

# Association of ABO Blood Groups and major Ischaemic Heart Disease Risk Factors

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**Objectives:** To study the association of ABO blood groups with major ischaemic heart disease risk factors.

**Setting:** Department of Cardiology, Mayo hospital, Lahore over a period of two years from January 2008 to December 2009.

**Study Design:** Analytic comparative study.

**Subjects and Methods:** The study group included 907 patients of ischaemic heart disease (IHD). The distribution of ABO blood groups in IHD patients was compared for presence or absence of major IHD risk factors. Data was analyzed using SPSS 16. ANOVA and Chi-square tests for significance were used. P-value less than 0.05 was taken as significant.

**Results:** In this study, the following pattern of ABO blood groups was observed in IHD patients : blood group A 251 (27.67%); blood group B 329 (36.27%); blood group O 235 (25.91%); blood group AB 92 (10.14%). We found no relationship of ABO blood groups with age (p-value = 0.234), gender (p-value = 0.093), hypertension (p-value = 0.230), diabetes mellitus (p-value = 0.801), family history of IHD (p-value = 0.277), transverse ear lobe crease (p-value = 0.231), total cholesterol (p-value = 0.797), triglycerides (p-value = 0.351), low density lipoprotein (p-value = 0.078), high density lipoprotein (p-value = 0.114). Similarly no relationship was found of smoking, weight, height and body mass index with ABO blood groups, p-values 0.428, 0.528, 0.908 and 0.455 respectively.

**Conclusion:** There is no association of ABO blood groups and major ischaemic heart disease risk factors.

**Key Words:** Ischaemic heart disease risk factors, ABO blood groups, Atherosclerosis.

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## Introduction

Ischaemic heart disease (IHD) is a worldwide health problem. Its incidence is on the rise. It is one of the most common causes of death and morbidity in the most regions of the world. In almost all the cases, atherosclerosis is the underlying cause of IHD and its different presentations.<sup>1</sup> With the development of medical science, different etiological factors of atherosclerosis or IHD were studied. Genetic factors along with environmental factors play a role in the development of IHD. Framingham heart study was one of the initial landmark studies<sup>2</sup> which evaluated IHD risk factors. Age, sex, family history of IHD and height are among the non-modifiable IHD risk factors. Smoking, hypertension, diabetes mellitus, and dislipidemia are major modifiable risk factors.<sup>1,2</sup> Good understanding of these risk factors helps in the primary prevention of IHD.

With the discovery of ABO blood group system in 1901 by Landsteiner,<sup>3</sup> it was studied as etiological factor of many diseases for example peptic ulcer and carcinoma of stomach.<sup>4</sup> Similarly association of ABO blood groups with IHD was studied by many investigators. Bronte – Stewart mentioned that Gertler and White were the first ones to study the association of ABO blood groups with IHD.<sup>5</sup> A small but significant higher risk of IHD in patients having blood group A as compared with O group was found by some later studies.<sup>5-7</sup> In 2005, Khan IA et al<sup>8</sup> and Wazirali<sup>9</sup> found strong association of IHD with blood group A as compared with blood group O. Mead TW<sup>10</sup> et al in their study showed higher incidence of IHD in AB blood group.<sup>10</sup> Whincup<sup>11</sup> ob-

erved higher incidence of IHD in towns with high prevalence of blood group O. On the other hand, in individual subjects, the incidence of IHD was slightly higher in blood group A.<sup>11</sup> In Lithuanian women, Stakishaitis<sup>12</sup> observed significant relationship of blood group B with IHD. A recent cross – sectional study did not show any significant difference between the frequencies of ABO blood groups in IHD patients as compared to the Iranian general population.<sup>13</sup>

IHD risk factors and ABO blood groups association have also been studied in the past. Kamil M et al (2004) found negative association of type II diabetes mellitus with blood group A and O.<sup>14</sup> Quraishi MA and Bhatti R (2001) observed positive association of diabetes mellitus with group B and negative association with blood group A in general population.<sup>15</sup> No statistically significant relationship was found between diabetes mellitus and ABO blood groups by Koley S.<sup>16</sup> Namesure<sup>17</sup> in 2006 and Bhattacharyya<sup>18</sup> in 2008 found negative association for blood group A with hypertension. No significant association of blood group with hypertension was found in the study conducted by Miller.<sup>19</sup> Higher levels of total cholesterol (T-Chol)<sup>11,20,21</sup> and low density lipoprotein cholesterol (LDL – C)<sup>20</sup> in blood group A have also been reported. Tarjan<sup>22</sup> found no such association. Gilum<sup>21</sup> found no relationship of blood groups with blood pressure and skinfold thickness. Mead observed that men having blood group AB to be 2 cm shorter than those of other blood groups.<sup>10</sup> Tranchessi<sup>23</sup> showed increased prevalence of ear lobe crease in IHD patients but its association with ABO blood group has not been studied in the past. Amir-

