



## RESEARCH ARTICLE

## ABO Blood Group: Its Relationship with Anthropometric Parameters Among Young Adult Nigerians of Yoruba Ethnicity

Asafa MA<sup>1\*</sup>, Ogunlade O<sup>1</sup>, Bolarinwa RA<sup>2</sup>, Bisiriyu LA<sup>3</sup> and Asafa ST<sup>4</sup>

<sup>1</sup>Department of Physiological Sciences, Obafemi Awolowo University, Nigeria

<sup>2</sup>Department of Haematology and Immunology, Obafemi Awolowo University, Nigeria

<sup>3</sup>Department of Demography and Social Statistics, Obafemi Awolowo University, Nigeria

<sup>4</sup>Department of Zoology, Obafemi Awolowo University, Nigeria



**\*Corresponding author:** Asafa MA, Department of Physiological Sciences, Faculty of Basic Medical Sciences, College of Health Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria

### Abstract

**Introduction:** It had been established that ABO blood group system associated with some diseases or disorders. The objective of this study was to determine the effect of ABO blood group on anthropometric indices among apparently healthy young adults of Yoruba ethnicity.

**Methods:** Eighty apparently healthy young adults who were purposely selected participated in the study after screening for the ABO blood groups following the standard protocol. They were divided into four equal groups; 20 in each of blood groups A, B, AB and O who were age- and sex- matched. The weight (kg) and height (cm) of the participants were measured following standard protocol. Body mass index (BMI) and body surface area (BSA) were estimated from weight and height using Quetelet and Mosteller formulae respectively. Chi square was used to compare grouped data while comparison of means of parameters among the four blood groups was done using Analysis of Variance (ANOVA). A p-value of  $< 0.05$  was taken statistically significant.

**Results:** Out of the total 80 participants, 15% were males. The mean  $\pm$  SD of height (m) of participants with blood groups A, B, O and AB were  $1.65 \pm 0.06$ ,  $1.63 \pm 0.08$ ,  $1.62 \pm 0.08$  and  $1.63 \pm 0.08$  ( $F = 0.349$ ,  $p = 0.790$ ) respectively. The mean  $\pm$  SD of weight (kg) of the participants with blood group A, B, O and AB were  $56.15 \pm 8.71$ ,  $56.00 \pm 11.21$ ,  $57.10 \pm 12.73$  and  $58.05 \pm 10.35$  ( $F = 0.154$ ,  $p = 0.927$ ) respectively. The mean  $\pm$  SD of BMI in  $\text{kg}/\text{m}^2$  for blood groups A, B, O and AB were  $20.74 \pm 3.22$ ,  $20.86 \pm 2.91$ ,  $21.79 \pm 5.10$  and  $21.91 \pm 4.21$  ( $F = 0.472$ ,  $p = 0.703$ ) respectively while the mean  $\pm$  SD of BSA ( $\text{m}^2$ ) for blood group A, B, O and AB were  $1.60 \pm 0.12$ ,  $1.59 \pm 0.19$ ,  $1.60 \pm 0.18$  and  $1.62 \pm 0.15$  ( $F = 0.098$ ,  $p = 0.961$ ) respectively.

**Conclusion:** Blood group AB is associated with weight, BSA and BMI than any other blood group.

### Keywords

ABO blood groups, Anthropometry, Young adults, Ethnicity

### Introduction

The ABO blood group system was the first and most important human blood group system [1]. It was credited to be discovered by Karl Landsteiner in 1900 [2]. The ABO blood group system is unique in immunology and haematology because it is the only system in which antibodies are consistently and predictably present in the serum of normal individuals whose red cells lack the antigens [3]. The antibody production becomes detectable at three to six months of age [4]. Several epidemiological studies have reported that the distribution of different ABO blood groups vary markedly among the populations of different geographical areas reflecting racial differences [5-7]. Human blood groups are genetically determined antigens expressed on the surface of red blood cells [8]. The antigens may also be found in body fluids (urine, saliva and amniotic fluid) of secretors [9]. Blood groups may also be expressed on organ cellular surfaces. The association between ABO blood groups and disease susceptibility has generated a lot of interest [10-17]. Its association with anthropometric indices among young adults is rarely studied in

