



## STUDY OF ASSOCIATION BETWEEN ABO GROUPS AND BMI (BASAL METABOLIC INDEX): A CROSS-SECTIONAL STUDY

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### ABSTRACT

**Introduction:** Study of blood groups, mainly ABO and Rh systems has been given high priority because of their medical importance. ABO antigen type has been proved as a risk factor for obesity, cardiovascular diseases, cancers, and infectious diseases. Body mass index (BMI), a measure of excess body weight, is useful for assessing aspects of health in children and adults within a population. **Aim:** The study aims to find out the association if any between blood groups and body mass index. **Material & Methods:** The data collection was done considering gender, age, blood groups (ABO and Rh), height and weight of each participant with their consent. The participants were donors of age between 18 to 50 years. Weight of the participants was measured in the upright position to the nearest 0.5 kg using a weight measuring scale. Height was measured without shoes to the nearest 0.1 cm with a meter. Blood samples were collected for ABO blood group analysis and grouping was done by gel card method. **Result:** Blood type O was the prevalent ABO blood group in our study. Our study did not observe any significant association between ABO blood group and BMI. Our observation agrees with findings from large cross-sectional studies by Jafari et al. among different ethnicities in Pakistan which showed absence of any significant association between ABO and BMI. **Conclusion:** The prevalence of overweight, obesity, blood type O, and Rhesus positive observed among donors in this study is largely similar to what has been generally reported in literature. However, overweight and obesity were not associated with ABO blood groups; this finding is contrary to the view of some reports.

**KEYWORDS :** ABO, Rh, BMI (basal metabolic index).

### INTRODUCTION

Study of blood groups, mainly ABO and Rh systems has been given high priority because of their medical importance [1-5]. ABO antigen type has been proved as a risk factor for obesity, cardiovascular diseases, cancers, and infectious diseases [6-8]. The mechanism believed to underlie how ABO blood group may influence cardiovascular disease risk involves the possible regulatory effect of ABO antigens on plasma levels of von Willebrand factor (VWF) and coagulation factor VIII (FVIII) [9-10]. Individuals with non-O blood group have circulating levels of both VWF and FVIII that are approximately 25% higher than those in O blood group subjects [9].

Obesity is defined by World Health Organisation (WHO) as abnormal and excessive fat accumulation [11]. It is a major risk factor for development of multiple diseases like metabolic syndrome, type 2 diabetes, cardiovascular diseases and cancer [12]. Obesity is classified based on Body Mass Index (BMI).

Body mass index (BMI), a measure of excess body weight, is useful for assessing aspects of health in children and adults within a population. Based on the WHO classification of BMI, an individual may be clinically considered obese, overweight, normal, or underweight. BMI is defined as weight in kilograms divided by square of height in metres. Based on the WHO classification for obesity in adults, a BMI between 25 and 29.9 is overweight and BMI >30 is obese [13-14].

The goal of present study is to find any potential relation between the ABO blood groups and BMI (body mass index) or obesity.

### AIM:

The study aims to find out the association if any between blood groups and body mass index.

### MATERIAL & METHODS:

A descriptive cross-sectional study was conducted in the Department of Blood Bank, Government Doon Medical College, Dehradun during December 2022 to April 2023. The data collection was done considering gender, age, blood groups (ABO and Rh), height and weight of each participant with their consent. The participants were donors of age between 18 to 50 years and healthy having no history of current and past chronic illness.

### Anthropometric Measurement and ABO Blood Group Analysis

Weight of the participants was measured in the upright position to the nearest 0.5 kg using a weight measuring scale. Height was measured without shoes to the nearest 0.1 cm with a meter. Blood samples were collected for ABO blood group analysis and grouping was done by gel card method.

BMI was calculated by dividing body weight in Kilogram on the height in Metric Square ( $BMI = \frac{\text{Body weight (kg)}}{\text{Height (m)}^2}$ ). Then on the basis of BMI, the subjects were categorized into <18.5, 18.5-24.9, 25-29.9, 30 defined as underweight, normal, overweight and obese, respectively in accordance with the WHO recommendation [9].

