

Prevalence, Gender Distribution, and Allelic Distribution of ABO and Rh-D Blood Groups in AL-Salim Laboratory for Medical Analysis, Ajdabiya, Libya

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Abstract: *Objective:* To determine the prevalence of ABO, ABO blood groups, Rh factor frequency, gender distribution and allelic distribution in AL-Salim laboratory for medical analysis at Ajdabiya City. *Methodology:* ABO and Rh blood groups tests. The study of blood group determination (hemo classification) and Rh factor determination was carried out between January and December 2019. *Results:* Total number of 2095 individuals was collected from AL-Salim laboratory for medical analysis at Ajdabiya City show that phenotype O is the most common with a frequency of 38.56801%, followed by phenotype A (29.642004%), B (16.5632458%) and AB (15.22673031%). The calculated allelic frequencies were 0.2048624908, 0.1741059592 and 0.6210315539, for I^A (p), I^B (q), and I^O (r), respectively. In Addition, it was found that 78.9498806% of the individuals were Rh+ and 21.050119% were Rh-. *Conclusion:* Blood group O and Rh+ factor were dominant in the both genders. There is no relationship between the gender and the distribution of ABO and Rh blood groups.

Keywords: Prevalence, ABO & Rhesus blood groups. Allele. Hardy-Weinberg. Gender Distribution

1. Introduction

ABO blood group system is the most important blood system clinically especially in human blood transfusion. Grouping of the blood in ABO system is based on the presence or absence of one or the both antigens A and B. There are four types of ABO blood groups; blood groups A, B, AB and O. Blood groups A and B have antigens A and B on the surface of the red blood cells respectively. While group AB has the both antigens A and B. Group O has neither antigen A or B (Seeley, Stephen and Tate, 1998). Distribution of ABO and Rh (D) blood groups varies between populations and races. The studies of blood groups are important parameters in various genetic studies for reliable geographical information and in blood transfusion process with associated diseases, which will eventually help in reducing morbidity and mortality rate. Knowledge of blood grouping is also essential for effective management of blood bank inventory (Behra and Joshi, 2013 & Eweidah *et al.*, 2011).

ABO blood group system is governed by a single gene located on chromosome 9 with three alleles (I^A , I^B and I^O) (Zahid *et al.*, 2016) with six genotypes, that is OO (type O), OA (type A), OB (type B), AA (type A), BB (type B), AB (type AB) (Khalid *et al.*, 2013). I^A and I^B alleles are codominant but both of them are dominant over the

recessive allele I^O in intra-allelic interaction in diploid condition (Murphy *et al.*, 2003). Rhesus blood group system (Rh) is the second most important blood group system due to hemolytic disease of newborn, which is determined by a gene located on the short arm of chromosome 1 (Murphy *et al.*, 2003).

Samples and methods

Blood grouping was carried out over a period of 12 months from January 2019 to December 2019. These were categorized according to ABO/Rh system, and allele frequency was computed according to Hardy-Weinberg law (Mollison, Engelfriet and Conteras, 1993 & Saadat, 2015).

Collection of blood samples

2.0 ml of blood sample was drawn from the antecubital vein of each subject in a disposable syringe, and transferred immediately to a tube containing ethylene diamine tetra acetic acid (EDTA).

Determination of blood groups

Slide Method

The slide test is relatively the least sensitive method among others for BG determination, but due to its prompt results. This method, a glass slide or white porcelain support is divided into three parts, as for each part, a drop of donor or

recipient blood is mixed with anti-A, anti-B and anti-D separately. The agglutination or blood clumping pattern can be visually observed from which the ABO and rhesus D (RhD) type of blood can be determined. The test completes in 5–10 min and is inexpensive, which requires only a small volume of blood typing reagents (Malomgre and Neumeister, 2009).

Statistical analysis

Data were analyzed using SPSS-25 for the frequency and percentage. Allele frequencies were calculated by applied the assumption of Hardy–Weinberg equilibrium and expressed as percentages. Association of blood groups with gender was calculated using Chi Square test. Alpha error was kept ≤ 0.05 .

