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Relationship of Blood Groups to the Incidence of Hyperuricemia and Hyperglycemia

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Abstract

Several experiments have been carried out to estimate the relationship between blood grouping types and the occurrence of diabetes, but not hyperuricemia. The effects of the potential correlation between the ABO blood groups and the incidence of these cases have been recorded in this study. The aim of this study is to see whether there is a connection between ABO blood groups and the occurrence of hyperuricemia and hyperglycemia among samples of Iraqi patients. This research was carried out in Educational Laboratories/Medical City (Baghdad Governorate). The research was carried out of the ABO blood with age range (40-70) years, ABO blood group was performed by the sliding method, while uric acid and glucose blood levels were measured by utilizing an enzymatic procedure. There are significant differences in the levels of uric acid between blood groups (A and AB) and blood groups (A and O), while the levels of serum glucose were highly significant between blood groups (B and AB) and blood groups (AB and O). It is concluded that blood groups type AB could be the most vulnerable to the occurrence of hyperuricemia and hyperglycemia. However, further investigations with consideration to Rhesus factor Rh are required.

Keywords: ABO; Blood Sugar; Diabetes Mellitus; Glucose; Uric Acid

1. Introduction

The concept "blood group" contributes to the whole blood group system, which contains antigens found on red blood cells (RBCs) whose specificity is regulated by gene sequences that may be allelic or quite closely related on the same chromosome. The concept "blood type" relates to a specific pattern of antisera tests within a system; our understanding of blood types has expanded significantly to involve not only transfusion-related concerns, but also complicated disease interactions with RBC surface antigens. Karl Landsteiner is credited with discovering the ABO blood group system in 1900 [1]. The ABO system is studied in a wide range of research areas, and it is often referred to as the histo-blood group system rather than the blood group system. ABO matching is important not only in blood transfusion but also in cell, tissue, and organ transplantation since these antigens occur in the cells other than RBCs, the ABO blood groups are used in forensic science in the study of criminal scenes evidence of victims such as blood, spit, semen, and even hairs [2].

The ABO blood types have a major impact on hemostasis [3]. According to a certain theory, hereditary predispositions such as the "ABO" blood group are related to the prevalence of disorders such as diabetes type 2 [4].

Hyperglycemia is described as blood glucose levels of more than 125 mg/dL when fasting and more than 180 mg/dL two hours after eating. With fasting plasma glucose of 100 mg/dL to 125 mg/dL, a patient has reduced glucose metabolism or pre-diabetes. A patient is diagnosed as diabetic if his or her fasting blood glucose level is more than 125 mg/dL [5, 6].

When hyperglycemia is left uncontrolled, it can cause damage to the eye, kidneys, nerves, heart, and peripheral vascular system, among other possible life-threatening complications. To avoid diabetes complications and increase health outcomes, it is important to treat hyperglycemia safely and efficiently [7].

Nomenclature			
Rh	Rhesus factor	NS	Non–Significant
RBCs	Red Blood Cells	S	Significant
SPSS	Statistical Package for the Social Sciences	HS	Highly Significant
SD	Standard Deviation	mg/dL	Milligrams per decilitre
CS	Coefficient Significance	nm/fluorometric	Nanometer per fluorometric

Hyperuricemia is a prevalent condition that affects people in all ages and genders. Hyperuricemia is described as a high level of uric acid in the blood (the normal upper limit is 6.8 mg/dL, so anything over 7 mg/dL is considered saturated), which may result in symptoms. This high level is caused by a rise in uric acid consumption versus synthesis, a decrease in uric acid excretion, or a combination of the two [8].

Genetics, insulin resistance, iron overload, hypertension, hypothyroidism [9], chronic renal disease, obesity, diet, diuretics (e.g. thiazides, loop diuretics), and excessive alcoholic beverage [10] intake are all variables that lead to hyperuricemia. The most crucial of these is alcohol consumption [11].

Hyperuricemia may be divided into three functions of groups: increased uric acid synthesis, reduced uric acid elimination, and mixed type. High purine values in the diet and enhanced purine metabolism are two factors that contribute to higher output. Kidney illness, some medications, and struggle for excretion between uric acid and other molecules are all causes of reduced excretion. High amounts of alcohol and/or sugar in the diet, as well as hunger, are all possible reasons [12].

Hyperuricemia can cause both gout and nephrolithiasis. Metabolic syndrome, diabetes mellitus, cardiovascular disease, and kidney disease have also been related to it [13]. To test whether the ABO blood group related to the incidence of hyperglycemia and hyperuricemia we assessed its impact on the patients with high glucose and uric acid blood levels.

2. Materials and Methods

2.1. Chemicals

A coupled enzyme reaction determines the concentration of uric acid, resulting in a colorimetric 570 nm/fluorometric effect. Uric Acid Assay Kit was used from Sigma-Aldrich Co., USA. Enzymatic colorimetric determination of glucose is achieved by Glucose Assay Kit from Sigma-Aldrich Co., USA. Agglutination test were done by using Blood Group Test Kit Biolab, Mumbai, Maharashtra, India.