Nigeria. Body mass index (BMI) is regarded as most popular among the anthropometric indices. It is an internationally accepted index for assessing obesity [18-20]. Age and ethnicity had been reported to play significant role in the anthropometric dimensions [21,22]. BMI as a trait is determined not only by environmental factors but also largely by interaction with inherited genetic factors [23]. Several studies have indicated that genetic factors account for a substantial portion of variation in human adiposity [24-26]. The ABO blood group system is known to be one of such genetic make-up of an individual that may provide much valuable information for early detection of vulnerable groups for abnormal BMI such as obesity [27]. Data is sparsely with regards to the association between ABO blood group and anthropometric indices among young adults of Yoruba ethnicity in Nigeria, hence this study.

## Methods

This study was carried out at Obafemi Awolowo University, Ile-Ife. It was a cross-sectional descriptive study involving apparently healthy young adults between the ages of 18 and 40 years (inclusive) of Yoruba ethnicity. The target population were the students of Obafemi Awolowo University community, Ile-Ife, Nigeria. Ethical approval was obtained from the Institute of Public Health of the Obafemi Awolowo University, Ile-Ife. The participants were selected using purposive sampling method. Blood samples were obtained from superficial cubital vein (2 ml) from the participants at resting position after cleaning with 75% ethyl alcohol using 5 ml syringe and the sample was dispensed into Sodium EDTA anticoagulant bottle. All sample collections followed standard procedure. A drop of each antisera A, B and AB were placed on a clean white tile in three different places marked X, Y and Z. Drops of blood were added to drops of antisera at points X, Y and Z respectively and mixed with the aid of glass rods. Then, the mixture was rocked gently for 60 seconds to observe for agglutination. The results of agglutination were recorded immediately after mixing. The tests were done in duplicates to ensure validity of results. The agglutinations in X & Z were considered as blood group A and agglutinations in Y & Z were considered as blood group B. The agglutinations at points X, Y and Z were considered as group AB. If no agglutination at points X, Y and Z, the sample was considered as blood group O. Agglutination at point X or Y or Z were considered invalid and the test was repeated. Heights and weight of all participants were measured to the nearest 1 cm and 0.5 kg respectively using ZT120 Health Scale. The body mass index was calculated from height in metres and weight in kg [28] and body surface area (BSA) was calculated from the weight (kg) and height (cm) using Mosteller formula,  $BSA = [(weight \text{ in kg} \times height \text{ in cm})/3600]^{1/2}$  [29]. The data were analyzed by the aids of IBM version 20.0 software using descriptive statistics and cross tabulations. Comparison of means of parameters among the four blood groups

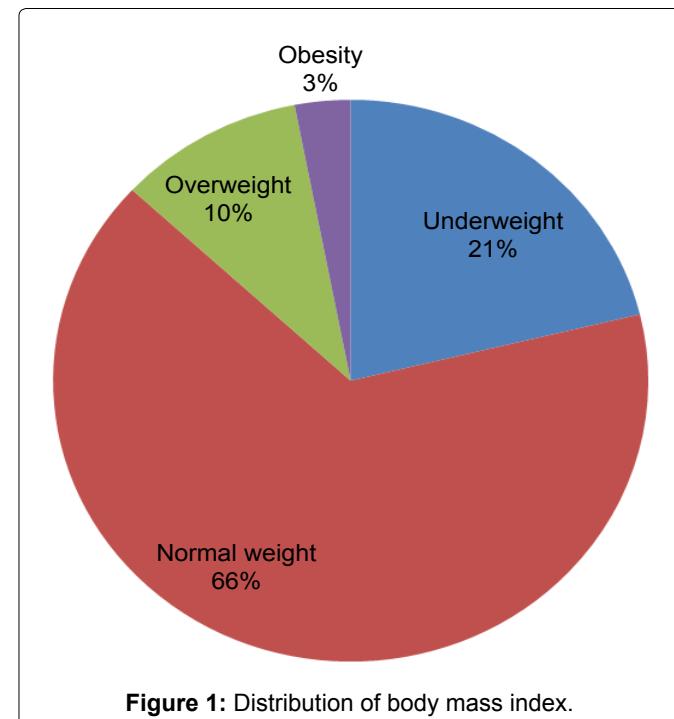


Figure 1: Distribution of body mass index.

