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

Rawa Hadi Shareef¹, Basim A. Abd², Zahraa Fathi Sharba¹

¹Department of Pharmacology and Toxicology, College of pharmacy-University of Kufa, Iraq
²Department of Medical Physiology, College of Medicine-University of Babylon, Iraq

**Article History:**
Received on: 28 Jul 2020
Revised on: 12 Aug 2020
Accepted on: 31 Aug 2020

**Keywords:**
Obesity, body mass index, blood groups, blood pressure

**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.

*Corresponding Author
Name: Rawaa Hadi Shareef
Phone: +9647811400952
Email: rawaah.alsaabary@uokufa.edu.iq

ISSN: 0975-7538
DOI: [https://doi.org/10.26452/ijrps.v12i1.3967](https://doi.org/10.26452/ijrps.v12i1.3967)

**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 BMI categories | A No. (%) | AB No. (%) | O No. (%) | Total No. (%) | p value |
|----------------------------|-----------|------------|-----------|---------------|---------|
| Underweight                | 0 (0.0%)  | 2 (100%)   | 0 (0.0%)  | 2 (100%)      | 0.0001  |
| No. (%)                    | 11 (21.6%)| 10 (19.6%) | 30 (58.8%)| 51 (100%)     |
| Normal                     | 4 (4.9%)  | 9 (11.0%)  | 37 (45.1%)| 82 (100%)     |
| Overweight                 | 26 (22.6%)| 11 (9.6%)  | 26 (22.6%)| 115 (100%)    |
| Obese                      | 41 (16.4%)| 32 (12.8%) | 93 (37.2%)| 250 (100%)    |
| Total No. (%)              | 69 (27.6%)| 50 (20.0%) | 90 (36.0%)| 250 (100%)    |

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

| Blood groups Age groups | A+ No. (%) | B+ No. (%) | AB+ No. (%) | O+ No. (%) | B- No. (%) | O- No. (%) | Total No. (%) | p value |
|-------------------------|------------|------------|-------------|------------|------------|------------|---------------|---------|
| 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   |
| No. (%)                 | 44 (30.6)  | 25 (17.4)  | 11 (7.6%)   | 56 (38.9)  | 6 (4.2%)   | 2 (1.4%)   | 144 (100.0)   |
| 25-34 years             | 9 (20.9%)  | 9 (20.9%)  | 3 (7.0%)    | 21 (48.8)  | 0 (0.0%)   | 1 (2.3%)   | 43 (100.0)    |
| No. (%)                 | 25 (17.4)  | 25 (17.4)  | 12 (7.6%)   | 34 (32.1)  | 0 (0.0%)   | 1 (0.9%)   | 106 (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)    |
| No. (%)                 | 10 (11.9)  | 5 (11.9)   | 12 (28.6)   | 13 (31.0)  | 2 (4.8%)   | 0 (0.0%)   | 42 (100.0)    |
| 45-54 years             | 5 (15.2)   | 5 (15.2)   | 2 (6.1%)    | 15 (45.5)  | 2 (6.1%)   | 1 (3.0%)   | 33 (100.0)    |
| No. (%)                 | 5 (15.2)   | 5 (15.2)   | 2 (6.1%)    | 15 (45.5)  | 2 (6.1%)   | 1 (3.0%)   | 17 (100.0)    |
| 55-64 years             | 6 (35.3)   | 5 (29.4)   | 2 (11.8%)   | 4 (23.5)   | 0 (0.0%)   | 0 (0.0%)   | 25 (100.0)    |
| No. (%)                 | 10 (20.0)  | 50 (20.0)  | 32 (12.8%)  | 90 (36.0)  | 6 (2.4%)   | 3 (1.2%)   | 250 (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)   |

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

| Blood groups Gender | A+ No. (%) | B+ No. (%) | AB+ No. (%) | O+ No. (%) | B- No. (%) | O- No. (%) | Total No. (%) | p value |
|---------------------|------------|------------|-------------|------------|------------|------------|---------------|---------|
| Males               | 44 (30.6)  | 25 (17.4)  | 11 (7.6%)   | 56 (38.9)  | 6 (4.2%)   | 2 (1.4%)   | 144 (100.0)   | 0.005   |
| No. (%)             | 25 (17.4)  | 25 (17.4)  | 11 (7.6%)   | 56 (38.9)  | 6 (4.2%)   | 2 (1.4%)   | 144 (100.0)   |
| Females             | 25 (23.6)  | 25 (23.6)  | 21 (19.8)   | 34 (32.1)  | 0 (0.0%)   | 1 (0.9%)   | 106 (100.0)   |
| No. (%)             | 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)   |
| No. (%)             | 69 (27.6)  | 50 (20.0)  | 32 (12.8%)  | 90 (36.0)  | 6 (2.4%)   | 3 (1.2%)   | 250 (100.0)   |
other liquidsof the body (epithelium of vessels in addition to the saliva and different cells, such as platelets, endothelium and addition to red blood cells) are also found in other

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

| Blood groups | 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) |         |

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 (≥140/≥90 mmHg) (Whelton et al., 2018). Some information was taken from every participant in this study such as 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 15-2 years) contains the same numbers (42), group age (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 have (11) subjects. Finally, males with blood groups $B^-$ and $O^-$ and females with blood group $O^-$ have the lowest number (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 compatible 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 Tassaduqe 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.

Financial support

The authors declare that they have no funding support for this study.

Acknowledgement

The authors would like to thank all volunteer participants in this study for their kind permission, time and understanding, which made this study possible.

REFERENCES

Abdollahi, A., Qorbani, M., Salehi, A., Mansourian, M. 2009. ABO blood group distribution and cardiovascular major risk factors in healthy population. *Iranian J Publ Health*, 38(3):123–126.