**Table 1:** Descriptive and Inferential Statistics of different ABO blood groups with respect to Age and Lipid profile.

	Blood Group	N	Mean	Std. Deviation	Minimum	Maximum	p-value
<b>Age</b>	A	251	52.62	10.424	26	80	0.234
	B	329	53.12	11.535	26	90	
	O	235	53.89	10.511	27	80	
	AB	92	55.14	11.339	31	80	
	<b>Total</b>	<b>907</b>	<b>53.39</b>	<b>10.962</b>	<b>26</b>	<b>90</b>	
<b>TG</b>	A	251	187.83	46.609	69	479	0.351
	B	329	180.60	44.646	80	349	
	O	235	182.52	58.267	89	556	
	AB	92	184.89	44.365	90	390	
	<b>Total</b>	<b>907</b>	<b>183.53</b>	<b>49.039</b>	<b>69</b>	<b>556</b>	
<b>T-Chol</b>	A	251	196.45	30.105	136	324	0.797
	B	329	191.76	32.594	80	311	
	O	235	193.39	95.791	21	1550	
	AB	92	193.46	29.685	150	282	
	<b>Total</b>	<b>907</b>	<b>193.65</b>	<b>55.669</b>	<b>21</b>	<b>1550</b>	
<b>LDL-C</b>	A	251	122.36	28.366	42	210	0.078
	B	329	117.67	27.257	34	312	
	O	235	116.31	26.795	40	221	
	AB	92	118.91	24.406	80	210	
	<b>Total</b>	<b>907</b>	<b>118.74</b>	<b>27.240</b>	<b>34</b>	<b>312</b>	
<b>HDL-C</b>	A	251	38.14	5.790	25	75	0.114
	B	329	39.05	7.005	25	118	
	O	235	38.43	8.275	24	132	
	AB	92	40.01	6.034	29	63	
	<b>Total</b>	<b>907</b>	<b>38.74</b>	<b>6.978</b>	<b>24</b>	<b>132</b>	

TG = triglycerides, T – Chol = total cholesterol, LDL – C = low density lipoprotein cholesterol, HDL – C = high density lipoprotein cholesterol, N = number

zadgan<sup>13</sup> in 2005 and Abdollahi<sup>24</sup> in 2009 found no association of ABO blood groups with age, sex, diabetes mellitus, hypertension, hyperlipidemia, obesity and smoking in established patients of IHD and general population respectively. Only significant association of blood group A with family history IHD was observed by Abdollahi.<sup>24</sup>

Considering previous conflicting results, we conducted this study to evaluate association of ABO blood groups with different IHD risk factors in our IHD patients.

### Material and Methods

This analytic comparative study was conducted over a period of two years from January 2008 to December 2009 at the department of Cardiology, Mayo hospital, Lahore. 907 patients of IHD were included in the study. Continuous sampling method was used. All the diagnosed cases of IHD admitted in Cardiology department on the basis of ECG changes (significant Q waves, ST segment depression or elevation, t wave inversion, new left bundle branch block), echo-