2. Results

The total number of 2095 individual included in this study was collected from Al-Salem Laboratory for Medical Analysis in Ajdabiya show in Table (1). The prevalence of blood groups was obtained from Al-Salem Laboratory for medical analysis during the year 2019. The phenotype O is the most common with a frequency of 38.56801%, followed

by phenotype A (29.642004%), B (16.5632458%) and AB (15.22673031%). The prevalence of Rhesus positive and negative distribution in this study population was found 78.9498806% and 21.050119% respectively (Table 3). Distribution of blood groups in study of the population according to rhesus phenotype found that 78.9498806% of the individuals were Rh+, and 21.050119% were Rh-. The calculated allelic frequencies were 0.2048624908, 0.1741059592 and 0.6210315539 for groups A, Band O respectively (Table4). The frequency and percentages of ABO/Rhesus blood groups among arrivals to AL-Salim Laboratory for Medical Analysis were O positive 553 (26.3961%), Onegative255 (12.1718%), (12.3150358%), AB negative 61 (1.2%), A positive 552 (26.3484%), A negative 69 (3.2935%) and B positive 291(13.89021%), B negative 56(2.6730%), the distribution of ABO/Rhesus blood groups (Figure 1) and the percentage of the distribution of ABO/Rhesus blood groups in the study population are shown in Table (2). Table (6) shows the association of the gender with ABO blood grouping. Table (7) shows the association of the gender with Rh grouping. The results of this study are not shown any relationship between the gender and blood types, whether it was ABO or Rh ($p < 0.05$).

Table 1: Prevalence of Blood types arrivals to Al-Salem laboratory for medical analysis during 2019

O-		O+		AB-		AB+		B-		B+		A-		A+		Year 2019
F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	<i>M=MALE F=FEMALE</i>
3	20	15	31	1	3	5	16	1	5	2	14	0	4	18	17	January
0	2	18	53	1	3	12	18	1	3	7	16	1	6	5	35	February
6	17	11	44	2	4	5	20	1	7	6	10	0	2	15	30	March
3	20	14	41	0	2	4	10	1	5	12	19	4	6	17	45	April
9	16	16	19	0	7	7	15	2	6	10	22	0	5	7	23	May
11	19	11	38	2	9	8	10	0	9	7	20	2	9	16	55	June
10	8	10	46	0	4	7	15	3	3	2	16	0	2	10	35	July
14	20	7	50	2	5	13	18	0	3	5	8	3	11	16	50	August
1	20	13	31	0	3	20	19	0	1	5	9	0	6	12	20	September
14	10	5	17	0	8	5	10	0	4	12	21	0	0	15	55	October
6	8	18	23	0	1	5	16	0	0	6	11	0	8	18	20	November
1	17	3	19	1	3	0	0	0	1	1	50	0	0	2	16	December
78	177	141	412	9	52	91	167	9	47	75	216	10	59	151	401	Total

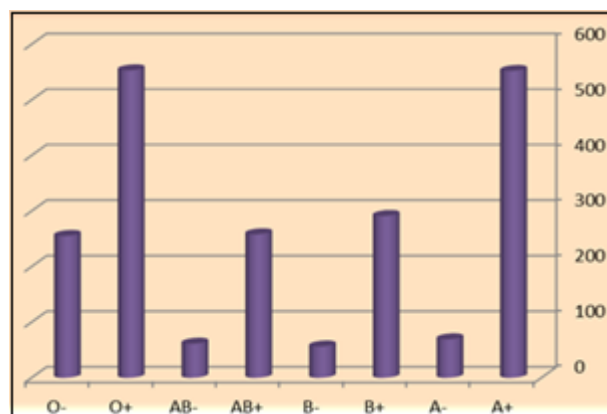


Figure 1: Distribution of ABO/Rhesus blood groups in the study population

Table 2: Percentage the distribution the ABO/Rhesus blood groups in the study population

O-	O+	AB-	AB+	B-	B+	A-	A+	Blood group
255	553	61	258	56	291	69	552	Frequency
12.1718%	26.3961%	2.9116%	12.3150358%	2.6730%	13.89021%	3.2935%	26.3484%	Percentage

Table 3: Distribution of blood groups in the study population according to rhesus phenotype

Rh	Blood group				Total
	A	AB	B	O	
Rh-	69 (3.29%)	61 (2.91%)	56 (2.673%)	255 (12.7%)	441 (21.050119%)
Rh+	552(26.3484%)	258(12.3150358%)	291(13.89021%)	553(26.3961%)	1654 (78.949880%)
Total	621 (29.64%)	319(15.2267303)	347(16.5632458%)	808(38.56801%)	2095(100%)

Table 4: Gene frequencies of ABO and Rh blood group alleles in the study population

