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# Prevalence Frequency of ABO and Rhesus Blood Groups in Human in District Rahim Yar Khan, Pakistan

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**Abstract:** Many diseases and genetic disorders are associated with ABO and Rh systems of blood antigens. This study was conducted to determine the frequency of ABO and Rhesus (Rh) blood groups in District Rahim Yar Khan, Pakistan so that the results could be used for further application. A total of 9891 subjects including patients and healthy individual were sampled only belonging to District Rahim Yar Khan during this study. The ABO and Rh blood grouping were carried out by tile method using commercially available anti sera and subsequently the frequency of each blood type was computed. Out of 9891 subjects 7451 were male, while 2440 were female. In both genders the prevalence frequency of ABO, association between ABO and Rhesus blood grouping systems was computed and analyzed. The brought out the conclusion that blood group B is at the highest frequency level among both the genders with an overall higher to lower order B (37.41%), O (33.95%), A (20.97%), and AB (7.65%). The blood group B was also at the highest frequency in Rh<sup>+ve</sup> as well as Rh<sup>-ve</sup> in male subjects. However, in female subjects the blood group O (33%) was at the highest frequency in Rh<sup>+ve</sup> and blood group A was at peak in Rh<sup>-ve</sup>.

**Keywords:** ABO Blood Group, Rh Blood Group, Rahim Yar Khan, Pakistan

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## 1. Introduction

The importance of ABO cannot be over ruled in blood transfusion and in some cases in paternity assessment. Like ABO system, Rhesus antigen (afterward called as Rh antigen) is also equally significant in terms of clinical blood transfusion or tissue transplant [1]. The ABO blood antigens were discovered for the first time by Landsteiner in 1901 [2] and afterward Rhesus antigen was discovered in 1941 by Wiener and Landsteiner [3]. So far, at least 400 antigens associated with erythrocytes have been discovered [4] and many of these are transmitted to next generation as Mendelian traits [5]. In this modern era, apart from blood transfusion the blood antigens have been established to have the correlations with certain health issues. For example, the individuals with blood group O are more vulnerable to gastric and duodenal ulcer [6]; [7]. The human beings all over the world possess varying frequencies of ABO and Rh antigens at regional and population level. This prevalence frequency variation exists in Pakistan also, geographically as well as racially [8]. There is a high need of documentation of data of blood groups not only for assigning the phylogenetic relations between different human populations of the world

but also to correlate these data with the diseases of various kinds [9]. Although, in many areas of Pakistan, the ABO and Rh blood groups have been computed yet, no data is so far available for District Rahim Yar Khan. Therefore, we selected this remote district of southern Punjab (Pakistan) for documentation of ABO and Rh blood type frequencies so that our data might be compared with available research carried out in other regions of Pakistan. Moreover, our data could be used by the researchers in the days to come.

## 2. Materials and Methods

A total of 9891 subjects from urban and rural population of District Rahim Yar Khan from amongst male and female were randomly sampled during the study spanned between 1st Jan, 2008 to 31st Dec, 2013. Blood samples were collected under from anti-cubital vein from each subject maintaining the aseptic conditions. For determination of ABO blood groups, the tile method was applied utilizing the commercially available anti sera, anti-A, anti-B, (Plasmatec Kent, UK). The prevalence of Rh D antigen was established by anti-D (Biotec Laboratories Ltd UK). Du test was performed for Rh<sup>-ve</sup> subjects. The data was analyzed for demonstration of prevalence frequency of ABO and Rh blood

groups at both human population and genders level.

### 3. Results

Among the total 9891 subjects studied, 7451 (75.331%) were male, while 2440 (24.668%) were female individuals. In ABO system, out of all the subjects sampled, 37.41% (3701/9891), with highest distribution, belonged to blood group B succeeded by group O subjects 33.95% (3358/9891), with lesser distribution were group A subjects 20.97% (2075/9891), and with the least distribution frequency subjects belonged to the group AB (7.65%) as shown in Table 1. Out of the total subjects, 9262 (93.640%) subjects were found positive for Rh antigen while 629 (6.359%) individuals were negative for Rh antigen. A higher frequency of Rh<sup>-ve</sup> was found among female subjects 158/2440 (6.475%) in comparison with male subjects 471/7451 (6.321%) as shown

