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RELATIONSHIP OF BLOOD GROUPS WITH RISK FACTORS FOR CARDIOVASCULAR DISEASES IN SAUDI ARABIAN POPULATION

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ABSTRACT

The aim of this study was to investigate the possible association of risk factors for cardiovascular diseases and blood groups in local population of Saudi Arabia. The present cross-sectional study analyzed ABO blood groups and lipid profile of 187 subjects in the age group between 36 and 62 years, attending a primary health care center in Makkah city for common illnesses. ABO blood groups were determined by slide agglutination method and serum lipid profile was measured after 10-12 hours fasting, using chemistry auto-analyzer. The study reveals that there is no significant correlation between blood groups and serum lipid profiles among participants, although highest number of subjects with blood group AB showed abnormal levels of serum total cholesterol, low density lipoprotein cholesterol and high density lipoprotein cholesterol. We suggest that individuals with blood group AB may be more predisposed to cardiovascular diseases and therefore, blood group screening may play an important role in identifying individuals at higher risk.

KEYWORDS

ABO Blood Groups, Lipid Profile, Cardiovascular Diseases, Lipoproteins, Cholesterol and Saudi Arabia.

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INTRODUCTON

The clinical significance of ABO blood group system is now known to extend beyond blood transfusion and solid organ transplantation to its correlation with pathogenesis of several systemic diseases. In the past, research on association of ABO blood groups with different pathologies have been of immense interest. Several studies have elucidated the role of blood groups as predisposing factors for diseases such as gastric cancer¹, peptic ulcer², pancreatic cancer³, breast cancer⁴, upper urinary tract cancer⁵, ovarian cancer⁶, bladder

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cancer⁷, pulmonary diseases⁸, upper urinary tract infection⁹, cardiovascular diseases¹⁰, asthma¹¹ and psychological disorders¹². Of these, studies on association of blood groups and cardiovascular diseases (CVD) have been of great significance. Several reports have appeared in recent years suggesting an association between blood groups and various manifestations of heart diseases¹³. During the last few decades, some reports have suggested that ABO blood groups are associated with risk of ischemic heart diseases and developing severe manifestation of atherosclerosis¹⁴. CVD that include coronary artery disease (CAD) and other heart diseases, are the principal cause of mortality and disability worldwide¹⁵. There is acute shortage of data showing relationship of different blood groups with pathogenesis of CVD in the Kingdom of Saudi Arabia. With rapid socioeconomic growth in Saudi Arabia, there has been an increase in rates of CVD and associated risk factors¹⁶. The prevalence of dyslipidemia, one of the leading causes of CVD, is high in Saudi population. The available national surveys indicated that half of the Saudi population has high level of total cholesterol and almost half of the males and one-third of Saudi females have high level of triglyceride¹⁷.

During the last few decades, many studies have demonstrated a link between ABO blood groups, in particular non O blood groups and risk of developing CVD^{18,20}. Role of ABO blood group antigens has been strongly implicated in pathogenesis of CVD, but the underlying pathophysiology is yet to be explained. Researchers have been interested in the study of the possible relationship between blood groups and coronary artery disease risk factors^{21,22}, ABO blood groups in correlation with hyperlipidemia, diabetes mellitus type-II and essential hypertension²³ and association of blood group antigens with total serum cholesterol²⁴. Clinical studies have shown that individuals with a phenotype blood group are more susceptible to cardiovascular diseases²⁵. The incidence of heart diseases is higher in patients with blood group A among British men²⁶ and general Hungarian population²⁷. The relationship between blood type and total cholesterol level in Japanese

also show that cholesterol levels are significantly elevated in blood group A compared to other blood groups²⁸. However, other reports suggest higher incidence of ischemic heart diseases (IHD) in patients with blood group phenotype AB as compared with groups O, A or B¹⁴. Few reports, on the other hand, found blood groups O and B to be predominant in patients with myocardial infarction^{29,30}. Therefore, different investigations showed varying findings regarding the relationship of blood groups with susceptibility to cardiovascular diseases.

It has been established that dyslipidemia is one of the major risk factors of cardiovascular diseases and that it acts synergistically with other major risk factors of this disease^{31,32}. Risk factors for developing cardiovascular diseases are known to be proportional to the levels of total serum cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) and triglycerides (TGs). However, there is an inverse relation between risk factors for CVD and levels of serum high-density lipoprotein cholesterol (HDL-C), since this lipoprotein is known to be protective against heart diseases and stroke by being involved in reverse cholesterol transport process.

