

Correlation of ABO Blood Groups and Rh Factor with The Severity of Generalized Chronic Periodontitis: Across Sectional Study in Riyadh, Saudi Arabia

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Abstract

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BACKGROUND: The development of periodontal diseases depends on the presence of causative microorganisms, host immunity and risk factors. Although variability present among the types of periodontal diseases, all are represented to a shared interaction between host and bacteria. ABO blood groups are the most investigated erythrocyte antigen system. However, limited investigations have been conducted to explore the alliance between ABO blood groups and periodontal diseases.

AIM: Our purpose was to explore any possible association between the severity of chronic periodontitis with ABO blood groups and Rh factor.

METHODS: A cross-sectional study was carried out on 205 patients out of 1126 generalised chronic periodontitis patients (GCP) who were referred to Al-Farabi Colleges, Riyadh, Saudi Arabia. They were categorized into; group I (mild), group II (moderate) and group III (sever).

RESULTS: The patients with blood group O were at a greater risk to develop GCP irrespective of its severity, followed by those with blood group A, B, and AB. The dispensation of the Rh factor in all groups exhibited a significantly greater distribution of Rh positive.

CONCLUSION: Genetic factors such as ABO blood group antigens may act as a risk influencer that affects the progression and severity of the chronic periodontitis.

Introduction

Periodontal diseases, including gingivitis and periodontitis, are known to be chronic immune inflammatory responses. The inflammatory reaction in periodontal diseases involves the triggering of leucocytes, neutrophils, T-lymphocytes and plasma cells, also the stimulation of antibodies and chemical mediators such as cytokines, chemokines and C-reactive protein. They are among the most common diseases in all communities and along with dental caries are considered the main causes of tooth loss [1]. The development of periodontal diseases depends on the existence of pathogenic micro-organisms, host immunity reaction and risk factors. These risk factors

include oral hygiene, age, gender, immunity status, smoking, medications, drug abuse and socioeconomic status. Although variances that are present among the several types of periodontal diseases, all contribute a shared characteristic of complex host-microbial interactions. Disease development reflects the balance between homeostasis and the progression of the destruction of the periodontal tissues [2], [3].

ABO blood groups are the greatest reported erythrocyte antigen system where they have been utilised as haematological biomarkers in scientific studies and their associations with different diseases [4], [5]. The ABO blood type system implicates four blood categories: O, A, B and AB. Blood group O presents the erythrocytes without true antigen, but

create antibodies to A and B antigens while Type A and B blood groups present the erythrocytes that have the A and B antigens, respectively, and manufacture antibodies to the other blood type. In contrast, the Type AB blood group represents erythrocytes that do not make antibodies to others because they carry both A and B antigens [6].

The secretion of antigens of ABO blood groups in the saliva prohibits the ability of micro-organisms to adhere to the surface of a tooth; this is because many of these micro-organisms have surface lectins, which they use to adhere to surfaces of the body and are often ABO specific. Also, non-secretors tend to have minor levels of the immunoglobulin A (IgA) antibodies in the saliva, which may compromise their ability to keep bacterial counts low [7]. Therefore, the genetic factors may alter the oral ecology as genetic dissimilarities in the immune response and presentation of antigens may indicate the susceptibility to virulent and periodontal diseases. However, limited investigations have been revealed to explore the association between the ABO blood group and the diseases of periodontal tissues. The majority of the authors showed a positive correlation between periodontal diseases and ABO blood groups and claimed that the different ABO group could be a risk factor for periodontal diseases [8], [9], [10], [11], [12], [13], [14], [15]. In contrast, others did not find any associations between patients who have periodontal disease and ABO blood groups [16], [17].

Accordingly, this present study was done on generalised chronic periodontitis (GCP) patients and their corresponding blood types, to find out if there was any possible correlation between them. If any, whether of ABO blood types and the Rhesus (Rh) factor affect the severity of chronic periodontitis. Performing investigations in this field help us to understand more the risk factors of chronic periodontitis that will give more chances in prevention and successful treatment in the future.

Our purpose was to investigate any possible relationship between the severity of chronic periodontitis, ABO blood groups and Rh factor.

Patients and Methods

The study proposal was evaluated and accepted by the Ethical Committee of Al-Farabi colleges, Riyadh, KSA. Informed consent was received by participants after explaining all the details of the study.