Blood group	Gene allele	Frequencies of alleles	Phenotype Frequency	Percentage
ABO	A	0.2048624908	621A	29.642004%
	B	0.1741059592	347B	16.5632458%
	O	0.6210315539	319AB 808 O	15.22673031% 38.56801%
Rh	D	0.5411959097	Rh(D) +ve	1654(78.9498806%)
	d	0.4588040903	Rh(d) -ve	441 (21.050119%)

Table 5: Gender and distribution of ABO and Rh blood groups in the study population

Blood group	Rh+		Rh-		Total
	Male	Female	Male	Female	
A	401(19.14%)	151(7.2%)	59(2.816%)	10(0.477%)	621 (29.64 %)
B	216(10.31%)	75(3.57%)	47(2.243%)	9(0.429%)	347 (16.5632458%)
AB	167(7.97%)	91(4.34%)	52(2.482%)	9(0.429%)	319 (15.22673031%)
O	412(19.66%)	141(6.73%)	177(8.44%)	78(3.72%)	(%56801.38) 808
Total	1196(57.088%)	458(21.86 %)	335(15.99%)	106(5.05%)	2095 (100%)

Table 6: Frequency of ABO blood groups in males and females

Gender	Blood group				Total
	ABABO				
Male	460 (21.95%)	263 (12.55%)	219 (10.453%)	589(28.11%)	1531 (73.78%)
Female	161 (7.695 %)	84(4%)	100 (7.4%)	219(10.453%)	564(26.9%)
Total	621 (29.64 %)	347(16.56324587%)	319 (15.2267303 1%)	808(38.56801%)	2095 (100%)

Table 7: Frequency of Rh blood groups in males and females

Gender	Rh+	Rh-	Total
Male	1196(57.088%)	335(15.99%)	1531 (73.78%)
Female	458(21.861%)	106(5.05%)	564 (26.9%)
Total	1654(78.949808 %)	441(21.050119%)	2095 (100%)

3. Discussion

Individuals are divided into 4 major blood groups namely A, B, AB and O groups depending on the antigen present on their RBCs (Conteras and Lubenko, 2001 & Knowles and Poole, 2002). Moreover, the human red blood cells that carry antigen D are referred to as Rhesus positive (Rh+) while those without it are Rhesus negative (Rh-) (Conteras and Lubenko, 2001). The global distribution of the different phenotypes of this system varies among geographic regions and ethnic groups (Choudhury *et al.*, 2014). The phenotype O is the most common with a frequency of 38.56801% in this study which is may be explained the reason of the high frequency of blood type O, this is due to the fact that many people have an A or B with the genotype is heterozygous, with O allele co-occurring with gene A or B.

The pattern of ABO and Rhesus blood group distribution of this population is similar to those reported in other regions of the country. Local studies in different areas of Libya showed the control of blood type O, following the pattern obtained in this study, ABO frequency, among Libyans of Fazzan Province blood group was the most frequent group O 48.2%, the least frequent group was group AB 4.9% (Salih *et al.*, 2005). ABO frequency in ALzawia was blood group

O48.9% followed by blood group A 33.1%, B 12.8% and AB 5.2% (Fayrouz, Farida and Irshad, 2012). ABO frequency, in the western part of Libya found that blood group O 48.9% was the highest, followed by A 33.1% B12.8% (Noor and Eldin, 2013). In the blood bank of the central hospital in Al-Bayda 37.44%, 23.43%, 30.17%, and 8.96%, and blood types O, A, B, and AB respectively (Saad, 2016). In Bani Waleed O blood group was the most common 43.6%, followed by A 31.7%, B 17.7%, and finally, AB blood group 7.0% (Ameigal and Ageel, 2019).

Total number of 3000 individuals was collected from Ajdabiya and Ghemins, then analyzed. Phenotype O blood type has the highest frequency, followed by A and B, whereas the lowest prevalent blood group was AB. The overall phenotypic frequencies of ABO blood groups were O>A>B>AB (El-Moghrabi *et al.*, 2020). Similar result (O >A >B >AB) was obtained from a study by Hamed *et al.* 2012 in Mauritania, the United State (Garratty *et al.*, 2004), tub there was a slight discrepancy (O >B>A >AB) from Saudi Arabia (Sarhan *et al.*, 2009) and Iraq studies conducted in Antananrivo (Madagascar) (Randriamanantany *et al.*, 2012) and in Guinea (Loua *et al.*, 2007). Results from Jordan by Hanania *et al.* 2007 reported a different distribution (A >O>B >AB) of ABO blood group.