Prior studies show inconsistent results with respect to distribution of ABO blood groups and risk factors for CVD in different parts of the world. Nevertheless, the subjects under study in most of these investigations have been confirmed cases of CVD. Since reducing risk factors is the basic clinical approach to decreasing the mortality and morbidity caused by CVD, we planned to confirm the relationship between ABO blood group and serum lipid parameters among healthy population in Makkah city of Saudi Arabia, with a view to design an effective strategy for primary prevention of risk factors that are known to cause CVD.

MATERIAL AND METHODS

One hundred and eighty seven (187) subjects that included 143 females and 44 males aged between 36 to 62 years, were recruited for this study. The subjects were the patients attending primary health care center for treatment of common ailments, in Makkah region. Informed consent was sought

individually after explanation of the purpose and nature of procedure used, before being enlisted for the study. This study was approved by ethics committee of the college of applied medical sciences in Taif University and primary health care center in Makkah.

The subjects with known cases of smoking, obesity, diabetes mellitus, hypertension, thyroid disorders, liver diseases and other chronic diseases were excluded from the study. Subjects taking lipid lowering drugs were also excluded from the study.

The blood groups were determined by commercially available kits using standard slide agglutination method using Anti-A and Anti-B sera. Samples for serum lipid profile parameters (total serum cholesterol, low density lipoprotein-cholesterol, high density lipoprotein-cholesterol and triglycerides) were collected after 10-12 hours of fasting and measured via the enzymatic colorimetric method with biochemistry auto-analyzer. The subjects were classified according to ABO blood typing. The normal ranges for serum lipids were considered as follows: TC<200 mg/dl; LDL-C< 130 mg/dl; HDL-C> 50 mg/d and TG<150 mg/d. The relation of different blood groups to the level of serum TC, LDL-C, HDL-C and TG were found out and results tabulated. The results obtained were expressed in mean \pm standard deviation (\pm SD) and in percentage. Collected data was analyzed statistically using SPSS program software, version 22.0 (SPSS Institute, Inc.; Chicago, IL, USA). Analysis of variance (ANOVA) test was used to compare the means of lipid profile values among different blood groups and post hoc test was used wherever required. A p-value of >0.05 was considered statistically non-significant on all analysis.

RESULTS AND DISCUSSION

A total of one hundred and eighty seven subjects including both males and females, were recruited for this study. Of the total participants included in the study, 143 (76.5%) were females and 44 (23.5%) were male participants. The result of this study showed that the most frequent blood group in Mecca city was group O+ followed by group A+,

then group B+ and lastly group AB+. Ninety one (48.7%) of the subjects were of blood group O+, fifty (26.7%) were of blood group A+, thirty six (19.2%) were of blood group B+ and ten (5.4%) were of blood group AB+ (Table No.1). This distribution of blood groups is in agreement with the study done in 2015 among Saudi patients in King Abdul Aziz Medical City in Riyadh, where they found 48%, 27%, 22% and 3% patients with blood groups O, A, B and AB respectively³³. There was no significant statistical change in the prevalence of Rh positive and negative samples with respect to sex and blood groups (p values >0.05 for each). Similar observations were made among Iranian population in 2014³⁴. The average age of the participants was 43.6 ± 7.5 years, with the youngest being thirty six years old and the oldest being sixty two years old.

The average values of lipid profile among the participants were as follows: TC (188.08 ± 36.78 mg/dl); LDL-C (112.10 ± 31.15 mg/dl); HDL-C (53.22 ± 12.23 mg/dl); and TG (111.71 ± 53.98 mg/dl). Table No.2 shows the mean distribution of serum lipid profile parameters among different blood groups. It is evident from Table No.2 that no significant association exists for TC, TG and lipoproteins among different blood groups. The p-value was found to be >0.05 for each of the variables. The range of TC in mg/dl is found to be 184.24 ± 37.82 in blood group A to 190.17 ± 35.70 in blood group B. The values of TC for blood groups AB and O lie within this range (185.28 ± 43.02 in case of blood group AB and 189.80 ± 33.55 in case of blood group O). These values clearly show the closeness of the mean among different blood groups and its invariance as shown by standard deviation values for each of these blood groups. Similarly, the values of lipoprotein LDL-C in mg/dl were found to be 107.84 ± 34.21 , 112.32 ± 29.87 , 111.32 ± 33.24 and 115.91 ± 29.11 for blood groups A, B, AB and O respectively. The values of good cholesterol, HDL-C ranged from 51.34 ± 11.36 mg/dl in subjects with blood group AB to 54.06 ± 13.10 mg/dl in blood group A. The values of triglyceride in mg/dl was found to be 112.70 ± 54.45 , 122.73 ± 63.76 , 113.06 ± 45.35 and 101.91 ± 49.17 for blood groups