**Table 2:** Association of major risk factors of IHD with blood groups and their p-values.

		Blood group				Total	p-value
		A	B	O	AB		
Gender	Male	165 (65.74%)	234 (71.12%)	153 (65.11%)	71 (77.17%)	623	0.093
	Female	86 (34.26%)	95 (28.88%)	82 (34.89%)	21 (22.83%)	284	
	<b>Total</b>	<b>251 (100%)</b>	<b>329 (100%)</b>	<b>235 (100%)</b>	<b>92 (100%)</b>	<b>907</b>	
Hypertension	Yes	120 (47.81%)	167 (50.76%)	134 (57.02%)	48 (52.17%)	469	0.230
	No	131 (52.19%)	162 (49.24%)	101 (42.98%)	44 (47.83%)	438	
	<b>Total</b>	<b>251 (100%)</b>	<b>329 (100%)</b>	<b>235 (100%)</b>	<b>92 (100%)</b>	<b>907</b>	
Diabetes Mellitus	Yes	85 (33.86%)	120 (36.47%)	84 (35.74%)	29 (31.52%)	318	0.801
	No	166 (66.14%)	209 (63.53%)	151 (64.26%)	63 (68.48%)	589	
	<b>Total</b>	<b>251 (100%)</b>	<b>329 (100%)</b>	<b>235 (100%)</b>	<b>92 (100%)</b>	<b>907</b>	
Family history of IHD	Yes	51 (20.32%)	84 (25.53%)	55 (23.40%)	16 (17.39%)	206	0.277
	No	200 (79.68%)	245 (74.47%)	180 (76.60%)	76 (82.61%)	701	
	<b>Total</b>	<b>251 (100%)</b>	<b>329 (100%)</b>	<b>235 (100%)</b>	<b>92 (100%)</b>	<b>907</b>	
Smoking	Yes	104 (41.43%)	138 (41.95%)	89 (38.87%)	48 (52.17%)	379	0.428
	No	143 (56.97%)	185 (56.23%)	142 (60.43%)	42 (45.65%)	512	
	Ex. Smoker	4 (1.59%)	6 (1.82%)	4 (1.70%)	2 (2.17%)	16	
	<b>Total</b>	<b>251 (100%)</b>	<b>329 (100%)</b>	<b>235 (100%)</b>	<b>92 (100%)</b>	<b>907</b>	
Transverse ear lobe crease	Yes	153 (60.96%)	199 (60.49%)	154 (65.53%)	65 (70.65%)	571	0.231
	No	98 (39.04%)	130 (39.51%)	81 (34.47%)	27 (29.35%)	336	
	<b>Total</b>	<b>251 (100%)</b>	<b>329 (100%)</b>	<b>235 (100%)</b>	<b>92 (100%)</b>	<b>907</b>	

cardiographic evidence, cardiac enzymes or coronary angiographic evidence were included in the study. Information regarding age, sex, history of hypertension and smoking, diabetes mellitus, family history of IHD, weight and height and transverse ear lobe crease were collected by taking history and examination of the IHD patients. Blood sugar levels, fasting lipid profile was taken on the first post admission day. For blood grouping, blood sample was collected by finger prick method. Agglutination was noted after mixing drop of blood with anti-A, anti-B and anti-D sera on glass slide. All cases of non-cardiac chest pain, congenital heart disease, rheumatic heart disease, severe renal failure and malignancy were excluded from the study. An informed consent was taken in every case and data was entered in the Performa of the study. Statistical analysis was done using SPSS 16. ANOVA and Chi-square tests for significance were used. P-value less than 0.05 was taken as significant.

## Results

In this study of 907 IHD patients, the following pattern of ABO blood groups was observed : blood group A 251

(27.67%); blood group B 329 (36.27%); blood group O 235 (25.91%); blood group AB 92 (10.14%). The mean age of all patients was  $53.39 \pm 10.962$  years. While the mean ages of patients with blood group A, B, O and AB were  $52.62 \pm 10.244$  years,  $53.12 \pm 11.535$  years,  $53.89 \pm 10.511$  years and  $55.14 \pm 11.339$  years respectively. We found no relationship of blood groups and the age distribution in our IHD patients, p-value = 0.234 (table I). There were 623 males and 284 females in this study in which 251 (165 males and 86 females) had blood group A, 329 (234 males and 95 females) had blood group B, 235 (153 males and 82 females) had blood group O and 92 patients (71 males and 21 females) presented with AB blood group. There was no significant association in IHD patients with respect to gender and different blood groups, p-value = 0.093 (table 2). The history of hypertension was present in 469 patients and in these hypertensive patients ABO blood group distribution was : blood group A (120), B (167), O (134), and AB (48). According to this study of IHD patients there is no statistical association between hypertension and blood groups (table 2). Among the 318 diabetic patients of this study following