Researchers investigated 1126 generalised chronic periodontitis (GCP) patients who were referred to the periodontology department, Al Farabi dental hospital, Riyadh, KSA. Patients were selected

randomly according to the following criteria;

Inclusion criteria: -Healthy patients and former smokers with a clinically confirmed diagnosis of GCP according to AAP classification [18]; -Females and males ≥ 30 years old.; -Agreement (written informed consent) and compliance; -Clinical evidence of attachment loss in more than 30 % of the present teeth.

Excluded criteria: -Clinically diagnosed Gingivitis, Localized Chronic Periodontitis, Aggressive Periodontitis, non-inflammatory periodontal disease, acute periodontal diseases; -Current and former smoker patients; -Any systemic or mental diseases and systemic conditions like pregnancy; - Patients under any drugs, which affect periodontal health e.g. contraceptive pills; -Patients who had periodontal treatment 6 months prior to the examination; -Patients who had less than 20 teeth.

A group of 533 systemically fit patients were recruited, 319 medically compromised patients whether they smoked or not, and 9 systemically fit patients who had less than 20 teeth were excluded, only 205 patients (111 males and 94 females), aged 30-70 were enrolled in our cross-section study according to inclusion criteria (Figure 1). The study was based on the examination of the periodontal condition by two periodontal examiners, along with the detection of ABO blood groups.

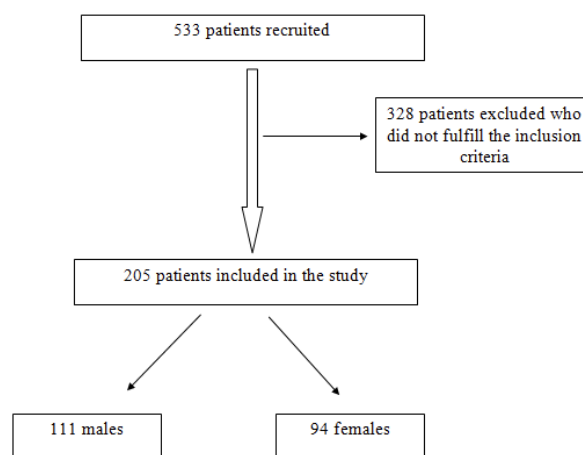


Figure 1: Flow chart

Periodontal Examination and diagnosis of chronic periodontitis

-Clinical examinations including documented patient age and gender, medical and dental history, oral care methods, extra and intra-oral examination were documented.

The Measurements of the Pocket depth (PD), Gingival marginal level (GML) and Clinical attachment loss (CAL) were done manually using periodontal probe (UNC-15), 3 readings were taken for each

surface Facially or Lingually/Palatally and the highest CAL reading was calculated and documented for each surface to assess the severity of the disease in periodontal tissues, The cemento-enamel junction (CEJ) was used as reference point if not visible in case of fixed restoration; restoration margins were used for these measurements. The workshop of Australian dental association classified the severity of chronic periodontitis according to the clinical attachment loss of the tissues as follows: Mild = 1-2 mm CAL; Moderate = 3 to 4 mm CAL; and Severe = 5 mm CAL [19].

-Horizontal furcation involvements were evaluated and measured by Naber's probe, if present.

-Panoramic radiographs were used to evaluate bone loss all over the teeth.

-Based on these clinical parameters, the subjects were segregated into 3 groups:

Group I (Mild Generalized Chronic Periodontitis): Subjects displayed clinical attachment loss more than 30 % of sites, CAL between 1-2 mm.

Group II (Moderate Generalized Chronic Periodontitis): Subjects displayed clinical attachment loss more than 30 % of sites, CAL 3-4mm.

Group III (Severe Generalized Chronic Periodontitis): Subjects displayed clinical attachment loss more than 30 % of sites, CAL equal to or more than 5 mm.

Blood Investigations

Samples of blood were gathered using a sterile disposable lancet and finger prick methods. The blood grouping was done using the slide agglutination method (visual method) for the determination of the ABO blood group and Rh factor [20]. Three drops of the patient blood were mixed with anti-A, anti-B and anti-D separately on a glass slide. The blood agglutination pattern can be detected from which the ABO and rhesus D (Rh D) type of blood can be recognised. Patients were categorised regarding their blood groups (A, B, AB, O) and Rh status (+, -).