Aboel-Fetoh, N., Alanazi, A., Alanazi, A., Alruwili, A. 2016. ABO blood groups and risk for obesity in Arar, Northern Saudi Arabia. *J Egypt Public Health Assoc*, 91(4):169–173.

Chandra, T., Gupta, A. 2012. Association and distribution of hypertension, obesity and ABO blood groups in blood donors. *Iranian J. Pediatric Hematology and Oncology*, 2(4):140–145.

Cusack, L., Buck, E. D., Compernolle, V., Vandekerckhove, P. 2013. Blood type diets lack supporting evidence: a systematic review. *The American Journal of Clinical Nutrition*, 98(1):99–104.

Dai, Y. L., Fu, J. F., Liang, L., Gong, C. X., Xiong, F., Luo, F. H., Liu, G. L., Chen, S. K. 2014. Association between obesity and sexual maturation in Chinese children: a multicenter study. *International Journal of Obesity*, 38(10):1312–1316.

Daniel, W. 2013. Biostatistics: A foundation for analysis in the health science. *John Wiely. Philadelphia.*

Faber, D. R., de Groot, P. G., Visseren, F. L. J. 2009. Role of adipose tissue in haemostasis, coagulation and fibrinolysis. *Obesity Reviews*, 10(5):554–563.

Flint, A. J., Hu, F. B., Glynn, R. J., Caspard, H., Manson, J. E., Willett, W. C., Rimm, E. B. 2010. Excess Weight and the Risk of Incident Coronary Heart Disease Among Men and Women. *Obesity*, 18(2):377–383.

Gyton, Hall 2011. *Textbook of medical physiology*. 12th edition.

Hajj, I. I. E., Hashash, J. G., Baz, E. M. K., Abdul-Baki, H., Sharara, A. I. 2007. ABO Blood Group and Gastric Cancer: Rekindling an Old Fire? *Southern Medical Journal*, 100(7):726–727.

Hercegovac, A., Hajdarević, E., Hodžić, S. 2017. Blood group, hypertension, and obesity in the student population of Northeast Bosnia and Herzegovina. *Springer*, 62.

Hosoi, E. 2008. Biological and clinical aspects of ABO blood group system. *The Journal of Medical Investigation*, 55(3,4):174–182.

Jadhav, L. R., S. T. K., L. R. D. M. 2015. A Relationship Between BMI And Blood Pressure Among First Year Mbbs Students Of Mysore Medical College And Research Institute. *Journal of Evidence Based Medicine and Healthcare*, 2(10):1478–1484.

Jafari, E., Sebghatollahi, V., Kolahdoozan, S. 2012. Body Mass Index and ABO Blood Groups among different ethnicities of the Golestan Cohort Study Subjects. *Govares*, 17(1):50–54.

Jaff 2010. ABO and rhesus blood group distribution in Kurds. *Journal of Blood Medicine*, 1:143–143.

Kamil, M., Al-Jamal, H. A. N., Yusoff, N. M. 2010. Association of ABO blood groups with diabetes mellitus. *Libyan Journal of Medicine*, 5(1):4847–4847.

Liumbruno, G., Franchini, M. 2013. Beyond immunohaematology: the role of the ABO blood group in human diseases. *Blood Transfuse*, 11(4):491–499.

Lozano, R., Naghavi, M., Foreman, K., et al. 2010. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study. *The Lancet*, 380(9859):2095–2128.

Ng, M., Fleming, T., Robinson, M., et al. 2013. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study. *The Lancet*, 380(9859):2095–2128.

Payandeh, M., Shazad, Babak, Sadeghi, M. 2015. Association between of BMI and blood groups with breast cancer incidence among women of west Iran: a case-control study. *Am. J. Cancer Prev*, 3(3):65–67.

Polednak, A. P. 2008. Estimating the number of U.S. incident cancers attributable to obesity and the impact on temporal trends in incidence rates for obesity-related cancers. *Cancer Detection and Pre-
vention, 32(3):190–199.

Qadir, M., Iqbal, S. 2018. Different Blood Groups Have Different Obesity Levels. Current Trends on Biotechnology and Microbiology.

Qadir, M., Malik, S. 2010. Comparison of alterations in red blood cell count and alterations in hemoglobin concentration in patients suffering from rectal carcinoma undergoing 5-fluorouracil and folic acid therapy. Pharmacology online, 3:240–243.

Qadir, M., Noor, A., Anemia 2018. Rare & Uncommon Diseases. Cambridge Scholars Publishing, Newcastle, England.

Rai, K., Sapkota, J. 2017. Relation of ABO blood group and hypertension in medical students of Kathmandu medical college, Duwakot Bhaktapur. Int. J. Sci. Res, 6(11):177–180.

Saleh, S., Abood, A. 2016. Rh (D) Blood Groups’ Distribution and Gene Frequencies in North Baghdad m Population-Iraq. International Journal of Scientific & Engineering Research, 7(8):581–584.

Siva, K., Umesh, P., Satyanarayana, P. 2012. Correlation between obesity & ABO blood group in school going children in India. Indian J Basic Appl Med Res, 1(4):280–284.

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, 2018:1–6.

Tassaduqe, K., Ali, M., Salam, A., et al. 2004. Hypertension in Relation to Obesity, Smoking, Stress, Family history, Age and Marital Status among Human Population of Multan, Pakistan. Journal of Medical Sciences(Faisalabad), 4(1):30–35.

Whelton, P., Carey, R., Aronow, W. 2018. A Guideline for the prevention, detection, evaluation, and management of high blood pressure in adults. Hypertension, 71:13–115.

WHO 2006. BMI Classification, Global Database on Body Mass Index.