in Table 2. In male subjects the ABO system in association with Rh<sup>+ve</sup> showed the highest frequency of the blood group B<sup>+ve</sup> (35.04 %) succeeded by blood group O<sup>+ve</sup> (32.09%) and followed by blood group A<sup>+ve</sup> (19.61%) and the blood group AB (6.94 %) while male subjects in the ABO system in association with Rh<sup>-ve</sup> showed the highest frequency of blood group B<sup>-ve</sup> (3.30%) succeeded by A<sup>-ve</sup> (1.22%) and followed by O<sup>-ve</sup> (1.15%) and the AB<sup>-ve</sup> (0.64%) as shown in Table 3. On the other hand, the ABO association with Rh<sup>+ve</sup> in female subjects was highest in blood group O<sup>+ve</sup> (35.0%) succeeded by B<sup>+ve</sup> (31.47%) and further followed by A<sup>+ve</sup> (19.83%) and the least value of prevalence was observed in AB<sup>+ve</sup> (7.21%); whereas the female subjects in ABO and Rh<sup>-ve</sup> association had the highest prevalence frequency of B<sup>-ve</sup> (3.11%) succeeded by A<sup>-ve</sup> (1.59%) followed by O<sup>-ve</sup> (1.11%) and the lowest being AB<sup>-ve</sup> (0.65%) as is shown in the Table 3.

**Table 1.** Prevalence frequency of blood groups in ABO system in total subjects (n=9891) .

Blood group	Male subjects	Female subjects	Total
A	1552 (15.69%)	523 (5.28%)	2075 (20.97%)
B	2857 (28.88%)	844 (8.53%)	3701 (37.41%)
AB	565 (5.71%)	192 (1.94%)	757 (7.65%)
O	2477 (25.04%)	881(8.90%)	3358 (33.95%)

**Table 2.** Comparison of Rh<sup>+ve</sup> and Rh<sup>-ve</sup> (%) between male and female subjects in Rahim Yar Khan.

Gender	Subjects	%	Rh <sup>+ve</sup> Subjects	%	Rh <sup>-ve</sup> Subjects	%
Male	7451	75.331	6980	93.678	471	6.321
Female	2440	24.668	2282	93.524	158	6.475
Total	9891	99.999	9262	93.64	629	6.359

**Table 3.** Prevalence Frequency of ABO in association with Rh blood groups in male and female subjects .

Male subjects				Female subjects				
Blood Groups	Rh <sup>+ve</sup>	%	Rh <sup>-ve</sup>	%	Rh <sup>+ve</sup>	%	Rh <sup>-ve</sup>	%
A	1461	19.61	91	1.22	484	19.83	39	1.59
B	2611	35.04	246	3.3	768	31.47	76	3.11
AB	517	6.94	48	0.64	176	7.21	16	0.655
O	2391	32.09	86	1.15	854	35	27	1.11
Total	6980	93.68	471	6.32	2282	93.52	158	6.48

**Table 4.** Prevalence frequency (%) of ABO and Rh blood groups in different countries of the world† .

Population	A	B	AAB	O	Rh <sup>+ve</sup>	Rh <sup>-ve</sup>
Britain	41.7	8.6	3	46.7	83	17
USA	41	9	4	46	85	15
Kenya	26.2	22	4.4	47.48	96.1	3.9
Saudi Arabia	24	17	4	52	93	7.0
India	18.85	32.5	38.75	9.9	94.45	5.55
Saudi Arabia	24	17	52	4	93	7.0

† With permission [4]

**Table 5.** Prevalence frequency (%) of ABO and Rh blood groups in different regions of Pakistan.

Regions	A	B	AB	O O	Rh <sup>+ve</sup>	Rh <sup>-ve</sup>
Punjab	22.4	32.4	30.5	8.4	93	7
Bannu	31.03	36.23	25.07	7.67	89.27	10.73
Sindh	25	30	36	9	91.8	8.2
Baluchistan	21.12	34.32	37.07	7.59	94.75	5.25
Swat	27.92	32.4	29.1	10.58	9	10
Rahim Yar Khan (present study)	20.97	37.41	7.65	33.95	93.6	6.7

† With permission, [4]