The allele frequencies of ABO and Rh blood groups in this study were calculated by Hardy-Weinberg equation and found to be 0.6210315539, 0.2048624908 and 0.1741059592 for I^O (r), I^A (p), and I^B (q), respectively. The Rh allelic frequencies were 0.5411959097 for D and 0.4588040903for d, respectively. Allele O proportion was

the maximum in the tested population, whereas allele frequency for allele B was the lowest (0.174105952) (Table 4). Other studies have calculated the alleles and reached the same results as this study. The allelic frequencies of O, A and B alleles for Ajdabiya city in the north eastern of Libya were O (0.6511528238), A (0.1839120439) and B (0.1649351323). The allelic frequencies for Ghemins city in the northeastern of Libya were O (0.5927337795), A (0.2273881627) and B (0.180) (El-Moghrabi *et al.*, 2020). The frequencies of I^A , I^B and I^O alleles in Egypt were calculated using the Hardy-Weinberg law of equilibrium. The calculated gene frequencies are 0.2537 for I^A (p), 0.1812 for I^B (q) and 0.5651 for I^O (r) (Abdelmonem *et al.*, 2019). The allele frequencies of ABO and Rh blood groups in Ethiopia were 0.6497, 0.1806 and 0.1697 for I^O (r), I^A (p), and I^B (q), the Rh allelic frequencies were 0.7737 for D and 0.2263 for d, respectively (Regasa and Gudeta, 2019).

Our study showed that 1531 (73.08%) were males and 564 (26.92%) females (Table 7). The percentage frequency of Rhesus negative is the highest, which constituted 441 (21.050119%) in this study although the percentage frequency of Rhesus positive was the most commonest, which constituted 1654 (78.9498806 %) (Table 4). Many other countries, an increase in Rhesus negative was observed compared to the British Rhesus negative factor, which represented 17% of the population, in the Caucasus 15% (Giriet *al.*, 2011), in Saudi Arabia, Rhesus negative, was 7.2% (Sarhan, Saleh and Dajem, 2009) and 29% (Eweidah *et al.*, 2011), in Turkey was 14% (Dilek *et al.*, 2006), in Morocco was 29% (Weinstock, 2014), and in the Kurds, Iraq 8.27% (Muhammad, 2010).

The distribution of Rh+ and Rh- groups were analyzed among the 4 blood groups phenotypes of ABO system. Group O+ was found to be the most common 553 (26.3961%), the least frequent group was group B- (56 (2.6730%)) (Table 2). Another study was the frequencies of ABO/Rh blood groups; O+ was found to be the most common, (39.31%), followed by A+ (25.98%), B+ (24.39%) and AB+ (5.2%), whereas among the Rh negative subjects, blood group O- was the most frequent (2.42%), followed by groups A- (1.31%), B- (1.08%) and AB- (0.31%) (Regasa and Gudeta, 2019). Group O + was the most frequent in male while group A + was the most frequent in female. Group O- was the most frequent in the both genders. A, B, and AB-related Rh positive had a higher frequency in males comparison to females. Well the same result with A, B, and AB related Rh negative had a higher frequency in males compared to females shown in table (5). Another study was the total survey results blood group A and Rh+ factor were dominant in both sexes (Vargas *et al.*, 2016).

Chi-Square in table (6) was applied to show the existence of a relationship between the two variables blood groups and gender. The number of rows: $R = 2$ and the number of columns $C = 4$, $df = (C-1) \times (R-1)$ $df = (2-1) \times (4-1) = 3$. The computed value (5.3) less than the tabular value (7.8). Decision-making; we reject the alternative hypothesis and accept the null hypothesis i.e. There is no relationship between the gender and blood group ABO. Chi-Square in table (7) was applied to test the existence of a relationship

between the two variables, Rh factor and gender, to find out statistical significance, the calculated chi value should be compared with the tabularity. The number of rows; $R = 2$ and the number of columns $C = 2$, $df = (C-1) \times (R-1)$, $df = (2-1) \times (2-1) = 1$. The result was obtained the computed value (1.837) is less than the tabular value (3.84). Decision-making: We reject the alternative hypothesis and accept the null hypothesis. There is no relationship between sex and Rh blood group distribution. The result obtained is consistent with a study conducted in Pakistan where the study did not show any relationship between sex and blood types, whether it was ABO or Rh ($p > 0.05$) (Abbasi, Sattar and Mansour, 2019).

