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Physiology

TO STUDY THE CORRELATION OF BMI WITH ABO BLOOD GROUP AND CARDIOVASCULAR RISK AMONG MEDICAL STUDENTS.

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ABSTRACT **Introduction:** Advancements and increase in access to healthcare have increased the life expectancy in India from 32 years in 1947 to almost 70 years currently. Due to robust vaccination and basic health programs, most of the communicable diseases are kept under control. The disease burden is now skewed towards non-communicable diseases. It is an established fact that body mass index (BMI) is a reliable predictor of cardiovascular disease (CVD) later in life. Early prediction can decrease the disease load and enable early preventative measures. A more novel approach of connecting it with blood groups would yield profound results in predictability and subsequent management. This study was done to see correlation between BMI and known blood groups in order to predict the potential incidence of CVDs in medical students. Material and Method - A cross-sectional descriptive study was conducted in Bhaskar Medical College from September 2022 - November 2022. The sample population included 150- 1st year medical students chosen by Randomized sampling method. BMI was calculated based as weight in kilograms divided by the square of the height in meters (kg/m2). Discussion - Many studies conducted on the association of Blood groups with BMI yielded mixed and inconclusive results. On analysis of the data obtained from this study, O- positive blood group showed the highest inclination towards obesity i.e. 30 of the total participants. A-positive and B- positive blood groups were shown to have a lesser association with obesity i.e. 11 participants of the 150. These results were in accordance with a study done among female students by Shireen Javad et.al, finding blood group O to be the most prone to obesity.8 Incompatible to our results, a study conducted by Samuel Smith Isaac Okai et.al. found no significant association between blood groups and BMI.10 Another study conducted by Christina Ravillo et.al. found that blood group O had the highest and blood group AB with lowest prevalence of obesity9. These findings were similar to the results obtained in our study. **AIMS and OBJECTIVES Aim: -** To study the correlation of BMI with ABO blood group and Cardiovascular risk among medical students. **Objectives: -** 1. Calculate and segregate the participants according to BMI using the standard formula provided by the WHO.
1. Determine Blood group using antisera
2. Evaluation of Lipid profile in obese individuals

KEYWORDS : Body Mass Index (BMI), ABO group , Lipid Profile , CVD

INTRODUCTION

Advancements and increase in access to healthcare have increased the life expectancy in India from 32 years in 1947 to almost 70 years currently. Due to robust vaccination and basic health programs, most of the communicable diseases are kept under control. The disease burden is now skewed towards non-communicable diseases (NCDs). In India, NCDs alone contributed to nearly 60 lakh deaths in 2017. The cause of NCDs has been difficult to ascertain. Studies have been conducted linking them to many modifiable and non-modifiable risk factors. It has been found that genetics plays a profound role.

It can be stated that most of the medical professionals, especially doctors, would be subjected to stressful careers. A critical look into the early stages of their career can point to risk factors and suggest precautionary measures. It is an established fact, that body mass index (BMI) is a reliable predictor of cardiovascular disease (CVD) later in life. Overweight and Obesity are defined by the World Health Organization (WHO) as abnormal or excessive fat that accumulate and can present significant risk to health. [1]Obesity is measured in BMI which is a person's weight in kgs divided by the square of his or her height (in meters). A person with a BMI of 30 or more is generally considered obese. A person with a BMI equal to or more than 25 is considered overweight. [1,2] Unhealthy BMI in early stages of career is certainly a critical element to take note of and give due consideration in managing health. Early evaluation and prediction would considerably decrease the disease load and enable early preventative measures.

A more novel approach of connecting it with blood groups can yield profound results in predictability and subsequent management. ABO blood groups have been associated with various disease phenotypes, particularly cardiovascular diseases .[3] Studies have linked them to many conditions such as cancers, infections, hematological disorders, and metabolic disease, etc. Blood types are non-modifiable and are unaffected by the environmental conditions that they are subject to. Another pragmatic consideration is that blood groups are easily tested and inexpensive. Since there are only four blood groups, they are easy to organize and co-relate.A comprehensive literature review will be done on any research work and its findings will be taken into consideration for the purpose of this study. In an environment of ever-increasing information in the medical field, a simple indicator like the blood group and its corresponding predictability is paramount. In conclusion, this study intends to seek correlation between BMI and known blood groups to predict the potential incidence of CVDs in medical students.

