



Impact of different blood groups on body mass index and blood pressure

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ABSTRACT

Obesity is considered as a public health problem that affects all age groups in the population. Genetic factors are considered as one of the non-modifiable risk factors, causing obesity. Hypertension is a chronic medical condition that is associated with vague symptoms. The ABO blood type is one of the fundamental genetic factors that can give important information for early detection of risky population. This study aimed to evaluate the impact of different blood groups on body mass index and blood pressure. The design of this study is a cross-sectional study, included 250 participants (144 males and 106 females), aged between 18-70 years were selected from the population of Al-Najaf Governorate, Iraq, through a period which extends from October 2019 to February 2020. The blood groups were determined for each participant; blood pressure and body mass index were also measured. The results of a current study revealed that from this 250 participants there was 115 were obese person, 82 were overweight person, 51 were normal weight, and 2 were underweight persons. In the obese group, the blood group B has the highest percentage (45.2%) followed by blood group A and O that were found to have the same percentage (22.6%), while the blood group AB has the lower percentage (9.6%). On the other hand, there was no significant relationship between hypertension and ABO blood groups.

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INTRODUCTION

One of the most developing problems in the world is obesity; many of the studies showed that obesity occurs in about one third or more of the populations (Ng *et al.*, 2013). Obesity can be defined as the accumulation of the abnormal or excessive

amount of fats in the body and causing many medical problems in the body. Body mass index (BMI) is considered as a simple index for obesity and when the body mass index of a person is equal or greater than 30 kg/m², in this case, considered as an obese person (WHO, 2006). For obesity and overweight, there are many causes. Still, the most common causes are overeating of food or eating food with high fats and calories, reduction of physical activity, little or excess sleep both cases cause many of hormonal changes, and these changes cause many of the effects on the appetite and metabolism in addition to genetic factors (Qadir *et al.*, 2018). The obesity is considered as a risk factor for many of disease such as particular type of cancer (Polednak, 2008), cardiovascular disease (Flint *et al.*, 2010), and type 2 Diabetes (Lozano *et al.*, 2010).

Hypertension is a significant health problem and one of the most common life-threatening non-communicable disease, that is caused by many fac-

Table 1: Distribution of body mass index (BMI) categories according to the type of blood group

Blood groups	A	No. (%)	AB	O	Total	p value
BMI categories	No. (%)		No. (%)	No. (%)	No. (%)	
Underweight	0 (0.0%)	0 (0.0%)	2 (100%)	0 (0.0%)	2 (100%)	0.0001
Normal	11 (21.6%)	0 (0.0%)	10 (19.6%)	30 (58.8%)	51 (100%)	
Overweight	4 (4.9%)	32 (39%)	9 (11.0%)	37 (45.1%)	82 (100%)	
Obese	26 (22.6%)	52 (45.2%)	11 (9.6%)	26 (22.6%)	115 (100%)	
Total	41 (16.4%)	84 (33.6%)	32 (12.8%)	93 (37.2%)	250 (100%)	

Table 2: Distribution of age groups according to the type of blood group

Blood groups	A+	B+	AB+	O+	B-	O-	Total	p value
Age groups	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
15-24 years	9 (21.4)	9 (21.4)	5 (11.9)	18 (42.9)	0 (0.0)	1 (2.4)	42 (100.0)	0.046
25-34 years	9 (20.9)	9 (20.9)	3 (7.0)	21 (48.8)	0 (0.0)	1 (2.3)	43 (100.0)	
35-44 years	30 (41.1)	14 (19.2)	8 (11.0)	19 (26.0)	2 (2.7)	0 (0.0)	73 (100.0)	
45-54 years	10 (23.8)	5 (11.9)	12 (28.6)	13 (31.0)	2 (4.8)	0 (0.0)	42 (100.0)	
55-64 years	5 (15.2)	8 (24.2)	2 (6.1)	15 (45.5)	2 (6.1)	1 (3.0)	33 (100.0)	
65-74 years	6 (35.3)	5 (29.4)	2 (11.8)	4 (23.5)	0 (0.0)	0 (0.0)	17 (100.0)	
Total	69 (27.6%)	50 (20.0%)	32 (12.8%)	90 (36.0%)	6 (2.4%)	3 (1.2%)	250 (100.0)	