### RESULT & DISCUSSION

#### Table no.1

Gender	No. of donors(n)	Percentage%
Male	122	47.8
Female	133	52.2

#### Table no.2

Age	No. of donors	Percentage%
<20 years	15	5.8
20-30 years	224	87.8
30-40 years	10	3.8
>40 years	07	2.6

**Table no.3**

BMI	No. of donors	Percentage%
< 18.5(underweight)	35	13.7
18.5-24.9(normal)	173	67.8
25.0-29.9(overweight)	40	15.7
>30(obese)	07	2.8

**Table no.4**

Blood group	No. of donors	Percentage%
A	75	29.4
B	73	28.6
AB	25	9.8
O	82	32.2

**Table no.5**

Rh factor	No. of donors	Percentage%
Positive	232	91
Negative	23	9

**Table no.6**

BMI	Blood Group								Chi Square = 1.1017 p=0.999
	A (n)	%	B(n)	%	AB(n)	%	O(n)	%	
Underweight	09	3.5	10	3.9	03	1.2	13	5.1	
Normal	44	17.3	47	18.4	17	6.7	65	25.5	
Overweight	12	4.7	10	3.9	04	1.6	14	5.5	
Obese	02	0.8	01	0.4	01	0.4	03	1.2	

In our study, out of 255 donors 47.6% were male and 52.2% were females (Table 1). The mean age of the study participants was 22.8 years with ± 5.7 SD. The mean weight was 59.83kg with ± 10.3 SD . The mean height was 164.22 with ± 8.81 SD .The mean BMI was 22.16kg/cm<sup>2</sup> with ± 3.34 SD.

Blood group O was the most prevalent (32.2%), followed by A (29.4%), B (28.6%), and AB (9.8%) (Table 4). 91% of individuals were Rhesus-positive, while 9% were Rhesus negative (Table 5). Also, 2.8% of donors were obese, while 15.7% were overweight, normal 67.8% and underweight 13.7% (Table 3).

Chi square test was applied to study the correlation between BMI and blood group and the p value was 0.99 and the result is not statistically significant (Table 6)

Blood type O was the prevalent ABO blood group in our study which is similar to the report from studies by Acquaye [15] in Ghana and Eru et al. [16] in Nigeria. Also, studies by Bhatti et al. [17] in India and Parveen et al. [18] as well as Bhattacharyya et al. [19] in Pakistan have reported similar ABO blood group pattern.

Reports in literature on the relationship between ABO blood group and BMI are inconsistent [20, 21], with various authors associating increased BMI with the presence of particular ABO antigens, while others have shown no association between these two factors. Significant association was seen between ABO blood group and BMI among sampled populations from Pakistan [22], India [23, 24, ], Malaysia [25, 26], Nigeria [27], and Denmark [28].

Our study did not observe any significant association between ABO blood group and BMI. Our observation agrees with findings from large cross-sectional studies by Jafari et al. [29] among different ethnicities in Pakistan which showed absence of any significant association between ABO and BMI . Other similar findings were seen in studies by Aboel-Fetoh et al. [30] in Saudi Arabia, Ainee et al. [31] in Sargodha District, Chuemere et al. [32] in Nigeria. Study conducted by Mascie-

Taylor and Lasker in the UK also [33] failed to link BMI with either ABO or Rh phenotype.

**Limitation**

However, being an institutional-based cross-sectional study, we recognize that making generalization of our findings to the Ghanaian population may be inappropriate.