(A, B, AB and O) was done using Analysis of Variance (ANOVA). Comparison of grouped data were done using chi square. A p value of  $< 0.05$  was taken as statistically significant.

## Results

The mean  $\pm$  SD and range of age in years, weight in kg, height in metres, body surface area in metre square, body mass index in  $\text{kg}/\text{m}^2$  were  $21.50 \pm 3.52$  (18-28),  $56.83 \pm 10.67$  (39-95),  $1.63 \pm 0.07$  (1.48-1.81),  $1.60 \pm 0.14$  (1.30  $\pm$  2.08),  $21.33 \pm 3.92$  (15.42-38.54) respectively. This study showed that 12% were underweight, 66% had normal weight, 10% had overweight and 3% had obesity (Figure 1). The highest and lowest mean height was found in blood groups A and O respectively. The highest mean weight, body surface area and body mass index were found in blood group AB. The relationship between ABO blood group and anthropometric parameters were not statistically significant ( $p$ -value  $> 0.05$ ) as shown in Table 1. The highest frequency of obesity was found in blood group AB. The distribution of ABO blood group according to the BMI class (underweight, normal weight, overweight and obesity) is as shown in Figure 2.

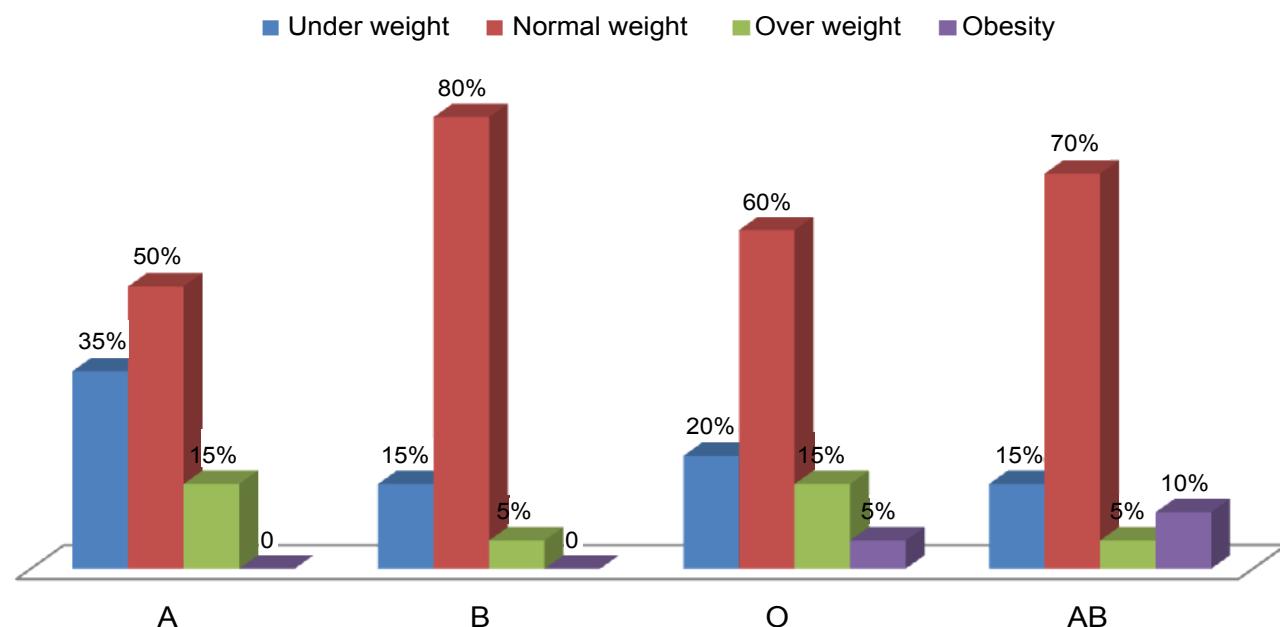
## Discussion

The mean weight ( $56.83 \pm 10.67$  kg) obtained from this study was similar to  $56.37 \pm 6.53$  kg reported in a study among young adults within the age range of 18-40 years in India [30]. The mean height, weight and BMI of the study population were similar to the earlier report of a study done within the same environment [31-33]. It is also in consistency with the report of the study done among the undergraduates of the University of Benin, Nigeria within the same age range [34]. The percentage of the participants that were either overweight (10%) or

**Table 1:** Relationship between ABO blood group and anthropometric parameters.

| Anthropometry            | Blood Group | Parameters (Mean $\pm$ SD) | F     | p-value |
|--------------------------|-------------|----------------------------|-------|---------|
| Weight (kg)              | A           | 56.15 $\pm$ 8.71           | 0.154 | 0.927   |
|                          | B           | 56.00 $\pm$ 11.21          |       |         |
|                          | O           | 57.10 $\pm$ 12.73          |       |         |
|                          | AB          | 58.05 $\pm$ 10.35          |       |         |
| Height (m)               | A           | 1.65 $\pm$ 0.06            | 0.349 | 0.790   |
|                          | B           | 1.63 $\pm$ 0.08            |       |         |
|                          | O           | 1.62 $\pm$ 0.08            |       |         |
|                          | AB          | 1.63 $\pm$ 0.08            |       |         |