## 4. Discussion

The ABO and Rh blood group systems have a significant role in blood transfusion, tissue transplant and vertical transmission of various traits in humans. The prevalence frequency of ABO and Rh blood groups is different in various populations in the world [10] and same is true with Pakistan [11]. We have computed the prevalence of frequency of ABO and Rh blood groups in human population of Rahim Yar Khan (Pakistan). The blood group B showed the highest prevalence frequency (37.41%) succeeded by group O (33.95%), group A (20.97%), and with the lowest frequency the group AB (7.65%). The overall prevalence of ABO antigens in our study was almost in agreement with [4] in Swat with blood group B (32.40%), O (29.10%), A (27.92%) and AB (10.58%) and [12] in AJK where the blood group B showed the highest peak (36.6%), followed by group O (35.3%), group A (20.5%) and AB (6.9%). A similar prevalence frequency trend B>O>A>AB of blood groups in ABO and Rh system was established by study results of [9] in Banu district of Khyber Pakhtoon Khwah, the then NWFP. Two studies from some regions of Punjab showing the frequency distribution of group B (32.4%), group O (30.50%), group A (22.60%) and group AB (8.60%) [3] and group B (38.24%), group O (28.16%), group A (23.26%) and group AB (9.98%) [13] were in agreement with present study results.

However, the overall prevalence frequency in our results varied from the study results in Baluchistan showing the highest rate of group O (37.07%), group B (34.32%), group A (21.12%) and group AB (7.57%) [14]. A study from Sind with blood group O (36%), blood group B (30%), blood group A (25%) and blood group AB (7.59%) [15] also differed from results of present study. The blood group B has been found dominant by some authors in different regions of Khyber Pakhtoon Khawah and Punjab province [16]; [9]; [17]; [3]. A similar dominance of blood group B has been observed in Rahim Yar Khan. On the other hand, in contrast to our results, the highest frequency has been shown by blood group O in Sind and Baluchistan [18]; [5]; [13]. Blood group O was also found dominant in southern India with frequency distribution (38.75%) followed by group B (32.69%) and group A (18.85%) [19], leading to the hypothesis that human populations in Sindh and Southern India were closely related if not same. The aborigines of South American continent share the dominant blood group O with southern India, Sindh, Baluchistan and Iran [18]; [19]; [14]; [15]; [20]; [21] the relics of same land before continental drift.

Globally, the Russian Federation has the blood group A at the highest prevalence ratio [22]. All the aborigines of South America, the Red Indians have the blood group O [21]. Blood group B is the most prevalent one in African population and the blood groups A and O share the dominance commonality in the Australian population [21]. In the USA the frequency distribution of ABO blood groups is 46% group O, 41% group A, 9% group B and 4% group AB

[2]. In Saudi Arabia, 52% are group O, 24% group A, 17% group B and 4% group AB [23].

During the current study, the Rh blood group prevalence in association ABO and separately was also investigated. The prevalence frequency rate of Rh system in association with ABO blood groups showed the gender wise variation. In male subjects, the blood group B was at the highest frequency in Rh<sup>+ve</sup> as well as Rh<sup>-ve</sup>. Whereas, in female subjects the blood group O (33%) was at the highest frequency in Rh<sup>+ve</sup> and blood group A was at peak in Rh<sup>-ve</sup>. Overall individual prevalence of frequency of Rh<sup>+ve</sup> was 93.6%, whereas Rh<sup>-ve</sup> was 6.3% the values congruous to those computed by some authors in other regions of Pakistan (Table 4).

The Rh<sup>+ve</sup> group prevalence is 95% in the British population [10] and the frequency of Rh<sup>+ve</sup> is 85% in the USA [2] while its frequency is 93% in Saudi Arabia [23]. The prevalence frequency of Rh<sup>-ve</sup> ranges between 0-1% as is Far Eastern populations & South American aborigines and 40% Basques population [4]. The present study results are similar to the previous studies conducted in Punjab [13]; [11]; [3] and Khyber Pakhtoon Khwah [16] and different from those established some regions of Pakistan such as in Sindh [18] and Baluchistan [14]. Moreover, the study proves the polyphyletic genetic makeup of Pakistani population.

## 5. Conclusion

This study demonstrated the prevalence frequency of clinically significant blood groups ABO and Rh system. The study also brought out the comparative results based on similarities and differences of ABO and Rh frequencies distributed in different areas of Pakistan. The distribution frequencies of ABO blood groups show that the population of Pakistan has the racial variation, perhaps due to frequent attacks from outside Indo-Pak. The results would be used in further investigations by the researchers in the future. Such studies need to be carried out at all the regions of Pakistan.

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## Human/Animal Rights and Informed Consent

This is to certify that the sampling was carried out from human subject as per ethical standards of the responsible committee on human experimentation in the Declaration of Helsinki.

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