**Table 3:** Association of blood group with weight, height and body mass index.

	Blood Groups	N	Mean	Std. Deviation	Minimum	Maximum	p-value
Weight (kg)	A	251	70.6016	12.34604	45.00	150.00	0.528
	B	329	71.5897	12.32358	42.00	140.00	
	O	235	70.7660	10.50806	50.00	168.00	
	AB	92	69.6630	13.96406	41.00	112.00	
	Total	907	70.9074	12.06249	41.00	168.00	
Height (cm)	A	251	160.6135	9.87472	135.00	185.00	0.908
	B	329	160.4772	9.27955	126.00	185.00	
	O	235	160.8638	8.52087	138.00	185.00	
	AB	92	160.0652	9.16252	135.00	180.00	
	Total	907	160.5733	9.23676	126.00	185.00	
Body mass index	A	251	27.4749	4.83441	18.38	53.78	0.455
	B	329	27.9081	4.97492	17.48	50.39	
	O	235	27.4639	4.50943	18.81	69.93	
	AB	92	27.1319	4.54906	16.90	40.64	
	Total	907	27.5944	4.77553	16.90	69.93	

N = number, cm = centimeter, kg = kilogram

ABO blood group distribution was observed : blood group A 85, B 120, O 84 and AB 29, there was no significance relationship between the blood groups and diabetes mellitus. Smoking, family history of IHD and transverse ear lobe crease also do not have any statistical relationship with different blood groups in this study, p-values: 0.428, 0.277 and 0.231 respectively (table 2).

The mean triglycerides (TG) of all patients were  $183.53 \pm 49.039$  mg/dl. The mean TG levels of patients with blood group A, B, O and AB were  $187.83 \pm 46.609$  mg/dl,  $180.60 \pm 44.646$  mg/dl,  $182.52 \pm 58.267$  mg/dl and  $184 \pm 44.36$  mg/dl respectively. According to this study the mean TG levels were slightly higher in A blood group, p-value = 0.351 (table 1). The mean total cholesterol (T-Chol) levels in blood group A, B, O and AB were  $196.76 \pm 30.105$  mg/dl,  $191.76 \pm 32.594$  mg/dl,  $193.39 \pm 95.79$  mg/dl and  $193.46 \pm 29.685$  mg/dl respectively. The mean T-Chol in A blood group was slightly higher, p-value 0.797. The mean low density lipoprotein – Cholesterol (LDL – C) was insignificantly higher in blood group A as compared to others while in blood O the mean LDL – C was insignificantly lower i.e. p-value 0.078. The mean high density lipoprotein cholesterol (HDL – C) was higher in AB blood group as compared to others, but statistically there was no significant difference in the mean HDL – C with respect to all blood groups, p-value = 0.114 (table 1). As shown in table 3, there is no significant difference in the mean weight, height and

body mass index in all ABO blood groups, p-values 0.528, 0.908 and 0.455 respectively.

### Discussion

It has been observed that in different regions of the world,<sup>8,9</sup> there is specific ABO blood group distribution. Blood group B is the most common group in Pakistan as evident from various studies.<sup>8,9,25</sup> More than 60% of the population in Pakistan has blood group B and O. The least common group is AB blood group.<sup>8,25</sup> Similar pattern was seen in IHD patients of our study. In USA, England, Africa, Australia and Saudi Arabia majority of the people have blood group A and O.<sup>8,9,25</sup>

Mean age was found to be almost similar in different ABO blood group in our study. Similar results were seen in other studies.<sup>13,24</sup> Sex distribution was also have no significant association with blood group as also observed by Abdollahi AA.<sup>24</sup> T – Chol, TG's and LDL – C were higher in blood group A, but the difference was not significant (table 1). The recent studies<sup>13,22,24</sup> have also shown similar results. This was in contradiction to the findings of the previous studies conducted by Whincup,<sup>11</sup> Djoumessi S<sup>20</sup> and Gillum RF.<sup>21</sup> Diabetes mellitus, hypertension, family history of IHD and ear lobe crease, was more common in blood group B, O, B and AB respectively as shown in table no. II. But the difference was insignificant. Our results are in consistent with the recent studies.<sup>13,16,17,18,24</sup> Qurashi<sup>15</sup> observed significant

association of diabetes mellitus with B blood group in general population while we evaluated IHD patients only. Smoking is an environmental risk factor. As observed by other investigators<sup>13,24</sup> we also did not find it to be associated with ABO blood groups. Association of ear lobe crease with ABO blood group has not been evaluated in the past.

### Conclusion

In this study, frequencies of cardiac risk factors studied were almost similar in different blood groups in our IHD patients. The results of the present study failed to show any association of ABO blood group with age, sex, family history of IHD, hypertension, smoking, diabetes mellitus, obesity, ear lobe crease and fasting lipid levels in our patients of IHD. Considering controversial results of the previous studies it is of great importance that extensive studies should be done to find any definite higher risk of IHD or its risk factors with particular blood group.

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