**CONCLUSION**

The prevalence of overweight, obesity, blood type O, and Rhesus positive observed among donors in this study is largely similar to what has been generally reported in literature. However, overweight and obesity were not associated with ABO blood groups this finding is contrary to the view of some reports

**REFERENCES**

- FINNE, J. (1980). Identification of the blood group ABH active glycoprotein components of human erythrocyte membrane. *European Journal of Biochemistry*, 104(1), 181-189.
- Kar, K., & Kar, S. (2021). Distribution and Association of ABO and Rh Blood Group Antigens with BMI Among Nepalese and Indian Students Studied in a Medical College of Nepal. *Journal of College of Medical Sciences-Nepal*, 17(3), 265-278.
- Kar, K., & Kar, S. (2021). Distribution and Association of ABO and Rh Blood Group Antigens with BMI Among Nepalese and Indian Students Studied in a Medical College of Nepal. *Journal of College of Medical Sciences-Nepal*, 17(3), 265-278.
- Mollison, P. L., Engelfriet, C. P., & Conteras, M. (1993). The Rh blood group system. *Blood Transfusion in Clinical Medicine, 9th Edition. Oxford: Black well Scientific Publication*, 2008-9.
- Anstee, D. J. (2010). The relationship between blood groups and disease. *Blood, The Journal of the American Society of Hematology*, 115(23), 4635-4643.
- Afoakwah, R., Auby, E., Prah, J., Nwaeuna, E. K., & Boampong, J. N. (2016). Relative susceptibilities of ABO blood groups to Plasmodium falciparum malaria in Ghana. *Advances in Hematology*, 2016.
- Kalayanaraj, S., Gibbons, R. V., Vaughn, D., Green, S., Nisalak, A., Jarman, R. G., ... & Perng, G. C. (2007). Blood group AB is associated with increased risk for severe dengue disease in secondary infections. *The Journal of infectious diseases*, 195(7), 1014-1017.
- Mohsenpour, B., Hajibagheri, K., Afrasiabian, S., Ghaderi, E., & Ghasembegloo, S. (2015). ABO blood groups and susceptibility to brucellosis. *Japanese Journal of Infectious Diseases*, 68(2), 124-127.
- Jenkins, P. V., & O'Donnell, J. S. (2006). ABO blood group determines plasma von Willebrand factor levels: a biologic function after all? *Transfusion*, 46(10), 1836-1844.
- Song, J., Chen, F., Campos, M., Bolgiano, D., Houck, K., Chambliss, L. E., ... & Dong, J. F. (2015). Quantitative influence of ABO blood groups on factor VIII and its ratio to von Willebrand factor, novel observations from an ARIC study of 11,673 subjects. *PLoS one*, 10(8), e0132626.
- World Health Organization. (2013). *Oral health surveys: basic methods*. World Health Organization.
- Tesaro, M., & Cardillo, C. (2011). Obesity, blood vessels and metabolic syndrome. *Acta physiologica*, 203(1), 279-286.
- Subramanian, S. V., Perkins, J. M., Ozaltin, E., & Davey Smith, G. (2011). Weight of nations: a socioeconomic analysis of women in low-to middle-income countries. *The American journal of clinical nutrition*, 93(2), 413-421.
- Smith, S., Okai, I., Abaidoo, C. S., & Acheampong, E. (2018). Association of ABO blood group and body mass index: A cross-sectional study from a Ghanaian population. *Journal of nutrition and metabolism*, 2018.
- Acquaye, J. K. (2004). ABO, Rhesus and Kell blood groups in the Akans of Ghana. *Ghana Medical Journal*, 38(2), 68-71.
- Eru, E. U., Adeniyi, O. S., & Jogo, A. A. (2014). ABO and Rhesus blood group distribution among students of Benue State University Makurdi, Nigeria. *African Journal of Biomedical Research*, 17(1), 49-52.
- Bhatti, R., & Sheikh, D. M. (1998). Variations of ABO blood groups. Gene frequencies in the population of Sindh (Pakistan). *Annals of King Edward Medical University*, 4(4), 55-58.
- Parveen, N., Rehman, J., Hassan, S. H., Hassan, Z., & Rehman, M. (2016). DIFFERENT BLOOD GROUPS: ASSOCIATION WITH BODY MASS INDEX IN MEDICAL STUDENTS OF KARACHI. *The Professional Medical Journal*, 23(08), 1001-1004.
- Bhattacharyya, S., Ganaraja, B., & Ramesh, B. M. (2010). Correlation between the blood groups, BMI and pre-hypertension among medical students. *Journal of Chinese Clinical Medicine*, 5(2).
- Chandra, T., & Gupta, A. (2012). Association and distribution of hypertension, obesity and ABO blood groups in blood donors. *Iranian journal of pediatric hematology and oncology*, 2(4), 140.
- Slipko, Z., Latuschowska, B., & Wojtkowska, E. (1994). Body structure and ABO and Rh blood groups in patients with advanced coronary heart disease after aorto-coronary by-pass surgery. *Polskie Archiwum Medycyny Wewnętrznej*, 91(1), 55-60.
- Parveen, N., Rehman, J., Hassan, S. H., Hassan, Z., & Rehman, M. (2016). DIFFERENT BLOOD GROUPS: ASSOCIATION WITH BODY MASS INDEX IN MEDICAL STUDENTS OF KARACHI. *The Professional Medical Journal*, 23(08), 1001-1004.
- Behera, S., Sahoo, A., & Satyanarayana, P. (1970). Relationship of blood group with body fat percentage, visceral fat, and waist-hip ratio. *National Journal of Physiology, Pharmacology and Pharmacology*, 6(6), 591-591.
- Ganesan, K., & Gani, S. B. (2014). Relationship between ABO, Rh blood groups and diabetes mellitus, obesity in Namakkal town, Tamilnadu.