The participants were classified into three groups; Mild GCP (Group I), Moderate GCP (group II) and Severe GCP (group III). The participants and their ABO blood groups and Rh were analysed and tabulated. The percentages and distributions were estimated.

Statistical Analysis

To explore the relationship between the study groups, ABO blood groups and Rh factor, the percentage distribution was calculated and the tabulated data was statistically analyzed, the comparison of the distribution of blood groups was performed between the three groups using the Chi-

square test using the SPSS version 19.00 program (SPSS Inc., Chicago, IL, USA).

Results

In this cross-sectional study, 205 patients (111 males and 94 females) with clinically and radiographically diagnosed GCP were divided into 3 groups regarding the severity of GCP. Table 1, and Figure 2 shows the patients' characterisation regarding gender and age disruption.

Table 1: Demographic data

Gender	30-39 years	%	40-49years	%	>50 years	%
Female (94) 45%	29	14.1	54	26.3	11	5.3
Male (111) 56%	35	17.1	64	31.2	12	5.8
Total (205) 100%	64	31.2	118	57.5	23	11.2

However, the ages of patients included in this study were above 30 years old where the noticed largest group ranged from 40-49 years which represents 57.5% of the total patients.

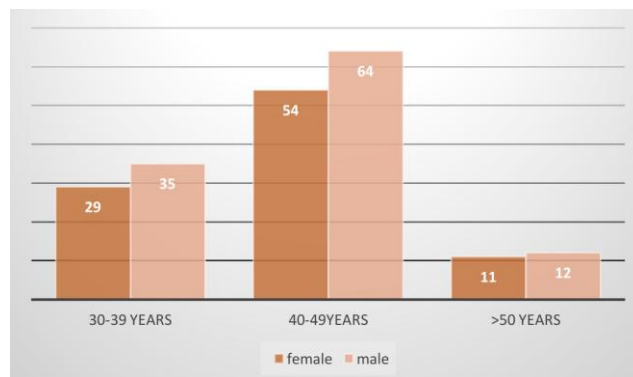


Figure 2: Demographic representation

Table 2, Figure 3 demonstrates the distribution of the ABO blood groups in 205 patients with different grades of periodontitis, patients of mild chronic periodontitis (group I) had 6% of A blood group, 5.4% B blood group, 1.5% AB blood group and 10.7% O blood group.

Table 2: Distribution of periodontal status with the blood group of the study population

Blood group	Total no of patients	%	Group I	%	Group II	%	Group III	%
A	55	26.8	7 M+5 F	6	17 M+13 F	14	7 M +6 F	6.8
B	47	23	6 M+5 F	5.4	11 M +9 F	9.8	9 M +7 F	7.8
AB	19	9.3	2 M+1F	1.5	7 M + 2F	4.4	4M + 3F	3.4
O	84	40.9	11 M+ 13F	10.7	19 M+ 17 F	18	11 M +13F	12.2

While moderate chronic periodontitis patients (group II) had 14% of A blood group, 9.8% B blood group, 4.4% AB blood group and 18% O blood group.

On the other hand, the third group which represented the severe form of chronic periodontitis (group III) had 6.8% of A blood group, 7.8% B blood group, 3.4% AB blood group and 12.2% O blood group.

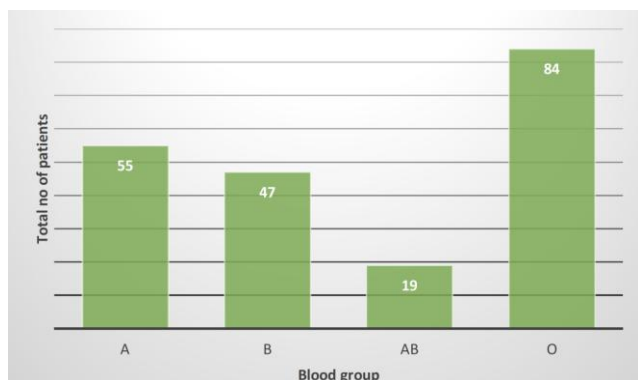


Figure 3: Distribution of periodontal status with the blood group of the study population

On comparison between the four blood groups, we found that all blood groups' highest percentage was related to the moderate form of GCP, and O blood group had the highest percentage of either mild (10.7%), moderate (18%) or severe form of GCP (12.2) in comparison with the other three blood groups. From this documented data, we find a higher frequency of GCP in patients with blood group O followed by A blood group, where among the surveyed 205 blood samples, O blood group represented 40.9%, and A blood group represented 26.8% of all three groups of chronic periodontitis.