| BSA (m <sup>2</sup> )    | A           | 1.60 $\pm$ 0.12            | 0.098 | 0.961   |
|                          | B           | 1.59 $\pm$ 0.19            |       |         |
|                          | O           | 1.60 $\pm$ 0.18            |       |         |
|                          | AB          | 1.62 $\pm$ 0.15            |       |         |
| BMI (kg/m <sup>2</sup> ) | A           | 20.74 $\pm$ 3.22           | 0.472 | 0.703   |
|                          | B           | 20.86 $\pm$ 2.91           |       |         |
|                          | O           | 21.79 $\pm$ 5.10           |       |         |
|                          | AB          | 21.91 $\pm$ 4.21           |       |         |

N = 80 Statistically significant p-value\*; SD: Standard Deviation; BSA: Body Surface Area; BMI: Body Mass Index.

**Figure 2:** Distribution of ABO blood group according to body mass index.

$\chi^2 = 9.735$ , p-value = 0.372.

obese (3%) was far lower than 33.9% and 25.4% respectively that was reported by Jafari, et al. in 2012 in adult Iran population between the ages of 40-57 years [35]. The difference may be as a result of difference in age and genetic make-up. The mean body surface area gotten from the study is similar to the report of El Missiri, et al. 2016 in a study conducted among young healthy Egyptian adults [36].

From this study, the highest mean height was found in blood group A which is in line with the report of Chaitra, et al. in a study done among 120 young adults of Kasturba Medical College, Mangalore in India within the age range of 18-22 years [37]. This is in contrast with blood group B reported by Kuar in 2014 in study done among post-menopausal females between 45 to 80 years of age living in India [17]. This contrast may be due to the age difference among the participants.

Highest mean BMI was found in blood group AB which is supported by the studies of Ainee, et al., Amela, et al. and Chaitra, et al. in studies done among young adults [37-39]. The high BMI in this blood group may predispose them to metabolic syndrome. This was in contrast with a study by Jafari, et al. which reported highest BMI in blood group A [35]. ABO blood group system did not have significant effect on body anthropometric parameters (height, weight, BSA and BMI). This was in support of the report of Jafari, et al. in 2012 in a population based study of 50,045 men and women who reside in rural and urban areas of Golestan Province of Iran [35]. This was also in line with report of Chaitra, et al. in 2014 and Amela, et al. in 2017 among other studies [37,39,40]. The lowest mean BMI was in blood group A. this could be due to preference of this blood group for fruits and vegetables as earlier reported by Lam [41].

