI groups.

Table 2b**:** BMI of undergraduate medical students

BMI	**Frequency (no. of students)**	**%age**
<18.5 (Underweight)	13	11.4
18.5 - 24.9 (Normal)	77	67.5
25.0 - 29.9 (Overweight)	21	18.4
>30 (Obese)	3	2.6
Total	114	100.0

The frequency of each blood group was determined by the BMI group to detect a correlation between the blood groups and BMI (Fig. 3).

Fig. 3 Blood groups and BMI of undergraduate medical students



To measure the importance of the disparity between groups, Chi-square test was applied. There was no association found between the blood groups and BMI of the students (p = 0.335).

DISCUSSION

For over a millennium, Hema, or blood, has been the metaphorical hinge for ideological and mythical beliefs. From the time of the Hellen-Greeks to the Romancs, blood has symbolized something strange and enigmatic. While the Greeks went so far as to contemplate the mechanisms of coagulation and even referred to the blood transfusions, humanity was eluded by the possibility of inherent and intrinsic differences of blood, known as blood types[18].

Many blood group systems have been proposed till date; however, the most acceptable ones still remain the ABO blood group system and the Rh system for the grouping of the blood types by Karl Landsteiner in 1901. The study of blood groups and their prevalence is of supreme importance, especially with particular regards to procedures like blood transfusions, organ transplantation, research in the field of genetics, human evolution and various forensic issues leading to medico-legal matters. Based on various factors, such as biology, race and ethnicity, the distribution of ABO blood groups varies worldwide[19]. Moreover, it has been found that certain diseases are more prevalent among people with a specific blood group[8,9,10]. A similar study was done by Shireen et al in 2017 in Faisalabad. The study showed that although

blood group B was most prevalent among the population under study, diastolic pre-hypertension was more prevalent among blood group O[20].

BMI is the Body Mass Index calculated by dividing the body weight with the square of the body height and is always denoted in kg/m^2. It is essentially the quantity of fat that a body possesses. The BMI of an individual depends upon a number of factors including metabolic rate, eating habits, physical activity, genetic variants, family, ethnicity and even the socioeconomic and marital status of the individual[21]. Individuals having a BMI of less than 18.5 kg/m^2 are considered to be underweight and are at greater risk of acquiring nutritional deficiencies[22], osteoporosis[23], and atrial flutter[24], while those with a BMI of 18.5 – 23 kg/m^2 are normal. Individuals with a BMI of 23 kg/m^2 or greater are considered overweight and obese hence are more susceptible to cardiovascular disorders[25] and diabetes mellitus[26]. Within the population under study, a majority fell under the normal range of the BMI; however, a considerable population was noted to be overweight. A large proportion of Pakistani medical students are overweight or obese. Central obesity, but not a BMI greater than 25 kg/m^2, was associated with higher average daily caloric intake. An overall sedentary lifestyle of medical students can be neutralized by physical activity parameters[27]. In medical schools, health awareness activities should be coordinated to teach students about the adverse effects of obesity[28]. To prevent weight gain, young adults should be motivated to have healthy diet and physical activity[29].

Among the many factors that influence BMI as mentioned above, blood groups are one them. Many experiments have been done recently that prove so. In 2017, Gosh AK et al studied third-year MBBS students of RG Kar Medical College, Kolkata, and found 25.6% students to be overweight and 6% to be students[16]. Jadhav et al studied first-year MBBS students of Mysore Medical College and found 23.8% overweight students[30.] These studies indicated a relationship between being overweight or obese and the O or B blood group, although Kelso et al showed no betting relationship[31].

In another study, BMI and blood group B were positively associated. In contrast, BMI and blood group A were negatively associated[15,32]. Some researchers have claimed that people with blood group B are more susceptible to high BMI in comparison to other blood groups[33]. Similarly, work done by Christina Raeblo Flor concludes that within the male population, prevalence of obesity is low for individuals with blood groups B and O; however, among women of the same two blood groups, chances of being obese were found to be higher[34].

Based on a similar rationale, this research project was designed to identify a relationship between blood groups and BMI. Within the population under observation, the most prevalent blood groups were B positive, A positive and O positive, whereas B negative and AB negative were among the rarer blood groups. Among female students, B positive was most common and A negative and AB negative were the least common, while B positive was the most common blood group among male students. The majority of the students (67.5%) weighed within the normal range whereas 18.4% were noted to be overweight. In general, most of the overweight students had O blood group while most of the obese students had AB blood group. However, these findings had no statistical significance. Also, no association was found between blood groups and BMI. The small sample size due to lack of feasibility to use a larger sample size limited the final results. However, there is significant evidence that points towards a possible association between the two variables under study. Hence, further light needs to be shed on the matter as it is of radical significance with various aspects yet to be explored.

CONCLUSIONS

The most prevalent blood group amongst the students was found to be B positive. Higher than normal BMI was observed in a considerable percentage of the total population under study. However, there was no substantial relationship between blood groups and BMI.

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Conflict of interest: None.
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