Table 3: Frequency of Rh factor in subjects with periodontitis

Rh factor	%	Group I (Mild GCP)	Group II (Moderate GCP)	Group III (Severe GCP)
Rh+	90.2	41	83	60
Rh-	9.8	7	12	2

Table 3, and 4 exhibits the frequency of Rh factor of the total 205 participants who had chronic periodontitis, 184 (90.2%) participants were Rh Positive, and 21 (9.8%) participants were Rh negative, the variables of the equation showed statistical significance between the variables.

Table 4: Variables in the Equation for Rh Factor

	B	S.E.	Wald	Df	Sig.	Exp (B)
Step 0 Constant	.000	1.414	.000	1	.021	1.000

P Value = 0.021 < 0.05 Significant

Our results revealed that individuals with blood group O were at a greater risk to develop GCP irrespective of its severity, followed by those with blood group A, B, and AB respectively (Table 2). Thereby, the patients with the AB blood group had the least risk to develop GCP. The statistical analysis gave significant values when comparing the blood groups in different groups of Periodontitis (Table 5, and 6).

Table 5: Association between the between the blood groups

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.000 ^a	1	.137
Continuity Correction ^b	.000	1	1.000
Likelihood Ratio	2.773	1	.106
Fisher's Exact Test			
Linear-by-Linear Association	1.000	1	.317
N of Valid Cases	2		

The RH distributions in all estimated groups revealed significantly higher results of Rh Positive (Table 3).

Table 6: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.000	9	.00
Likelihood Ratio	11.090	9	.90
N of Valid Cases	4		

Discussion

Plaque is a dynamic, well-organised microbial film that adheres tenaciously to teeth and other hard surfaces in the oral cavity. It is well known to be the main cause of periodontal diseases. Numerous factors may affect the qualitative and quantitative progress of the microorganisms responsible for periodontal diseases. Likewise, ABO blood groups were documented to be effective in bacterial colonisation and agglutination [21]. The progression of the disease can be related to host-based risk factors [13]. Genetic dissimilarities may act as risk or protective factors for chronic inflammatory reactions [10]. On the other hand, Offenbacher [22] stated that less than 20% of the variability of the severity of the periodontal diseases could be explained by the number of specific micro-organisms found in disease-associated plaques. At this moment, the role of genetic influences has been proposed.

Our study investigated the correlation between ABO blood group and the severity of the periodontal disease in systemically healthy patients with GCP above 30 years, as the chronic periodontitis don't explore significantly until the third decade [23].

A few early reports in the literature have considered the association between ABO blood group and periodontal diseases. Weber and Pastern were the pioneers in studying the relationship between ABO blood group and periodontal involvements in 1927. It was also noted that antigens of the ABO system could act as receptors for infectious agents [13]. Most of the previous studies have suggested that the ABO blood group is one of the genetic risk factors that may lead to periodontal diseases [3], [11], [12], [13]. While, Frias and Lopez [17], Barros and Witkop [24] and Pradhan et al., [25] stated that there is no correlation between ABO blood group and periodontal diseases.

In the present study, there was a positive and significant association between blood group and GCP. Also, the results revealed that blood group O is considered as a predictive factor for chronic periodontitis development and it increases the severity of this periodontal disease. While the patients with the AB blood group had the least risk to develop GCP. Similarly, Arati et al., in 2010 [14] reported that blood group O presented a greater percentage in the periodontitis patients and the blood group AB displayed the least percentage of periodontal involvements.

The results of our study also correspond to similar studies conducted by Gawrzewska [8], Demir et al., [9], Vivek S et al., [12], Koregol et al., [15] and Anup et al., [16]. They conducted that individuals' blood group O and Rh positive had a superior predisposition for periodontitis. Instead, Koregol et al., [15] and Gawrzewska [8] reported that patients with blood group A have more resistance to develop diseases of the periodontium.