2.2. Study design

This research is a correlational study looking for the relationship between uric acid and glucose variables with blood groups and carried out in Educational Laboratories/Medical City (Baghdad Governorate) during the period September/ 2020 to February/ 2021. Eighty-eight volunteers were participated in this study, after checking laboratory tests of uric acid and glucose blood levels for all participants, 40 volunteers only with high levels of uric acid and glucose were included and the rest (48) participants with low or normal levels of uric acid and glucose were excluded, the ages range of included participants were 40-70 in both genders were enrolled to this study, then the ABO blood group were achieved by sliding method for a blood group test. The study is approved by the Ethics Committee of Educational Laboratories/Medical City.

2.3. Statistical analysis

Descriptive data analysis such as frequencies, and percentages Mean and Standard deviation was followed. Independent samples T- test was used to compare between two nominal variables. A significance level of α=0.05 was used in the test. SPSS 24 program was used to analyze current data.

3. Results

The results in this study showed that from the total number 40 patients with different blood groups, the ABO blood group type O was predominant than others in the studied group, there were 15 blood group type O, 14 blood group type B, 9 blood group type A and 2 blood group type AB in which presented in Table 1.

The result presented in table 2 were shown the mean value and standard deviation SD of uric acid and glucose according to ABO blood groups, as the following: blood group type A the mean was 7.78, and SD 0.50, blood group type B, the mean was 8.12 and SD 1.66, blood group type AB the mean was 10.0 and SD 2.83, and blood group type O, the mean was 8.87 and SD 1.43 from this table we noticed that blood group type AB is the most blood group that may affected to the incidence of hyperglycemia and hyperuricemia, the mean was 10.0, otherwise statistically this is non-significant.

Table 3 showed a comparison between ABO blood groups with uric acid and glucose levels, blood group type A+B showed non-significant differences with a p-value 0.556 and 0.722 with uric acid and glucose respectively. While blood group type A+AB was significant with a p-value 0.025 and 0.052 with uric acid and glucose respectively. Blood group type A+O showed significant differences with uric acid, p-value 0.040 and non-significant differences with glucose p-value 0.290. On the other hand, blood group type B+AB was non- significant with uric acid; p-value 0.182, but highly significant with glucose; p-value 0.008. Blood group type B+O was non-significant both with uric acid and glucose, p-values 0.206, 0.385 respectively. Finally, blood group type AB+O was non-significant with uric acid; p-value 0.351, but highly significant with glucose; p-value 0.002. These results could confirm the possibility that blood group type AB is the most affected one by diseases.

Table 4 revealed a comparison between gender according to uric acid and glucose, first of all, the males were predominant than females in this study in which they were 26 out of 40 as compared with females 14 out of 40. The p-values of both genders showed non-significant to uric acid and glucose 0.689, 0.534 respectively.

Distribution of blood groups according to ages were presented in table 5, blood group type A with total no. of 9 distributed as 3, 2, 4 in age groups of 40-49, 50-59, 60-70 respectively. Whereas blood group type B with total no. of 14 distributed as 5, 5, 4 in age groups of 40-49, 50-59, 60-70 respectively. On the other hand, blood group type AB with a total no. of 2 existed only in the 60-70 age group. Finally, blood group type O with total no. of 15 distributed as 6, 6, 3 in age groups of 40-49, 50-59, 60-70 respectively.

Distribution of blood groups according to gender were presented in table 6, types A, B, AB, and O of blood were distributed as 6, 3, 6, 8, 2, 0 and 12, 3 in gender groups of male, female respectively. The predominance for males was found in all blood groups except type B in this study, males of blood group type O in particular.

Table 1 Distribution of blood groups in studied group

ABO	No.	%
A	9	22.5
B	14	35.0
AB	2	5.0
O	15	37.5
Total	40	100.0

Table 2 The Mean value of uric acid and glucose according to ABO Blood groups

	ABO	No.	Mean	SD
Uric Acid	A	9	7.78	0.50
	B	14	8.12	1.66
	AB	2	10.00	2.83
	O	15	8.87	1.43
Glucose	A	9	211.33	96.08
	B	14	198.36	76.29
	AB	2	374.00	62.23
	O	15	174.07	71.87

SD: Standard Deviation

Table 3 Comparison between ABO blood groups with uric acid and glucose

	ABO	t-test	*P*-value	C.S*
Uric Acid	A & B	0.598	0.556	P>0.05 (NS)**
	A & AB	2.695	0.025	P<0.05 (S)***
	A & O	2.187	0.040	P<0.05 (S)
	B & AB	1.403	0.182	P>0.05 (NS)
	B & O	1.297	0.206	P>0.05 (NS)
	AB & O	0.963	0.351	p>0.05 (NS)
Glucose	A & B	0.360	0.722	P>0.05 (NS)
	A & AB	2.239	0.052	P<0.05 (S)
	A & O	1.084	0.290	P>0.05 (NS)
	B & AB	3.083	0.008	P<0.01 (HS)****
	B & O	0.883	0.385	P>0.05 (NS)
	AB & O	3.727	0.002	P<0.01 (HS)