## Conclusion

Though ABO blood group has no significant effect on body anthropometric parameters but blood group AB may be predisposed to metabolic syndrome due to the higher mean of weight, BSA and BMI found in this group.

## Acknowledgement

The authors would like to thank the entire staff of Department of Physiological Sciences, Faculty of Basic Medical Sciences, Obafemi Awolowo University Ile-Ife, Nigeria for their support during the data collection, as well as the staff of the University Health Centre of Obafemi Awolowo University Ile-Ife, Nigeria during the research process.

## Funding

No fund was received for this study.

## References

1. Seeley RR, Stephens TD, Tate P (1988) Anatomy and Physiology. (4<sup>th</sup> edn), The McGraw Hill Companies, Inc, USA, 1098.
2. Watkins WM (2001) The ABO blood group system: Historical background. *Transfus Med* 11: 243-265.
3. Daniels GL (2002) Human Blood Groups. (2<sup>nd</sup> edn), Blackwell Science, Oxford, United Kingdom.
4. Puneet KK (2012) Blood transfusion in clinical practice. (1<sup>st</sup> edn), Copyright Intech open.
5. Sana Ullah, Ahmad T (2015) Distribution of ABO and Rh (D) blood groups in the population of district dir lower, Khyber Pakhtunkhwa Pakistan. *World Applied Sci J* 33: 123-135.
6. Anees M, Mirza MS (2005) Distribution of ABO and RH blood group alleles in Gujarat region of Punjab, Pakistan. *Proc Pak Acad Sci* 42: 233-238.
7. Bakare AA, Azeem MA, Agbolade JO (2006) Gene frequencies of ABO and rhesus blood groups and haemoglobin variants in Ogbomoso, south-west Nigeria. *African Journal of Biotechnology* 5: 224-229.
8. Mondal B, Maiti S, Biswas BK, Ghosh D, Paul S (2012) Prevalence of hemoglobinopathy, ABO and rhesus blood groups in rural areas of West Bengal, India. *J Res Med Sci* 17: 772-776.
9. Sheryle AW (2010) Immunohematology for medical laboratory Technicians. (1<sup>st</sup> edn), Delmar, Cengage Learning.
10. Kucevic I, Vasic J, Svorcan JZ, Radisic B (2013) Evaluation of ABO blood group distribution in Serbian patients with diabetes mellitus Type 2. *Ser J Exp Clinical Res* 14: 109-112.
11. Bener A, Yousafzai MT (2014) The distribution of the ABO blood groups among diabetes mellitus patients in Qatar. *Niger J Clin Pract* 17: 565-568.
12. Moinzadeh F, Najafabady GM, Toghiani A (2014) Type 2 diabetes mellitus and ABO/Rh blood groups. *J Res Med Sci* 19: 382.
13. Wolpin BM, Kraft P, Gross M, Helzlsouer K, Bueno-de-Mesquita HB, et al. (2010) Pancreatic cancer risk and ABO blood group alleles: Results from the pancreatic cancer cohort consortium. *Cancer Res* 70: 1015-1023.
14. Xie J, Qureshi AA, Li Y, Han J (2010) ABO blood group and incidence of skin cancer. *PLoS One* 5: e11972.
15. Bhattacharyya S, Ganaraja B, Ramesh BM (2010) Correlation between the blood groups, BMI and prehypertension among medical students. *J Chinese Clinical Medicine* 5: 78-82.
16. Nasreen AR (2006) Blood groups and hypertension. *J Bagh Coll Dentistry* 18: 68-70.
17. Kaur M (2014) Association between ABO blood group and hypertension among post-menopausal females of North India. *The Anthropologist* 17: 677-680.
18. Must A, Anderson SE (2006) Body mass index in children and adolescents: Considerations for population-based applications. *Int J Obes* 30: 590-594.
19. Ajayi OI, Akinbo DB, Okafor AM (2017) Correlation between Body Mass Index and Hematological Indices in Young Adult Nigerians with Different Hemoglobin Genotypes. *Am J Biomed Sci* 9: 38-46.
20. Billewicz WZ, Kemsley WFF, Thomson AM (1962) Indices of adiposity. *Br J Prev Soc Med* 16: 183-188.
21. Lean ME, Han TS, Bush H, Anderson AS, Bradby H, Williams R (2001) Ethnic differences in anthropometric and lifestyle measures related to coronary heart disease risk between South Asian, Italian and general population British women living in the west of Scotland. *Int J Obes Relat Metab Disord* 25: 1800-1805.
22. Yu-Cheng L, Wang JM, Wang EM (2004) The comparisons of anthropometric characteristics among four peoples in East Asia. *Appl Ergon* 35: 173-178.
23. Loos RJ, Bouchard C (2003) Obesity—is it a genetic disorder? *J Intern Med* 254: 401-425.
24. Allison DB, Kaprio J, Korkeila M, Koskenvuo M, Neale M, et al. (1996) The heritability of body mass index among an international sample of monozygotic twins reared apart. *Int J Obes Relat Metab Disord* 20: 501-506.
25. Bouchard C, Tremblay A, Després JP, Nadeau A, Lupien PJ, et al. (1990) The response to long-term overfeeding in identical twins. *N Engl J Med* 322: 1477-1482.
26. Price RA, Gottesman II (1991) Body fat in identical twins reared apart: Roles for genes and environment. *Behav Genet* 21: 1-7.