Furthermore, Pai et al., [13] worked in 750 subjects with periodontal diseases. They determined that there was an existing relationship between periodontal disease and ABO blood group and there was a high prevalence of individuals with blood groups O and AB with healthy periodontal status, but individuals with blood groups B and A presented inclination toward unhealthy periodontal involvements. While, Aravind et al., [11] conducted that there was a relatively increased percentage of the B blood group in subjects with gingivitis and periodontitis while the subjects of O blood group had higher percentage healthy periodontium.

In contrast, some investigators demonstrated that patients with blood group B were found to be superior in the risk of developing periodontitis [3], [10], [13]. Also, Mortazavi et al., [26] found that periodontitis did not show any relationship with blood groups despite the most frequent blood group had periodontitis was O.

Some studies [27], [28] showed that O and B were the most frequent blood groups although blood group A and AB were detected at a lower incidence. Dental health providers in screening and prevention programs should consider this finding in addition to our results.

The Rh factor distributions in the present study exhibited a significantly greater percentage of Rh-positive than the Rh-negative factor. Similar conclusions were reported by numerous authors [3], [9], [13], [15]. This may be related to the difference in substitutes of cell membrane proteins, which is detected by a series of allelic genes at a single locus [15].

In conclusion, from the data of this study, it can be concluded that there was a clear relation between blood group ABO and Rh group with GCP

and its severity. Genetic influences such as blood group antigens may act as a risk factor that affects the development and severity of the chronic periodontitis. Therefore, the information of the ABO blood group of patients in the periodontal clinics may be given an advantage in developing early treatment strategies in highly susceptible individuals. Because there is a conflict among results of studies, large, diverse population samples from different geographic regions with more extended investigations are recommended to create a more comprehensive evaluation of the influence of ABO blood group on the health of Periodontium.

References

- Humagain M, Rokaya D. Evaluation of association between the prevalence and severity of periodontal diseases and abo blood groups among Nepalese adults. *Ind J Sci Res and Tech.* 2014; 2:66-70.
- Patel R, Patel KM, Patel HN, Shah HG. ABO Blood Group & Periodontitis: Correlation or No-Relation. *Ann Int Med Den Res.* 2006; 2:251-4.
- Serio FG, Duncan TB. *The Pathogenesis and Treatment of Periodontal Disease.* Academy of Dental Therapeutics and Stomatology. PennWell Publications, 2009:1-12.
- Mourant AE, Kopec AC, Domaniewska-Sobczak K. *The distribution of the human blood groups and other polymorphisms.* London: Oxford University Press, 1976.
- Mourant AE, Kopec AC, Domaniewska-Sobczak K. *Blood groups and diseases: a study of associations of diseases with blood groups and other polymorphisms.* London: Oxford University Press, 1978.
- Abd ST. Individual variations in secretory ABO group antigen. *IJSN.* 2015; 6:447-51.
- Blackwell CC. The role of ABO blood groups and secretor status in host defences. *FEMS Microbiol Immunol.* 1989; 1(6-7):341-349. <https://doi.org/10.1111/j.1574-6968.1989.tb02419.x> PMID:2698729
- Gawrzewska B. ABO, Rh and MN Blood and ABH group factors in saliva related to periodontal diseases. *Czas Stomatol.* 1975; 28:1007. PMID:810324
- Demir T, Tezel A, Orbak R, Eltas A, Kara C, Kavrut F. The effect of ABO blood types on periodontal status. *Eur J Dent.* 2007; 1(3):139-143. PMID:19212557 PMID:PMC2638241
- Singh MP, Mehta A, Bhatia A, Aditya. ABO blood groups and periodontal status: is there any link? A clinical study. *JIDA.* 2011; 5(11):1128-31.
- Aravind T, Neela N, Mannava P, Chidrawar SK, Shetty S, Karda K, Gupta S. Evaluation of Correlation Between Periodontitis and ABO Blood Grouping- A Clinical Study. *J Adv Med Dent Scie Res.* 2016; 4(4):78-82. <https://doi.org/10.21276/jamdsr.2016.4.4.17>
- Vivek S, Jain J, Simon SP, Battur H, Supreetha S, Haridas R. Association of ABO Blood Group and Rh factor with periodontal disease in a population of Virajpet, Karnataka: A cross-sectional study. *Journal of international oral health: JIOH.* 2013; 5(4):30. PMID:24155617 PMID:PMC3780381
- Pai GP, Dayakar MM, Shaila M, Dayakar A. Correlation between "ABO" blood group phenotypes and periodontal disease: Prevalence in south Kanara district, Karnataka state, India. *Journal of Indian Society of Periodontology.* 2012; 16:519-23. <https://doi.org/10.4103/0972-124X.106892> PMID:23493096 PMID:PMC3590719

