

ABO Blood Group System: Its Association with Anthropometric Indices among Young Adults of Yoruba Ethnicity

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MAA, OO and RAB designed this research work. Authors MAA and OO conducted the research. Authors MAA, OO, RAB, LAB, OAE, STA and KAO analysed and interpreted the data. All authors made contributions to the overall manuscript and were responsible for drafting of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: 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. Several epidemiological studies have reported that the

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distribution of different ABO blood groups vary markedly among the populations of different geographical areas reflecting racial differences.

Aims: The aim of this study was to determine the association between ABO blood group and anthropometric indices among apparently healthy young adults of Yoruba ethnicity.

Study Design: This is a cross-sectional descriptive study.

Place and Duration of Study: The study was carried out at Department of Physiological Sciences and University Health Centre, Obafemi Awolowo University, Ile-Ife between May 2016 to June 2017.

Methodology: 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 Quetelex and Mosteller formulae respectively. Chi-square was used to compare grouped data while the 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 ± 0.06 , 1.63 ± 0.08 , 1.62 ± 0.08 and 1.63 ± 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 ± 8.71 , 56.00 ± 11.21 , 57.10 ± 12.73 and 58.05 ± 10.35 ($F= 0.154$, $p= 0.927$) respectively. The mean \pm SD of BMI in kg/m^2 for blood groups A, B, O and AB were 20.74 ± 3.22 , 20.86 ± 2.91 , 21.79 ± 5.10 and 21.91 ± 4.21 ($F= 0.472$, $p= 0.703$) respectively while the mean \pm SD of BSA (m^2) for blood group A, B, O and AB were 1.60 ± 0.12 , 1.59 ± 0.19 , 1.60 ± 0.18 and 1.62 ± 0.15 ($F= 0.098$, $p= 0.961$) respectively.

Conclusion: AB Blood group may be predisposed to metabolic syndrome due to the higher mean of weight, BSA and BMI found in this group.

Keywords: ABO blood groups; anthropometry; apparently healthy; young adults; ethnicity.

ABBREVIATIONS

ANOVA : Analysis of Variance; BMI: Body Mass Index

BSA : Body Surface Area

EDTA : Ethylene Diamine Tetraacetic Acid

WHO : World Health Organisation.

1. 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 varies 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. Anthropometry is the scientific study of the measurements and proportions of the human body. It can also be explained as a branch of anthropology dealing with measurement of the human body to determine differences in individuals and groups; especially for the purpose of classification and comparison [18]. Body mass index (BMI) is regarded as most popular among the anthropometric indices. It is an internationally accepted index for assessing obesity [19,20]. BMI is a measure of weight adjusted for height, calculated as weight in kilograms divided by the square of height in meters [20]. Age and ethnicity had been reported to play a 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 apparently healthy young adults of Yoruba ethnicity in Nigeria, hence this study.

2. MATERIALS AND 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 was 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. Eighty participants were purposively selected using Estimated sample size was determined using STATA statistical software (version 10) formula for estimation of sample size studies;

$$N = (4 \times \sigma^2 (Z_{crit} + Z_{pwr})^2 / D^2)$$

Where,

N = Total number of sample size,
 $\sigma = 0.05$,
 Z_{crit} = Standard normal deviate corresponding to selected significance criteria. It is a constant factor and it equals to 1.960
 Z_{pwr} = Standard normal deviate correspondence to selected statistical power. It is a constant factor and equal to 1.282,
 D = the effect size of 4% = 0.04.

$$N = \frac{4 \times (0.05)^2 (1.960 + 1.282)^2}{(0.04)^2} = 65$$

N was rounded up to 80 which was equally divided among the four groups.

Blood samples were obtained from a 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 the 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, $BSA = [(\text{weight in kg} \times \text{height in cm}) / 3600]^{1/2}$ [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 (A, B, AB and O) was done using Analysis of Variance (ANOVA). Comparison of grouped data was done using chi-square. A p value of < 0.05 was taken as statistically significant.

3. 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 kg/m^2 were 21.50 ± 3.52 (18-28), 56.83 ± 10.67 (39-95), 1.63 ± 0.07 (1.48-1.81), 1.60 ± 0.14 (1.30 ± 2.08), 21.33 ± 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 (Fig. 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 Fig. 2.