REVIEW OF LITERATURE

Different sources in the field of medicine were sought to find any corresponding information relevant to blood groups, BMI, and cardiovascular diseases. Although, blood groupings and BMI are rudimentary to the practice of medicine, specific and ample literature is lacking. Literature was sought out from relevant publications by reputed institutes.

Research studies were reviewed to quantify and seek objective relationship between obesity (BMI) and cardiovascular diseases**.** Results from a study showed a low association between obesity and MI rates (R2=0.067); a moderate association with stroke rates (R2=0.462); and a strong association with HBP rates (R2=0.811). [4] In another study, BMI and stroke were shown to have a strong association; for each one-unit increase in BMI, there was a 4% increase in the risk of ischemic stroke and 6% increase for hemorrhagic stroke.[5,6] A 10 kg higher body weight is associated with a 3.0 mm Hg higher systolic and 2.3 mm higher diastolic blood pressure; this increase estimates a 12% increase in CHD and 24% increased risk for stroke. [6]

The existing literature on correlation between obesity and cardiovascular diseases reiterates the conventional notions of increased risk of cardiovascular diseases associated with a higher BMI.

Additionally, literature review focused on the correlation between

BMI (obesity) and blood groups**.** Some research studies were done specifically to establish this correlation. In one such study, the logistic regression analysis conducted to detect the effect of ABO and Rh blood groups on obesity, a statistically significant association was found between ABO blood groups and obesity whereas a considerable association was also detected between Rh blood group and obesity. The authors found that the highest rate of the obese individuals was in A and Rh positive.[7]

Another study conducted by Jawed S, Atta K, Tariq S, Amir F et.al on the association of obesity and blood group pointed to an interesting observation. Blood group O showed a trend towards obese bodies and blood group AB showed a trend towards lean body.[8] A similar study was also published by Flor CR, Moura ICG, Baldoni AO, et al with the following findings. Blood group O had the highest prevalence (48.9%) and AB had the lowest prevalence (3.7%) among participants. The mean BMI was slightly above 25 kg/m2, the lower limit of an overweight classification in all ABO blood groups. Associations between specific ABO antigens and BMI were identified that differed according to gender. O and B were associated with a greater prevalence of obesity in women and a lower prevalence in men. Carriage of specific alleles in the ABO blood group may differently influence BMI, according to gender. [9]

However, some studies have shown no significant correlation and point to inconclusive patterns. For example, a research study by Smith S, Okai I, Abaidoo CS, et. Al presented the following results: Blood group O was the most prevalent (51.2%), while Rhesus-positive individuals constituted 90.3%. In this study group, 6.3% of the participants were obese, while 18.7% were considered overweight. There was significant (p=0.006) higher prevalence of obesity in females (10.3%) than in males (3.4%). The study did not observe any significant difference by association of ABO blood group with gender (p=0.973), BMI (p=0.307), or Rhesus status (p=0.723). Regarding gender (p=0.400) and BMI (p=0.197), no statistically significant difference was observed between Rhesus blood groups.[10]

Further, research studies conducted on association of cardiovascular diseases with blood groups were also studied as a part of literature review. Recent genome-wide association studies (GWAS) have identified ABO as a locus for thrombosis, MI and multiple cardiovascular risk biomarkers, refocusing attention on mechanisms and potential for clinical advances. [3]

