

# STUDY OF PREVALENCE AND POSSIBLE RELATION BETWEEN ABO, RHESUS BLOOD GROUPS & HYPERTENSION

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**Background:** The objective of the present study was to check for prevalence and any kind of association existing between hypertension and ABO blood groups in the blood donors in SIMS Lahore.

**Patients and Methods:** ABO and Rh grouping was done along with hypertensive screening on all prospective voluntary / replacement blood donors between 18-40 years of age and both sexes donating blood at SIMS Blood Bank, Lahore over a period of one month from 31st July to August 2006.

**Results:** Out of a total of 1725 blood donors, 1673 (97%) were males and 52(3%) were females. 97% amongst males, while 94.2% amongst females were found to be Rhesus positive. The frequency of Rhesus negative groups in males and females is 3% and 5.8% respectively. Well 335 male blood donors were found to be hypertensive (250%) as opposed to 7 hypertensive female blood donors (13.5%). The prevalence of hypertension is greatest among Rhesus positive male donors having blood group A (30.1%), followed by 18% prevalence rate in blood group B and prevalence rate about (17%) each in subjects having blood group O and AB. Rhesus negative male subjects also showed 9.8% prevalence rate.

**Conclusion:** The study indicates that donor population is predominantly positive. The results support the concept that certain blood groups increase the individual's risk of developing hypertension.

**Key Words:** Hypertension; ABO blood groups; Prevalence

## Introduction

The ABO blood group system is widely credited to have been discovered by the Austrian scientist Karl Landsteiner, Who Found three different blood types in 1901.<sup>1</sup> Landsteiner described A, B and O; Decastrello and Sturli discovered the fourth type, AB, in 1907.<sup>2</sup> The ABO system is the most important blood type and system in human blood transfusion. The associated anti-A antibodies and anti-B antibodies are usually powerful IgM antibodies. ABO IgM antibodies are produced in the first years of life by sensitization to environmental substances such as food, bacteria and viruses.

The Rhesus System is the second most important blood type system in the human blood transfusion. Alexander S. Wiener discovered this factor in 1937 (Publishing in 1940).<sup>3</sup> The most important Rhesus antigen is the RhD antigen because it is the most immunogenic of the five main rhesus antigens; however, anti-RhD antibodies are not usually produced by sensitization against environmental substances. It is common for RhD negative individuals not to have any anti-RhD IgG or IgM antibodies; nevertheless, RhD negative individuals can produce powerful IgG antibodies when they are

transfused with RhD positive RBCs/

Blood pressure is a continuously distributed variable and the risk of associated cardiovascular disease likewise rises continuously. The point at which blood pressure is defined as hypertension is therefore somewhat arbitrary. Presently finding sustained blood pressure of 140/90 mmHg or above, measured on both arms is generally regarded as diagnostic. Because blood pressure readings in many individuals are highly variable especially in the office setting the diagnosis of hypertension should be made only after noting a mean elevation on two or more readings on two or more office visits, unless the elevations are severe or associated with compelling indications such as diabetes mellitus, chronic kidney disease, heart failure, post-myocardial infarction, stroke, and high coronary disease risk.

Recently, the JNC 7 (The Seventh Report of the joint National Committee on Prevention, Detection, Evaluation, and Treatment of high Blood Pressure)<sup>4</sup> has defined blood pressure 120/80 mmHg to 139/89 mmHg as "prehypertension". Prehypertension is not a disease category; rather, it is a designation chosen to identify individuals at high risk of developing hypertension. Patients with prehypertension are at

## Subject and Methods

During a span of one month from 31<sup>st</sup> July 2006 to 31<sup>st</sup> August 2006, 1752 blood donors of both sexes were tested for ABO & Rhesus group using Anti-A, Anti-B, Anti-AB and Anti-D antisera. Rhesus negative groups were confirmed by two potent monoclonal IgM Anti-D antisera. Groupings were carried out at Services Hospital Lahore blood bank affiliated with the Institute of Hematology & Blood Transfusion Services, Punjab, located at Lahore. Appropriate records were maintained. This data has been reviewed & analyzed for sex distribution and frequency of ABO and rhesus groups.

Measurement of BP was carried out on each participant by medical student using the standardized technique. Standardized mercury sphygmomanometers compatible with guidelines given in World Hypertension League<sup>6</sup> with appropriate cuff sizes on the basis of arm circumferences of the participants were used. Before BP measurement, it was made sure that the subject had not consumed either tea or coffee, smoked or exercised vigorously in the last 30min. BP was measured in the sitting position on the upper arm with the arm supported, and sphygmomanometer at the level of the heart.