4. DISCUSSION

The mean weight (56.83 ± 10.67 kg) obtained from this study was similar to 56.37 ± 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 inconsistency 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 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 the 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 a 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

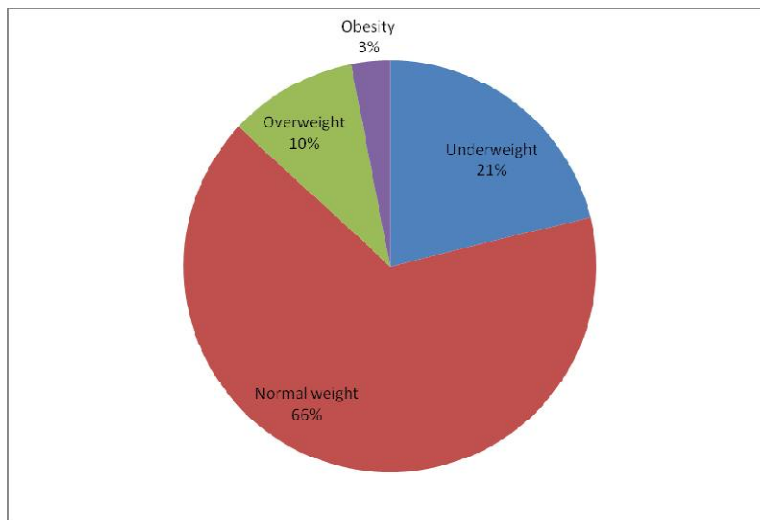


Fig. 1. Distribution of body mass index

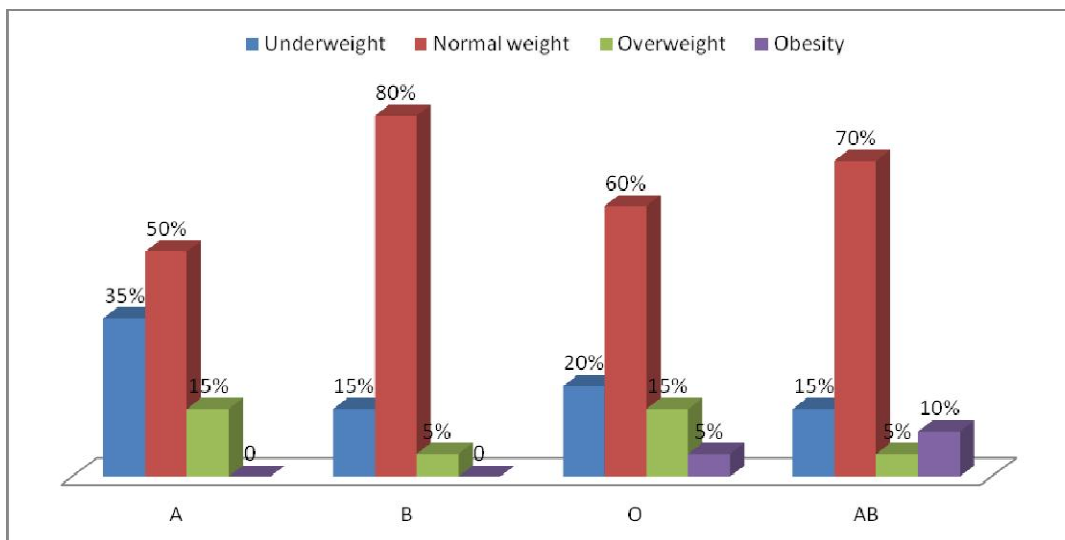


Fig. 2. Distribution of ABO blood group according to body mass index

$\chi^2 = 9.735, p\text{-value} = 0.372$

Table 1. Relationship between ABO blood group and anthropometric parameters

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

*N=80. Statistically significant p-value- *
SD- standard deviation, BSA- body surface area, BMI- body mass index*

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 the highest BMI in blood group A [35]. ABO blood group system did not have a 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 the 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 the preference of this blood group for fruits and vegetables as earlier reported by Lam [41]. It was also found that blood group AB has the highest percentage of participants with obesity (10%) when compared with other blood groups. This corroborates the findings shown in Table 1.

5. CONCLUSION

The mean ± SD and range of age in years, weight in kg, height in metres, body surface area in metre square, body mass index in kg/m² were 21.50 ± 3.52 (18-28), 56.83 ± 10.67 (39-95), 1.63 ± 0.07 (1.48-1.81), 1.60 ± 0.14 (1.30 ± 2.08), 21.33 ± 3.92 (15.42-38.54) respectively. This study showed that 12% were underweight, 66%

had had normal weight, 10% had overweight and 3% had obesity. The highest mean weight, body surface area and body mass index were found in blood group AB. Though ABO blood group has no significant effect on body anthropometric parameters blood group AB may be predisposed to metabolic syndrome due to the higher mean of weight, BSA and BMI found in this group.

CONSENT

Written informed consent was obtained from each participant.

ETHICAL APPROVAL

Ethical approval for this study was obtained from the Institute of Public Health of the Obafemi Awolowo University, Ile-Ife.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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