- International Journal of Advances in Pharmacy, Biology and Chemistry*, 3(4), 995-998.
25. Sukalingam, K., & Ganesan, K. (2015). Rhesus blood groups associated with risk to obesity and diabetes mellitus: A report on Punjabi population in Selangor, Malaysia. *Int J Intg Med Sci*, 2(4), 105-109.
  26. Amir, H. (2012). ABO blood group associations with obesity in random samples from Advanced Medical and Dental Institute Staff and Students. *Biohealth Sci Bull*, 4(1), 18-23.
  27. Mmom, F. C., & Chuemere, A. N. (2016). Study of incidence and prevalence of hypertension, diabetes and obesity with blood type in postmenopausal females in Port Harcourt. *Saudi J Biomed Res*, 1(1), 22-9.
  28. Suadicani, P., Hein, H. O., & Gyntelberg, F. (2002). Airborne occupational exposure, ABO phenotype and risk of ischaemic heart disease in the Copenhagen Male Study. *European Journal of Cardiovascular Prevention & Rehabilitation*, 9(4), 191-198.
  29. Jafari, E., Sebghatollahi, V., Kolahdoozan, S., Elahi, E., & Pourshams, A. (2012). Body Mass Index and ABO Blood Groups among Different Ethnicities of the Golestan Cohort Study Subjects. *Govaresh*, 17(1), 50-54.
  30. Aboel-Fetoh, N. M., Alanazi, A. R., Alanazi, A. S., & Alruwili, A. N. (2016). ABO blood groups and risk for obesity in Arar, Northern Saudi Arabia. *Journal of the Egyptian Public Health Association*, 91(4), 169-173.
  31. Ammara, A., Sarfraz, H., Tusneem, K., Qureshi, T. M., Muhammad, N., & Farhat, R. (2014). Studies on comparison of body mass index (BMI) of school going children having different blood groups (A, B, Ab and O) of Sargodha district. *Pakistan Journal of Nutrition*, 13(3), 164-167.
  32. Chuemere, A. N., Olorunfemi, O. J., Nwogu, J. U., Mmom, O. F., Agbai, E. O., & Vurey, V. V. (2015). Correlation between blood group, hypertension, obesity, diabetes, and combination of prehypertension and pre-diabetes in school aged children and adolescents in Port Harcourt. *IOSR Journal of Dental and Medical Sciences*, 14(12), 83-89.
  33. Mascie-Taylor, C. G. N., & Lasker, G. W. (1990). Lack of an association between ABO and Rh blood group polymorphisms and stature, body weight, and BMI in a cohort of British women. *Human biology*, 573-576.