Initially, BP was measured on both arms. If there was a difference in the readings obtained from the two arms, then only the arm with higher BP was used for the second measurement. Initially, radial pulse obliteration pressure was determined to estimate the systolic BP.

The cuff was inflated 20-30mm Hg above the level and the cuff was deflated at a rate of about 2mmHg /s. Phase 1 and phase 5 of the Korotkoff sound were taken as indicative of the systolic and diastolic pressures, respectively. The average values of two consecutive BP readings were taken.

## Results

During a period of one month, a total of 1725 donors donated blood at Services Hospital blood bank. All donors were aged between 18-40 years. 1673(97%) were males, while 52(3.0%) were females. (Table-1)

**Table-1:** Distribution of blood donors.

Blood Donors	No of Blood Donors	%age of Donors
Male	1673	97
Female	52	3.0
Total	1725	100

**Table-2** shows the distribution of rhesus group in the donor population.

It can be seen that females show a relatively higher frequency of rhesus negative group (5.8) as compared to males (3.0%). Of the total donors 3.1% were found to be rhesus negative.

Total number of subjects screened for possible hypertension were 1725 (Men: 1673; women: 52), age ranging from 18 to 40 years; mean age (24.7 ±8.10) years (**Table3**). Of these 342 (Men: 335; Women: 7) had hypertension. (Table3b)

Thus overall prevalence of HTN was 19.8% (342/1725) (Table3b). In men and women, prevalence was 20.0% (335/1673) and 13.5% (7/52), respectively. Prevalence of HTN increased with age, ranging from 8.4% in < 20 years to around 33.3% in 35-39 age groups. (**Table 4**)

The distribution of ABO blood groups in males and females (both rhesus positive and rhesus negative donors) is shown in Table-5. Amongst rhesus positive male donors, blood group B was found to be the prevalent group (36.6%), followed by group O (27.1%), group A (24.5%) and group AB (8.8%). Only 50 rhesus negative donors donated blood over a period of one month, due to very small number of the sample they were not used to find prevalence.

Frequency distribution of ABO groups in females amongst rhesus positive female donors, blood group B was found to be the most prevalent group (36.5%), followed by group O (23.1%), group A (19.2%) and group AB (15.4%). Only three rhesus negative female donated the blood which were all of blood group AB negative.

Table 6 shows that prevalence of hypertension is greatest among Rhesus positive male donors having blood group A (30.1%), followed by 18% prevalence rate in blood group B and prevalence rate of (16.9%) each in subjects having blood group O and (17%) AB. Rhesus negative male subjects also showed 10% prevalence rate.

45% of hypertensive subjects did not have any symptoms while 55% (188) had symptoms, with headache 76% being the most common symptom followed by dizziness 48.8% and 68.1% (233 / 342) subjects were unaware that they had HTN. Only 31.9% (109/342) subjects were aware of their hypertensive status.

## Discussion

Blood groups are inherited from both parents. The ABO blood type is controlled by a single gene with three alleles:  $i$ ,  $I^A$ , and  $I^B$ . The gene encodes a glycosyltransferase that is, an enzyme that modifies the carbohydrate content of the red blood cell.

**Table 2** Distribution of blood donor and % Frequency of rhesus groups in the donor population

Blood Donors	No of rhesus +ve donors	% frequency	No of rhesus ve donors	% frequency
Male	1632	97	50	3.0
Female	49	94.3	03	5.8
Total	1672	96.9	53	3.1

**Table 3a** Characteristics of study sample

Sex	Numbers	Age (Years)	Age(Mean $\pm$ SD)
Male	1673	18-40	24.8 $\pm$ 8.36
Female	52	18-28	23.0 $\pm$ 4.10
Total	1725	18-40	24.7 $\pm$ 8.10

**Table 3b** Prevalence of hypertension

Sex	Total Numbers	Hypertensive Subjects	Prevalence (%)
Male	1673	335	20.0
Female	52	07	13.5
Total	1725	342	19.8

**Table 4** Prevalence of hypertension in different age groups

Age Group (Years)	Hypertensive Subjects	Total Number	Prevalence
<20	17	409	30.1
20-24	160	612	18.0
25-29	73	455	16.9
30-34	46	147	17.0
35-39	33	50	10.0

**Table 5** Prevalence of hypertension in different age groups

Blood Group	A+Ve %	B+Ve %	O+Ve %	AB+Ve %	Rhesus-ve %
Male	24.5	36.6	27.1	8.8	3.0
Female	19.2	36.5	23.1	15.4	5.8

**Table 6** Prevalence of hypertension in different blood groups in Male donors

Blood Group	Hypertensive	Total Number	Prevalence
A+Ve	123	409	30.1
B+Ve	110	612	18.0
O+Ve	77	455	16.9
AB+Ve	25	147	17.0
Rhesus-ve	05	50	10.0

antigens.