14. Arati C. et al: ABO blood groups and Rhesus factor: An exploring link to periodontal diseases. *Indian Journal of Dental Research*. 2010; 21(3):364-368. <https://doi.org/10.4103/0970-9290.70804> PMID:20930346
15. Koregol AC, Raghavendra M, Nainegali S, Kalburgi N, Varma S. ABO blood groups and rhesus factor: An exploring link to periodontal diseases. *Indian J Dent Res*. 2010; 21:364-8. <https://doi.org/10.4103/0970-9290.70804> PMID:20930346
16. Anup P, Siddhartha V, Girish S, Keshava A, Sameer Z, Vishwajeet K. ABO and Rh blood group system and periodontal disease - A Prevalence Study. *British Journal of Medicine & Medical Research*. 2016; 16(5):1-6. <https://doi.org/10.9734/BJMMR/2016/24055>
17. Frias MT, Lopez NJ. No association between secretor status of ABO blood group antigens and juvenile periodontitis. *Acta Odontol Latinoam*. 1994; 8(2):9-15. PMID:11885229
18. Armitage GC. Development of a classification system for periodontal diseases and conditions. *Ann. Periodontol*. 1999; 4:1-6. <https://doi.org/10.1902/annals.1999.4.1.1> PMID:10863370
19. Highfield J. Diagnosis and classification of periodontal disease. *Australian Dental Journal*. 2009; 54:S11-S26. <https://doi.org/10.1111/j.1834-7819.2009.01140.x> PMID:19737262
20. Mohan H, editor. *Pathology Practical Book*. 2nd ed. New Delhi: Jaypee Brothers, 2007: 202-5. <https://doi.org/10.5005/jp/books/10592>
21. Hellström U, Hallberg EC, Sandros J, Rydberg L, Bäcker AE. Carbohydrates act as receptors for the periodontitis-associated bacterium *Porphyromonas gingivalis*: a study of bacterial binding to glycolipids. *Glycobiology*. 2004; 14:511-9. <https://doi.org/10.1093/glycob/cwh073> PMID:15044394
22. Offenbacher S. Periodontal diseases: pathogenesis. *Ann Periodontol*. 1996; 1(1):821-878. <https://doi.org/10.1902/annals.1996.1.1.821> PMID:9118282
23. AlJehani YA. Risk Factors of Periodontal Disease: Review of the literature. *International Journal of Dentistry*. 2014; 2014:182513. <https://doi.org/10.1155/2014/182513> PMID:24963294 PMCid:PMC4055151
24. Barros L, Witkop CJ. Oral and genetic study of Chileans 1960 III. Periodontal disease and nutritional factors. *Arch Oral Biol*. 1963; 8:195. [https://doi.org/10.1016/0003-9969\(63\)90057-8](https://doi.org/10.1016/0003-9969(63)90057-8)
25. Pradhan AC, Chawla TN, Samuel KC, Pradhan S: The relationship between periodontal disease and blood groups and secretor status. *J Periodontal Res*. 1971; 6:294-300. <https://doi.org/10.1111/j.1600-0765.1971.tb00620.x>
26. Mortazavi H, Lotfi G, Fadavi E, Hajian S, Baharvand M, Sabour S. Is ABO blood group a possible risk factor for periodontal disease? *Dent Hypotheses*. 2015; 6:14-18. <https://doi.org/10.4103/2155-8213.150865>
27. Bashwar LA, AL-Mulhim AA, Ahmad MS, Ahmed MA. Frequency of ABO blood groups in the Eastern region of Saudi Arabia. *Saudi Med J*. 2001; 22(11):1008-12.
28. Pourfathollah AA, Oody A, Honarkaran N. Geographical distribution of ABO and Rh (D) blood groups among Iranian blood donors in the year 1361 (1982) as compared with that of the year 1380 (2001). *Scientific Journal of Iran Blood Transfus Organ*. 2004; 1(1):11-7.