A, B, AB and O respectively. Our results are in agreement with the study done by Amirzadegan and colleagues where they showed no positive correlation between different blood groups and development of CAD and prevalence of major cardiovascular risk factors in patients who underwent coronary artery bypass graft³⁵. A study done by Ghazae and colleagues also showed lack of association between ABO blood groups and serum lipid profile among Iranian population³⁴.

Table No.3 shows pair wise comparison of p values for TC, lipoproteins and TG. It is evident from the table that there is no significant association of serum lipid parameters among the six paired blood groups, each pair having been analyzed individually. All p-values were found to be >0.05. This finding further strengthen our results showing no link between blood groups and serum TC, LDL-C, HDL-C and TG.

Hypercholesterolemia is considered a risk factor in the development of IHD³⁶. Besides elevated levels of total cholesterol, epidemiologists have identified elevated low density lipoprotein cholesterol and depressed high density lipoprotein cholesterol as other important risk factors for CAD³⁷. This relation holds true irrespective of sex and age. Percentage of subjects showing lipid profile values out of normal range, among different blood groups have been shown in Table No.4. It was found that the maximum number of subjects (60%) with blood group AB showed total serum cholesterol levels >200 mg/dl among all the blood groups. Similarly, highest number of subjects showed HDL-C levels <50 mg/dl (60%) and LDL-C >130 mg/dl (50%)

among blood group AB. Since high levels of serum cholesterol and low high density lipoprotein-cholesterol are known to be major risk factors in the development of CVD, these results indicate that people with blood group AB may be at a higher risk of developing these diseases in Saudi Arabia. Our results are consistent with the findings of Meade and coworkers where they showed higher incidence of ischemic heart diseases in patients with blood group phenotype AB as compared with groups O, A or B¹⁴. Similar findings have been reported by Girgla and colleagues in 2011, where they have shown significant relation of phenotype AB with serum lipid parameters in north Indian population³⁸. The result among blood group AB was followed by persons having blood group B (50% of the subjects showed TC>200 mg/dl, 47.22% showed HDL-C levels <50 mg/dl and 30.55% showed LDL-C >130 mg/dl). These results among blood group Bare consistent with the findings of Nydegger and coworkers where they have shown blood group B to be predominant in patients with myocardial infarction³⁰. Figures No.1-4 show the percentage of subjects showing the serum lipid parameters (TC, LDL-C, TG and HDL-C) within and out of normal range among different blood groups. It is found that maximum number of subjects with normal values of TC and HDL-C are found in blood groups A and O. Therefore, they are at a much lower risk for developing cardio vascular diseases. The most probable explanation for inconsistent results among various racial groups worldwide can be attributed to the age factor.

Table No.1: Distribution of subjects according to sex and blood groups A, B, AB and O

S.No	Sex	Antigen A	Antigen B	Antigen AB	Antigen O	TOTAL
1	MALE	13	7	3	21	44
2	FEMALE	37	29	7	70	143
3	Total	50	36	10	91	187
4	Percentage %	26.7	19.2	5.4	48.7	100

Table No.2: Distribution of serum lipid profile levels among different blood groups

S.No	Parameter (mg/dl)	Blood group A	Blood group B	Blood group AB	Blood group O	P value
1	TC	184.24±37.82	190.17±35.70	185.28±43.02	189.80±33.55	0.808
2	LDL-C	107.84±34.21	112.32±29.87	111.32±33.24	115.91±29.11	0.611
3	HDL-C	54.06±13.10	53.28±13.28	51.34±11.36	53.5±10.77	0.799
4	TG	112.70±54.45	122.73±63.76	113.06±45.35	101.91±49.17	0.275

Table No.3: Pairwise comparison of ‘P’ value for lipid profile parameters between different blood groups

S.No	Blood group pair	TC	LDL-C	HDL-C	TG
1	Blood group A Vs B	0.863	0.899	0.900	0.801
2	Blood group A Vs AB	0.999	0.961	0.764	1.000
3	Blood group A Vs O	0.861	0.538	0.995	0.723
4	Blood group B Vs AB	0.940	0.999	0.903	0.865
5	Blood group B Vs O	1.000	0.939	1.000	0.207
6	Blood group AB Vs O	0.944	0.910	0.854	0.780