27. Speliotes EK, Willer CJ, Berndt SI, Monda KL, Thorleifsson G, et al. (2010) Association analyses of 249,796 individuals reveal 18 new loci associated with body mass index. *Nat Genet* 42: 937-948.

28. Keys A, Fidanza F, Karvonen MJ, Kimura N, Taylor HL (1972) Indices of relative weight and obesity. *J Chronic Dis* 25: 329-343.

29. Mosteller RD (1987) Simplified calculation of body surface area. *N Engl J Med* 317: 1098.

30. Mahendrappa SK, Sathyanarayana TB (2014) The normal variations in heart rate and QRS complex of healthy individuals in different age groups. *Int J Res Med Sci* 2: 861-865.

31. Johnson OE, Adedoyin RA, Awotidebe TO, Mbada CE, Otolorin OA, et al. (2013) Cardiovascular risk among Undergraduates in a Nigerian University. *Int J Public Health Epidemiol* 2: 85-89.

32. Ogunlade O, Asafa Ma (2015) pattern and prevalence of underweight, overweight and obesity among young adult Nigerians. *Am J Biomed Life Sci* 3: 12-15.

33. Ogunlade O, Asafa MA, Ayoka AO, Akintomide AO (2016) Association between body anthropometric parameters and indices of cardiac autonomic function among apparently healthy young adults. *Archives of Medicine and Health Sciences* 4: 26-29.

34. Odili VU, Egor FO, Osarenmwinda IM, Obieche AO (2014) Prevalence of overweight and obesity among pharmacy students in a university in Benin City, Nigeria. *Trop J Pharm Res* 13: 2109-2114.

35. 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. *Govares* 17: 50-54.

36. El Missiri AM, El-Meniawy KA, Sakr SA, Mohamed AS (2016) Normal reference values of echocardiographic measurements in young Egyptian adults. *The Egyptian Heart Journal* 68: 209-215.

37. Chaitra U, Bhagyalakshmi K, Vinodini N, Anupama N, Rekha DK, et al. (2014) Comparison of heart rate variability in different ABO blood groups of young adults. *International Journal of Medical Science and Public Health* 3: 1466-1469.

38. Ainee A, Hussain S, Kauser T, Qureshi TM, Nadeem M, et al. (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. *Pak J Nutr* 3: 164-167.

39. Amela H, Edina H, Snježana H, Emir H, Aldijana A, et al. (2017) Blood Group, Hypertension and Obesity in the student population of northeast Bosnia and Herzegovina. *IFMBE Proceedings* 62: 774-777.

40. Mascie-Taylor CG, Lasker GW (1990) Lack of an association between ABO and Rh blood group polymorphisms and stature, body weight, and BMI in a cohort of British women. *Hum Biol* 62: 573-576.

41. Lam M Blood Type Diet.