*CS; coefficient significance, **NS; non–significant, ***S; significant, ****HS; highly significant

Table 4 Comparison between gender according to uric acid and glucose

	Gender	No.	Mean	SD	t-test	p-value	C.S
Uric Acid	**male**	26	8.49	1.63	0.404	0.689	p>0.05(NS)
	female	14	8.29	1.26			
Glucose	**male**	26	194.54	86.05	0.628	0.534	P>0.05(NS)
	female	14	212.86	91.69			

SD; Standard Deviation, CS; coefficient significance

Table 5 Distribution of blood groups according to ages

ABO Blood group		Age groups (year)			Total
		(40-49)	(50-59)	(60-70)	
A	No.	3	2	4	9
	%	7.5%	5.0%	10.0%	22.5%

B	No.	5	5	4	14
	%	12.5%	12.5%	10.0%	35.0%
AB	No.	0	0	2	2
	%	0.0%	0.0%	5.0%	5.0%
O	No.	6	6	3	15
	%	15.0%	15.0%	7.5%	37.5%
Total	No.	14	13	13	40
	%	35.0%	32.5%	32.5%	100.%

Table 6 Distribution of blood groups according to gender

ABO Blood group		**Gender**		**Total**
		male	**female**	
A	No.	6	3	9
	%	15.0%	7.5%	22.5%
B	No.	6	8	14
	%	5.0%	20.0%	35.0%
AB	No.	2	0	2
	%	5.0%	0.0%	5.0%
O	No.	12	3	15
	%	30.0%	7.5%	37.5%
Total	No.	26	14	40
	%	65.0%	35.0%	100.0%

4. Discussion

Hyperglycemia is a distinguishing feature of diabetes, defined as an elevated blood glucose level caused by the body's inability to correctly use or produce the hormone insulin. Glucose is obtained from the foods that consume. Fruit, milk, potatoes, bread, and rice are the most common sources of glucose in a normal diet. Carbohydrates are broken down into glucose by the liver, which is then transformed into the small intestine, then transported to the cells by the bloodstream.

Our findings may align with those of Öner et al., who stated that the level of the blood group type AB was highly significant in type 1 diabetes mellitus, but that blood type A was highly significant in type 2diabetes mellitus [14]. In contrast to the findings of this study, Meo et al. claim that blood group type (B) is related with a high occurrence of type 2 diabetes mellitus and, blood group type O is associated with a low incidence of type 2 diabetes mellitus. Both diabetic and non-diabetic populations have almost identical distributions of blood group-types A and AB [4]. People with blood type O, on the other hand, have the lowest risk of type 2 DM, while those with blood type B have the highest risk, preceded by type AB and type A; nevertheless, the risk for type AB persons was not statistically significant [15, 16]. According to a major study conducted in Bangladesh, there is no connection between ABO blood types and type 2 diabetes mellitus. Type 2 diabetes mellitus risk is also lower in blood types A and O, according to a Malaysian study (Kamil et al. 2010). Other studies revealed mixed results: an analysis in Yemen found that blood type A had the highest subjective blood sugar levels, whereas blood type AB had a protective effect [17, 18].

Since one's kidneys do not effectively remove uric acid, will develop a high uric acid level. Rich diets, being overweight, developing diabetes, consuming some diuretics, and consuming too much alcohol are all these possible causes that may slow down the removal of uric acid. A diet rich in purine-containing foods or the body releasing too much uric acid is another two less common reasons.

Our results showed the possibility that blood group type AB is the most affected one by diseases, the incidence of hyperglycemia, and hyperuricemia. And no significant differences in age groups, which contrast with Gillum who revealed that age-adjusted serum uric acid, differed significantly among blood groups in white males. Serum uric acid was significantly lower in group AB than in group O. Examination of age-specific data revealed lower serum uric acid levels in group AB at ages 12 through 16 but not at age 17 when group AB had the highest level of serum uric acid. The overall difference in white males was no longer significant after controlling for weight and age although the AB versus O contrast remained significant. Among black males, there was non-significant difference among blood groups and non-significant interaction with age. Age-adjusted serum uric acid did not differ significantly among blood groups in either white or black females [19].

5. Conclusion

It is concluded that 40 volunteers were affected by hyperuricemia and hyperglycemia. Blood group type O is predominant more than others in this study, type AB could be the most vulnerable to the occurrence of hyperuricemia and hyperglycemia. The gender is non-significant to both uric acid and glucose. The males predominant than females, blood group type O is predominant in age groups 40-50 and 50-60 than others in this study. However, further investigations with a high number of participants, focusing on the differences of the Rhesus factor Rh, in addition to choosing an appropriate or even number for both genders are also recommended.

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