Table No.4: Percentage of subjects showing lipid profile values out of normal range among different blood groups

S.No	Blood group	TC>200 mg/dl	LDL-C>130 mg/dl	HDL-C<50 mg/dl	TG>150 mg/dl
1	A	36	28	40	20
2	B	50	30.55	47.22	27.77
3	AB	60	50	60	20
4	O	41.75	28.57	30.76	23.07

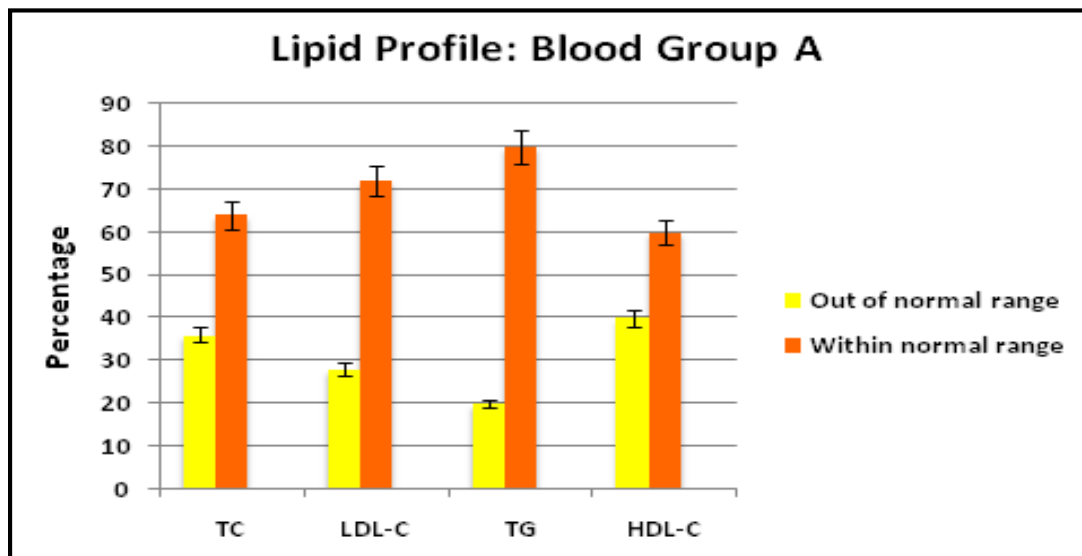


Figure No.1: Percentage of subjects with blood group a showing normal and abnormal values of serum lipid parameters

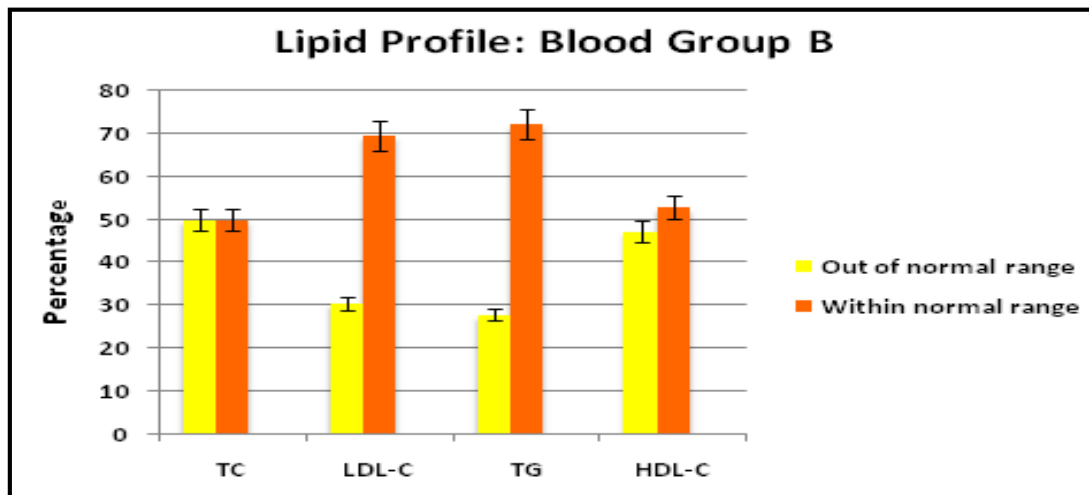


Figure No.2: Percentage of subjects with blood group B showing normal and abnormal values of serum lipid parameters