The gene is located on the long arm of the ninth chromosome (9q34). Similarly the Rh (D) antigen is inherited on one locus (on the short arm of the first chromosome, 1p36.13-p34.3) with two alleles, of which Rh + is dominant and Rh- recessive. The gene codes for a polypeptide on the red cell membrane. Rh- individuals (dd genotype) do not produce this antigen, and may be sensitized to Rh+ blood.

The frequency of ABO and Rhesus phenotypes varies in different populations throughout the world. South American, Indians all belong to group O. The commonest groups in Australian aborigines are O and A in Lapps, and in Europeans there is a higher frequency of A2, while in Africans B group is much commoner.<sup>9</sup> In the United State of America, 46% constitute group O, 41% A1, 9% B and 4% AB.<sup>10</sup> In Ahwaz (Iran), according to one study, 41.16% are group O.<sup>11</sup>

In so far as the distribution of the rhesus group is concerned, the frequency in the English population of rhesus positive individuals is 95%.<sup>12</sup> In the US, 85% belong to the rhesus positive group.<sup>10</sup> In Ahwaz region of Iran, 90% were found to be Rh- positive.<sup>11</sup> The frequency of D negative varies from 20-40% in Basques to 0-1% in Japanese, Chinese, Burmese, Melanesians, Maoris, American Indians and Eskimos.<sup>12</sup>

In Pakistan, racial variation is seen in the different provinces; Group O is the commonest in Sindh (37.78%) and in Baluchistan (35%).<sup>13,14</sup> The predominant group in Punjab and NWFP is group B. We have identified a frequency of B group in Lahore as 36.6%. A study in Bannu (NWFP) region of Pakistan reports a frequency of Group B as 36.23%.<sup>15</sup> Our results are consonant with previous studies.<sup>16,17</sup>

In the population that I studied, the frequency of rhesus positive donors was 97% while 3% were rhesus negative. These figures are also in conformity to other studies carried out in Punjab.<sup>16,18</sup> In all the other provinces as well, Rhesus positive group is the predominant group and the frequency is more or less the same.<sup>14-18</sup> I would also like to mention a similar study of prevalence done by Transfusion Services Punjab, which indicates more or less same prevalence results in voluntary donors.<sup>19</sup>

The prevalence of hypertension in our study was 19.8% (male: 20.0%: female:13.5%). The prevalence of hypertension according to new criteria (>140 / 90 mm Hg) varies between 15-35% in urban adult populations of Asia.<sup>20</sup> Similarly, in a recent study

carried out in Pakistan, the prevalence of hypertension in urban and rural population was 22.7% and 18.1% respectively.<sup>21</sup>

The study also indicates that 68.1% of the subjects were unaware that they have hypertension, showing lack of awareness and regular checkups at the doctor. A study performed in Karachi about prevalence of hypertension indicated that Fifty-eight percent of hypertensive was unaware of their hypertension. None of the hypertensive subjects who were aware of their condition had blood pressure under 140/90 mmHg.<sup>22</sup>

In Bangladesh, the prevalence has been reported to be 11.3%,<sup>23</sup> whereas in Sri Lanka, it was 20% in male and 12.7%.<sup>24</sup> Gu et al. In a recent study reported the prevalence of HTN in China in adult population of 35-74 years to be 27.2 %.<sup>25</sup> Using the currently recommended criteria for the diagnosis of HTN, the overall prevalence of HTN in US during 1999-2000 was 27% in men and 30% in women.<sup>26</sup> In a retrospective analysis by Wolf Maier *et al.*, the prevalence of HTN was 27.6% in North America compared to 44.2% in Europe. In Europe, the prevalence was the highest in Germany (55%) followed by Finland (49%), Spain (47%), England (42%), and Sweden / Italy (38%).<sup>27</sup>

Prevalence of hypertension is greatest among Rhesus positive male donors having blood group A (30%), followed by 18% prevalence rate in blood group B and prevalence rate of 16% each in subjects having blood group O and AB. Rhesus negative male subjects also showed 9.8% prevalence rate.

## Conclusion

This study provides an evidence for an association between hypertension and ABO blood groups at measured levels observed in population of Lahore. The survey results also indicate high prevalence and poor control of hypertension in the community, but more research is required to understand the reasons behind this phenomena.

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