Table 3: Gender distribution according to the type of blood group

Blood groups	A+	B+	AB+	O+	B-	O-	Total	p value
Gender	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
Males	44 (30.6)	25 (17.4)	11 (7.6)	56 (38.9)	6 (4.2)	2 (1.4)	144 (100.0)	0.005
Females	25 (23.6)	25 (23.6)	21 (19.8)	34 (32.1)	0 (0.0)	1 (0.9)	106 (100.0)	
Total	69 (27.6)	50 (20.0)	32 (12.8)	90 (36.0)	6 (2.4)	3 (1.2)	250 (100.0)	

Table 4: Distribution of blood pressure (BP) categories according to the type of blood group

Blood groups BP categories	A+ No. (%)	B+ No. (%)	AB+ No. (%)	O+ No. (%)	B- No. (%)	O- No. (%)	Total No. (%)	p value
Normal No. (%)	4 (30.8)	0 (0.0)	3 (23.1)	6 (46.2)	0 (0.0)	0 (0.0)	2 (100.0)	0.518
Prehypertension No. (%)	45 (28.7)	33 (21.0)	18 (11.5)	54 (34.4)	5 (3.2)	2 (1.3)	51 (100.0)	
Hypertension No. (%)	20 (25.0)	17 (21.3)	11 (13.8)	30 (37.5)	1 (1.3)	1 (1.3)	82 (100.0)	
Total No. (%)	69 (27.6)	50 (20.0)	32 (12.8)	90 (36.0)	6 (2.4)	3 (1.2)	250 (100.0)	

tors such as, obesity, high cholesterol, sedentary lifestyle, high fat and low dietary fibre food (Tas-saduqe et al., 2004). Hypertension can be divided into primary (essential) and secondary hypertension, in primary hypertension, there is no known cause for it, and it accounts for about 90% of all cases of hypertension. While, in secondary hypertension, there are many of the factors that cause it, and these factors may be a cardiac, endocrine or renal disease. It accounts for about 10% of hypertension cases (Gyton and Hall, 2011).

Blood types of blood groups are classified into four groups by depending on the presence or absence of inherited antigenic substances on the surface of red blood cells. These antigenic substances are different according to the blood group system so that they may be proteins, carbohydrate, glycoproteins or glycolipids (Cusack et al., 2013). These antigens (in addition to red blood cells) are also found in other different cells, such as platelets, endothelium and epithelium of vessels in addition to the saliva and other fluids of the body (Hosoi, 2008). Landsteiner is the first to discover of the ABO blood system in 1901, and this system is considered as the most important system and is found on chromosome 9 and encoded by gene 1 (Qadir and Malik, 2010).

The second type of blood group system is the Rhesus system. This system is important in the transfusion of blood in a human, antigen of this system or Rh factor called D. So when the person has Rh factor is called Rh-positive, while if the person does not have this factor called Rh negative (Qadir and Iqbal, 2018). The clinical importance of ABO blood type is extended outside transfusion reaction or solid organ transplantation, because different studies found that there are several associations between ABO blood groups and different disease, such as gastric cancer (Hajj et al., 2007), myocardial infarction in the presence of coronary artery atherosclerosis, Diabetes mellitus (Kamil et al., 2010), sexual matu-

rity (Dai et al., 2014), breast cancer (Payandeh et al., 2015), hypertension (Hercegovac et al., 2017).

The present study aimed to evaluate the impact of different blood groups on the body mass index and blood pressure.

MATERIALS AND METHODS

The current study is a cross-sectional study involved 250 subjects (144 males and 106 females), ranging in age from 18 to 70 years were selected from the population of Al-Najaf Governorate, Iraq, through a period which extends from October 2019 to February 2020. To calculate the body mass index (BMI), the participant's weight and height were measured by using weight and height scale. The participants were divided into four categories according to their body mass index: Underweight (BMI < 18.5 kg/m²), Normal (18.5-24.9 kg/m²), Overweight (25-29.9 kg/m²) and Obese (≥ 30 kg/m²) (WHO, 2006). Blood pressure was measured by using a standard manual mercury sphygmomanometer in a sitting position. The participants were divided into three categories according to their blood pressure: Normal (<120/<80 mmHg), Prehypertension (120-139/80-89 mmHg) and Hypertension ($\geq 140/\geq 90$ mmHg) (Whelton et al., 2018). Some information was taken from every participant in this study such as name, age and according to their age participants divided into six categories: (15-24 years; 25-34 years; 35-44 years, 45-54 years; 55-64 years, 65-74) and sex, besides, the blood group was determined for each one by standard methods using antigen-antibody reaction and according to the blood groups the participant divided into four groups (A, B, AB and O blood group).

Statistical analysis

Statistical analysis was done by using SPSS (statistical package for social science) version 18. Using Frequency, percentage, chi-square test and P-

value. When P value < 0.05 was considered significant (Daniel, 2013).