4. Conclusion

Phenotype O and allele O are the most common while the least frequent was the blood group AB in AL- Salim laboratory for medical analysis at Ajdabiya City. Overall the group O + was the most frequent in both men and women. Statistically, No significant association was found between the gender and ABO and Rh blood groups. There is no relationship between the gender and the distribution of ABO and Rh blood groups.

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References

- [1] Abbasi, Sana Qanber. Sattar and Mansoor, Rabia Ghazal. 2018. ASSOCIATION OF GENDER WITH ABO AND RH BLOOD GROUPS —A CROSS-SECTIONAL STUDY. *Pak J Physiol*; 14(3).
- [2] Abdelmonem, M., Fyala, A., Boraik, A., Shedid, M. and Mohamed, A. 2019. Distribution of Blood Types and ABO Gene Frequencies in Egypt. *American Journal of Clinical Pathology*, 152 (Supplement_1), S153-S153.
- [3] Ameigal, S. D. and Ageel, A. A. 2019. A cross sectional preliminary study on the prevalence of ABO and rhesus blood groups in Bani Waleed City, *Libya. Libyan international medical university*, 4 (2): 56-61.
- [4] Behra, R. and Joshi, Y. R. 2013. Distribution of ABO blood group and RH (D) factor in Western Rajasthan. *Natl J Med Res*; 3: 73-75.
- [5] Choudhury P, Chakrabarti JS, Choudhury PS, Mail I. 2014. Frequency and distribution of blood groups in blood donors of Tripura. *Health*, 2 (2) 57-61.
- [6] Conteras M. and Lubenko S. 2001. Immunohaematology: Introduction In: Postgraduate Haematology, Hoffbrand, AV, Lewis SM and Tuddenhan EGD (Eds). 4th Edition, Arnold Publishers, London, UK, 11, 164-181.
- [7] Dilek, I., Demir, C., Bay, A., Akdeniz, H. and Oner AF. 2006. ABO and Rh Blood Groups Frequency in Men and Women Living in Eastern Turkey.