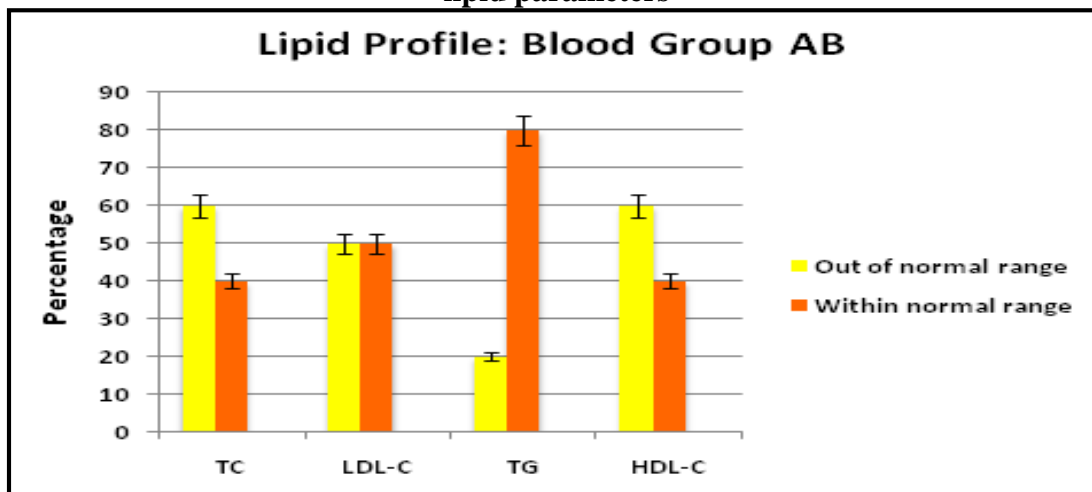


Figure No.3: Percentage of subjects with blood group AB showing normal and abnormal values of serum lipid parameters

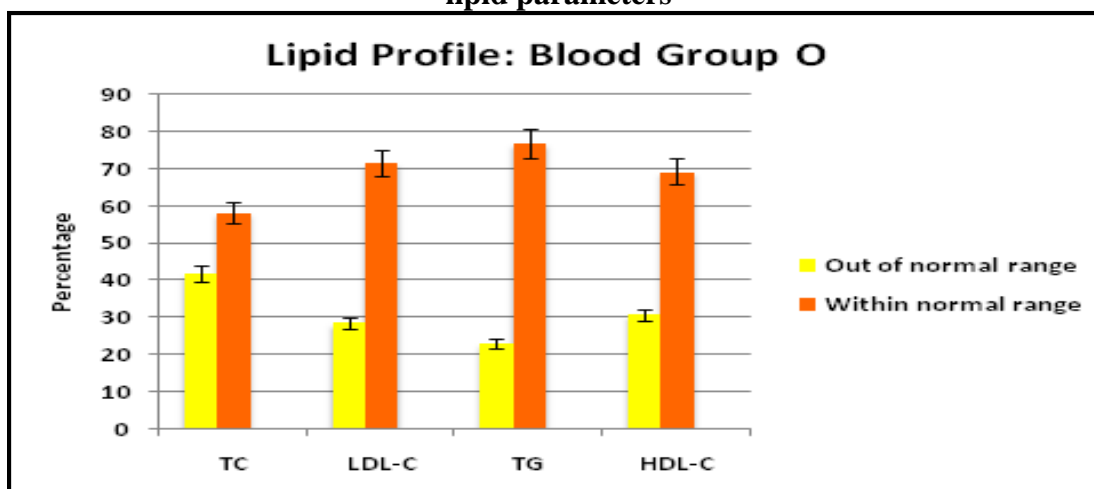


Figure No.4: Percentage of subjects with blood group O showing normal and abnormal values of serum lipid parameters

CONCLUSION

The study revealed that there was no marked correlation between serum lipid values and different ABO blood groups in our sample of Saudi Arabian population. This is an important finding that sheds light on the fact that the association of lipid parameters with different blood groups may vary with demographic characteristics. Since lipid profile is a genetic component, family history may play an important role in development of risk factors for cardiovascular diseases. Furthermore, more elaborate study with a much larger sample size is required to confirm the findings in Saudi Arabian population. Based on number of subjects showing abnormal levels of lipid parameters, the study reveals blood group AB to show the highest number.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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