RESULTS AND DISCUSSION

Table 1 indicate that there was a highly significant difference in the distribution of body mass index (BMI) categories according to the type of blood group (P-value = 0.0001). From the total 250 subjects, there was 115 (46%) obese, 82 (32.8%) overweight, 51(20.4%) normal and 2(0.8%) underweight. In obesity, blood group B was the most common, followed by O, A, and AB. While in overweight subjects, blood group O the most common, followed by B, AB and A. in normal weight, blood group O the most common, followed by A and AB and no blood group B in this group. Finally, underweight status occurs in the AB blood group only.

Table 2 results showed that there is a significant difference in the distribution of age, according to the type of blood groups (P-value = 0.046). The subjects in the age group of 35-44 years contain the highest number (73), then the group of 25-34 years contain (43) subject, age groups (45-54 and 15-2years) contains the same numbers (42), groupage (55-64 years) contains (33) subjects and group (65-74 years) contains the lowest number of subjects (17).

Also, the results of the study showed that there is a significant difference in the distribution of gender according to the type of blood groups (P-value =0.005), as shown in Table 3. Males with blood group O⁺ (56) was the most common group, followed by males with blood group A⁺ (44), then females having blood group O⁺ (34), then males having blood group B⁺ and females of blood groups A⁺ and B⁺ have the same numbers (25), while females with the AB⁺ blood group has (21) subjects and males with blood group AB⁺ has (11) subjects. Finally, males with blood groups B⁻ and O⁻ and females with blood group O⁻ have the lowest numbers (6, 2 and 1), respectively.

Finally, there are no significant differences in the distribution of blood pressure according to the type of blood groups (P-value = 0.518), as shown in Table 4 below.

Obesity is a chronic disease caused by a combination of many factors like genetic, environmental, metabolic, physiological and psychological factors. In the current study, obese subjects have the highest numbers of participants followed by overweight, normal and underweight. Obesity (BMI \geq 30) was found in subjects with blood group B followed by O, A and AB (Table 1). These findings are com-

patible with (Abdollahi *et al.*, 2009; Chandra and Gupta, 2012; Rai and Sapkota, 2017). Their studies came up with the fact that that blood group B was more susceptible to obesity followed by O, A and AB. Other studies (Siva *et al.*, 2012; Jadhav *et al.*, 2015) found that obesity was common in blood group O, while a study by (Jafari *et al.*, 2012) showed that the prevalence of obesity occurs in blood group A and study by (Hercegovac *et al.*, 2017) showed that subjects with AB blood group have the highest average value of BMI. While, studies done by (Aboel-Fetoh *et al.*, 2016; Smith *et al.*, 2018) showed no statistically significant association between obesity and blood groups. The results of the current study suggest that blood group B might be more predisposed genetically to obesity than other blood groups. Also, the obesity is considered to be an inflammatory disease (Faber *et al.*, 2009) and some other studies suggest that the antigens of blood groups may have a regulatory role in inflammation (Liumbruno and Franchini, 2013) and this may be linked to obesity.

The results of the study showed that there is a significant difference in the distribution of age, according to the type of blood groups (P-value <0.05) (Table 2). This outcome occurs because most of the participants are collected from Kufa university workers, and most of these workers lie at this age.

Study findings showed that there is a significant difference in the distribution of gender according to the type of blood (Table 3). Males have a higher number of participants than females. Males with blood group O⁺ was the most common group, while female and male with AB⁺ blood group was the less common group. These findings may occur because, in the Iraqi population, the blood group O was the most common group followed by A, B and AB (Jaff, 2010; Saleh and Abood, 2016). On the other hand, a study by (Smith *et al.*, 2018) observed that there is no significant difference regarding the association of ABO blood group with gender.

Hypertension is one of the critical health problems, and many patients are unaware of this health issue Tassaduq *et al.* (2004). In the current study, no significant difference was found in the distribution of blood pressure, according to the type of blood groups (Table 4). While, some other study found that blood group A was more susceptible to hypertension (Hercegovac *et al.*, 2017). These differences may be attributed to the differences in local factors such as geographical factors; in addition to sample size.

CONCLUSIONS

In conclusion, our results suggest that the relative risk of obesity was found to be higher in blood group B, and the blood group B has the highest tendency to develop obesity than other groups.

Recommendations

More studies needed with increased sample size, in addition to different geographical areas and populations should be included.

Conflict of interest

The authors declared that they have no competing interests.

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