The ABO blood group exerts a profound influence on hemostasis, being a key determinant of plasma concentrations of (VWF) and (FVIII).[11,12] It is well known that individuals with non-O have circulating levels of both VWF and FVIII that are approximately 25% higher than O group, and the underlying mechanism resides in the positive influence on VWF levels and activity of the addition of A and B antigens, by the specific glycosyltransferase enzymes, on the existing VWF H oligosaccharides. [13] The non-O related increased levels of VWF and FVIII, in addition with those of several inflammatory cytokines (i.e., TNF-alpha, soluble intercellular adhesion molecule 1, E-selectin, P-selectin and IL-6) and cholesterol levels, have been suggested as the most likely mechanisms for explaining the association between ABO and CVS diseases. [14-17]

Results from a study in the 'Cardiorisk' program in Italy by Capuzzo E, Bonfanti C,Frattini F, et al found a strong correlation between the ABO status and the cardiovascular risk, among the blood donors identified as high risk by the Cardiorisk program (i.e., those with a score ≥20). Those belonging to non-O blood type had a significantly increased incidence of cardiovascular adverse events compared with O blood type subjects.[18]

Material and Methods- A cross-sectional descriptive study was conducted in Bhaskar Medical College (BMC), Hyderabad in India from September 2022 - November 2022. The sample population included one hundred and fifty (150) 1st year medical students chosen by Randomized sampling method. Ethical approval for the study was obtained from Institutional Ethics Committee for Humans of BMC. All the participants were clearly explained about the details of the study and voluntary, written consent was obtained from each one of them. It was explained and assured that the information gathered was to be used strictly for research and academic purposes only and that there would be complete confidentiality in the matter. In addition, respondents were given the freedom to opt out any time they thought they could not continue with the study.

Inclusion criterion: all those who are willing to participate in the study.

Exclusion criterion: individuals with physical deformities, kyphosis, and scoliosis, as well as those with bleeding disorders.

PROCEDURE

The following stepwise procedure was followed:

- Weight of the students was measured in the upright position to the nearest 0.5 kg using a weight measuring scale (Seca). Similarly, each participant's height was also measured without shoes to the nearest 0.1cm with height chart.
- Body Mass Index (BMI) was calculated using the standard formula provided by the WHO. BMI is calculated by taking a person's weight in kilograms (kgs) and dividing it by the square of the person's height (meters). Hence, BMI = Weight/ (height) ^{2} with units of kg/mt ^{2}. BMI is classified into the following range categories:

1. Underweight: <18.5 kg/m^2; 2. Normal weight: 18.5- 24.9 kg/m^2; 3. Overweight: 25 -29.9 kg/m^2 and 4. Obese >30 kg/m^2.[1,2]

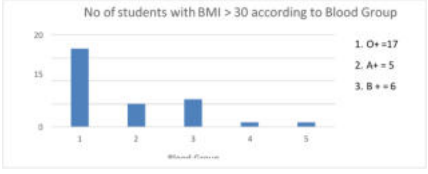
- ABO typing was done by classic (antigen-antibody agglutination test) method of making slides. Aseptic measures were ensured, and blood was taken by finger pricking with sterile lancet. Three clean slides were labeled as "A", "B" and "D" followed by placing drops of blood over them. Anti-sera A, antisera-B and antisera D were added on each slide and mixed with blood properly. The agglutination reaction was used to check blood groups
- For participants with a BMI >30 kg/m2, evaluation of complete lipid profile was done using enzymatic colorimetric method, after 12 hours fasting, and after ruling out the causes of secondary hypercholesterolemia.

RESULTS

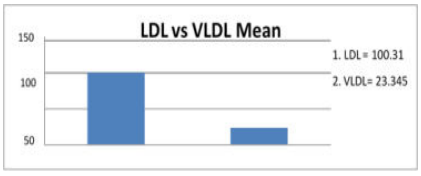
One hundred and fifty (150) medical students from Bhaskar Medical College, Hyderabad between 18-20 years of age formed the sample group. Out of 150, there were 80 female students and 70 male students. The information obtained from their respective blood groups is collated in the tabular form below:

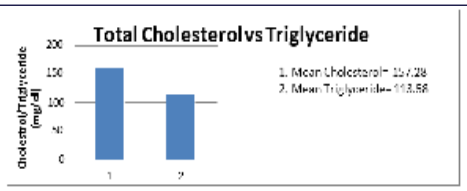
SNo.	Blood Group	Female (No.s)	Female (%)	Male (No.s)	Male (%)	Total	Total %
1.	O+ve	29	19.334	36	24	65	43.3
2.	A+ve	18	12	9	6	27	18
3.	B+ve	15	10	27	18	42	28
4.	AB+ve	3	2	7	4.667	10	6.66
5.	O-ve	2	1.334	0	0	2	1.33
6.	A-ve	0	0	1	0.667	1	0.67
7.	B-ve	1	0.667	1	0.667	2	1.33
8.	AB-ve	0	0	1	0.667	1	0.67

In the sample group, the mean height of male students was 163 centimeters (cm) with a mean weight of 69.5 kgs. The female students were measured at a mean height of 152.25 cm and mean weight of 59.74 kgs. Some of the important findings are presented as follows. O positive blood group had the maximum number of students with a BMI of > 30 i.e 17. Of the 150 students, 30 students had a BMI >30 and 39 students had BMI in the range 25-30 with the t-value as 30.09 and a p-value of 0.0001 which is statistically significant



Results obtained by the lipid profile done on students with a BMI >30 are presented below





- On paired T-test, the results with cholesterol and triglyceride were found to be: t= 3.72; p value =0.0004, which is statistically significant.
- The results with LDL and VLDL - t= 15.25; p value = 0.0001 which is statistically significant. The mean HDL was found to be 43.2 which is the normal range.

DISCUSSION

Many studies conducted on the association of Blood groups with BMI yielded mixed and inconclusive results.

On analysis of the data obtained from this study, O-positive blood group showed the highest inclination towards obesity i.e., 30 of the total participants. A-positive and B-positive blood groups were shown to have a lesser association with obesity i.e., 11 participants of the 150. These results were in accordance with a study done among female student by Shireen Javad et.al, finding blood group O to be the most prone to obesity.8 Incompatible to our results, a study conducted by Samuel Smith Isaac Okai et.al. found no significant association between blood groups and BMI.10 Another study conducted by Christina Ravillo et.al. found that blood group O had the highest and blood group AB with lowest prevalence of obesity9. These findings were similar to the results obtained in our study.

Lipid profile was exclusively assessed in individuals with BMI >30. It was seen that the mean cholesterol level was 157.8 and the mean triglyceride level was 113.5. On comparison of triglyceride and cholesterol levels, it was seen that the t value was 3.72 and p value was 0.0004 which was statistically significant. The high triglyceride and near normal cholesterol levels could be attributed poor dietary choices. LDL, as major predictor for CVD was shown to be moderately elevated (100.3). On comparison of the LDL and VLDL levels, the t-value and p -value were found to be 15.25 and 0.0001 respectively. These findings are similar to a study conducted by Yuqun Chen et.al. that demonstrated an inclination of coronary vascular disease with non-O type individuals mediated by increased LDL level.[17]

Various theories attempting to explain the causal relationship between BMI and blood group have been studied. These include the involvement of inflammatory cytokines as well as several clotting factors which vary in distribution in different blood groups.11-17 Associations between the ABO blood group and BMI may be influenced by factors including the local culture and environment. Thus, the association should be studied in further detail to come to more conclusive results.

Conclusion: This study projects the influence of blood group on BMI and thus further CVD with O blood group showing the highest association.

Conflict Of Interest: There is no conflict of interest in this study as this is purely done on young individuals with their voluntary and informed consent. No other agency is involved in finance of the study as it was done using the available facilities of the institute for academic purposes.

Implication – The main intention of this study is to project the association of the Blood groups with obesity as a risk factor for future CVD in young individuals. They are advised to check the BMI regularly. Lifestyle changes including a balanced diet and regular exercise regime are recommended.

Scope Of Study – This study was done on a smaller and younger population due to which the values obtained in the study showed fewer subjects falling in the risk group. The same study can be studied in a larger population with varied age groups.

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