- International Journal of Hematology and Oncology*; 16: 23-26.
- [8] El-Moghrabi, Hameda Ali., Al-Drussi ,Ibrahim., Jwieli, Latifa Abdel-Hafid and El-Brghty, Khalil.2020. Gene Frequencies of ABO and Rh (D) Blood Group Alleles in two Different Regions at theNortheastern of Libya. *GSJ*: 8(12), 1542-1554 .
- [9] Eweidah, M.H., Rahiman, S., Ali,H.andDhas Al-Shamary,A.M.2011 . Distribution of ABO and Rhesus (RHD) blood groups in Al-Jouf province of the Saudi Arabia. *Anthropologist*;13:99–2.
- [10] Fayrouz, I. N., Farida, N. and Irshad, A. H. 2012. Relation between fingerprints and different blood groups. *J Forensic Leg Med*, 19 (1): 18-21.
- [11] Garratty, G., Glynn, S.A., McEntire, R. and Retrovirus Epidemiology Donor Study (2004). ABO and Rh(D) phenotype frequencies of different racial/ethnic groups in the United States. *Transfusion*,44(5):703-6.
- [12] Giri, P. A., Yadav. S., Parhar. G. S.and Phalke, D. B. 2011. Frequency of ABO and Rhesus Blood Groups: A Study from a Rural Tertiary Care Teaching Hospital in India. *Int J Biol Med Res.*; 2(4): 988 -990
- [13] Hamed, C. T., Bollahi, M. A., Abdelhamid, I., Mahmoud, M.A., Ba, B., Ghaber, S. Habti, N. and Houmeida, A. 2012. Frequencies and ethnic distribution of ABO and Rh(D) blood groups in Mauritania: results of first nationwide study. *International Journal of Immunogenetics*,39(2):151–154.
- [14] Hanania, S. S., Hassawi, D.S. and Irshaid, N.M. (2007). Allele Frequency and Molecular genotypes of ABO blood group system in a Jordanian Population. *J. Med. Sci.*, 7(1):51-58.
- [15] Khalid, M., Aslam, N., Aslam,M.and Ahmad, R. 2013. Distribution of ABO and Rh (D) blood groups among blood donors in district Mardan, *Pakistan. Journal of SaiduMedical College*, 3(2):318-322.
- [16] Knowles,S.and Poole,G. 2002 .Human Blood group systems. In: Practical transfusion medicine. 1st Edition, Blackwell Publishing ltd., UK, pp, 72-93.
- [17] Loua, A., Lamah, M.R., Haba, N.Y. and Camara, M . 2007. Frequency of ABO blood group and rhesus D in the Guinean population. *Transfus Clin Biol.*,14(5):435–9.
- [18] Malomgre, W. and Neumeister, B. 2009. Recent and future trends in blood group typing. *Anal. Bioanal. Chem*, 393, 1443–1451.
- [19] Mohamad S. J. 2010 . ABO and rhesus blood group distribution in Kurds. *Journal of Blood Medicine*. (1): 143 – 146.
- [20] Mollison, P.L., C.P. Engelfriet& M. Conteras. 1993. Immunology of red cells. In: *Blood Transfusion in Clinical Medicine*, 9th ed. *Blackwell Scientific Publication* p. 87–88.
- [21] Murphy, W.J., Fronicke, L., O'Brien ,S.J. andStanyon,R.2003. The Origin of Human Chromosome 1 and Its Homologs in Placental Mammals". *Genome Research*,13(8):1880-1888.
- [22] Noor, F. and Eldin, F. I. N. 2013. ABO, Rh, Gene Frequency: A Comparative Study between Different Countries. *Indian Internet Journal of Forensic Medicine & Toxicology*, 11 (2): 23-32.
- [23] Randriamanantany, Z.A., Rajaonatahina, D.H., Razafimanantsoa, F.E., Rasamindrakotroka, M.T., Andriamahenina, R., Rasoarilalamanarivo, F.B., Hanitrinala, S.P., Herisoa, F.R., Rasamindrakotroka, A. and Alson, O.A.R. 2012 . Phenotypic and allelic profile of ABO and Rhesus D blood group system among blood donor in Antananarivo. *International Journal of Immunogenetics*,39(6):477–479
- [24] Regasa, M. and Gudeta, T . B . 2019. Allelic and Genotypic Frequencies of ABO and Rh (D) Blood Groups among Blood Donors in Bale Zone, South East Ethiopia. *African Journal of Basic & Applied Sciences*, 11 (1): 01-10.
- [25] Saadat, M . 2015. Estimation of allelic frequencies for ABO and Rh blood groups. *The Egyptian Journal of Medical Human Genetics*, Ain Shams University.
- [26] Saad, K . A. O. 2016. Distribution of ABO Blood Groups And Resus Factor (RH) in ALBIYDA ,Libya. *Journal of Medical and Dental Science Research*, 3 (9): 28-31.
- [27] Salih, K ., Abdrhman, O . M., Irhuma, A .A ., Elgadi,, B. and Abd El Latef, M . H. 2005. Anthropological studies among Libyans of Fazzan Province: ABO and Rh Systems. *Journal for Medical Sciences*, 4 (1), Sebha University, Sebha, Libya.
- [28] Sarhan, M. A., Saleh, K. A and Dajem, S. M. B. 2009. Distribution of ABO blood group and Rhesus factor in Southwest Saudi Arabia. *Saudi Med J.*; 30(1): 116-119.
- [29] Seeley, R. R., Stephens T. D and Tate, P. Anatomy & physiology 4th edition .1998. McGraw- Hill companies, U.S.A (Pp 592- 596)
- [30] Vargas, Luis Causil . , Gómez -Mercado Luis., Díaz, Daniel Otero., Moscote- Blanco, Luis., Luisa, Monterrosa- Mestra, Burgos –Flórez , Dallana. and Herrera- Benavides, Yonairo. 2016. FREQUENCY OF BLOOD GROUPS (ABO SYSTEM) AMONG STUDENTS OF THE UNIVERSITY OF CORDOBA BERASTEGUI VENUE. *CIMEL*, 21(1)24-26.
- [31] Weinstock C. 2014. It is worthwhile filling in the remaining blank spots for blood group antigen frequencies. *Blood Transfus*, 12:3–6.
- [32] Zahid, H.,Yahyaoui, A., Uwingabiye, J., El Khazraji,A., El HadeF.R and Messaoudi, N .2016. Phenotypic and allelic distribution of ABO and Rh-D blood Groups in Blood Transfusion Center of Avicenna Military Hospital, Marrakech, Morocco. *International Journal of Medicine and Health Research*, 2(1):1-9.