

Full Length Research Paper

Study of ABO and Rh-D blood group among the common people of Chittagong city corporation area of Bangladesh

Rashaduz Zaman*, Mohammad Parvez, Md. Jakaria and Mohammed Abu Sayeed

Department of Pharmacy, International Islamic University Chittagong, Chittagong-4203, Bangladesh, India.

Received 21 March, 2015; Accepted 24 June, 2015

This study was aimed to identify the distribution patterns of ABO and Rh-D blood group among the population of Chittagong city corporation area in Chittagong city of Bangladesh in order to promote social awareness, and safe blood transfusion among the population. A cross sectional, analytical study was carried out on a total of 937 people in three different area of Chittagong City Corporation (that is, Central railway building area, District commissioner hill area and Patenga sea beach area). The ABO blood group system in the total sample showed the same trend of prevalence with that of the general Indian subcontinent (B > O > A > AB). The same trend was found among males, but among females the order of prevalence was different (O > A > B > AB). Rh-D positive were 90.72% and Rh-D negative were 9.28%. Study of blood grouping is not only generating a simple database but also create a great social awareness about self-blood grouping and safe blood transfusion among the population of a country.

Key words: ABO, Rh-D, social awareness, agglutination method, Bangladesh.

INTRODUCTION

ABO blood groups were discovered by Landsteiner in 1901 (Landsteiner and Wiener, 1940). Later on in 1939, Rhesus blood groups were discovered by Landsteiner and Wiener in 1940. Since 1901, more than 20 distinct blood group systems have been identified but the ABO and Rhesus blood groups remain clinically the most important. Furthermore, they are also well defined genetic markers employed in population genetics (Aminud-Din et al., 2004; Sigmon, 1992). Blood group or blood type is based on the presence or absence of inherited antigenic substance on the surface of red blood cells that can be determined by specific antibodies (Garg et al.,

2014). The importance of blood group discovery lies in the transfusion of blood amongst different populations irrespective of their ethnic origin, in organ transplantation and in the development of legal medicine, genetic research and anthropology (Storry, 2003).

The major ABO blood group system is divided into four blood types on the basis of presence or absence of A and B surface antigens. The blood groups are A, B, O and AB. The frequency of four main ABO blood groups varies in the population throughout the world. ABO blood group system derives its importance from the fact that A and B are strongly antigenic and anti A and anti B naturally

*Corresponding author. E-mail: rashad.pharma.iuc@gmail.com.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

Table 1. Distribution of ABO blood group among the male and female volunteers of Chittagong city corporation area.

Sex	A	B	AB	O	Total
Male	223	298	81	249	851 (90.82%)
Female	26	22	9	29	86 (9.18%)
Total	249 (26.57%)	320 (34.15%)	90 (9.61%)	278 (29.67%)	937

occurring antibodies present in the serum of persons lacking the corresponding antigen, and these antibodies are capable of producing intravascular hemolysis in case of incompatible transfusion (Harmening and Firestone, 2005). Blood group investigations in this subcontinent started during 1st World War with Hirschfeld in 1919 who determined blood groups in large number of soldiers including Indians, and found high frequency of blood group B. Though records were not maintained separately for endogamous population groups, the studies revealed large regional and ethnic differences in blood group frequencies (Nydegger et al., 2007). The distribution of ABO and Rhesus blood group systems in Bangladesh was studied in South East zone of the country during 1984 to 1988; the predominant blood group was O followed by B group (Majumder and Roy, 1982). In Eastern part of Bangladesh, O group was predominant and distribution of O and B was almost same in Western part (Nandy, 1986).

The present study was conducted among the common population of Chittagong city corporation area with the objective to observe the distribution pattern of ABO and Rhesus blood group system among them. This study will document a blood group data base as well as create social awareness among them, allow safe blood transfusion and prevent hemolytic disease of new born and fetus by knowing ABO and Rh typing.

MATERIALS AND METHODS

This cross sectional study was conducted in three different places and those were at District commissioner hill area on 21st February, at Chittagong railway building area on 1st April and at Patenga sea beach on 16th December. The duration of the study was 8 months from February, 2013 to December, 2013. A total sample of 937 participants irrespective of age and sex were included in the study. Samples were determined using random sampling technique.

Collection of specimens

After aseptic washing with 70% ethyl alcohol, blood samples were collected on grease free clean slide from left ring finger tip with the help of a sterile lancet. Blood groups were determined in a single slide to minimize any errors.

Laboratory investigations

The determination of ABO blood group and Rh (D) blood group was

done according to the principle of slide method (Sultana et al., 2013). A drop of blood from each volunteer was placed on a glass slide in three places. A drop of each of the antisera A, B and D was added and mixed with each blood sample, with the aid of glass rods. Then, the mixture was rocked gently for 60 seconds to observe for agglutination. The results of agglutination were recorded immediately after mixing. The agglutination in blood drop A was considered as group A, and agglutination in blood drop B as group B. The agglutination in both drops was considered as group AB, and if both blood drops were not agglutinated, it was considered as group O. The agglutination in rhesus blood drop was considered as rhesus positive and non-agglutination as rhesus negative.

Data collection

All the participants were told about the aims and objectives of the study, and the blood grouping procedures were briefed to them. Written consent was taken from the participants aged more than 18 years, and parents' consent was taken for those who were less than 18 years old. Particulars of the each participant were taken in a data collection sheet.

Statistical analysis

All statistical analyses were done by Microsoft Office Excel 2007. The result was calculated as frequency of each blood group expressed as percentage.

RESULTS

Out of 937 participants, 90.82% were male and 9.18% were female. Table 1 shows the distribution of ABO blood group among the male and female volunteers. ABO blood grouping data revealed that group 'B' was predominant with 34.15%, followed by group O with 29.67%, group A with 26.57% and group AB with 9.61%. Figure 1 shows the distribution of ABO blood groups among the total participants (for both male and female). The frequency distribution of Rhesus blood group among the participants is shown in Figures 2 and 3. The Rhesus-negative blood group distribution is 2.45% for group A, 2.99% for both group B and O, 0.85% for group AB. In the rhesus-positive blood group distribution, blood group A has percentage frequency of 24.12%; blood group B 31.16%; blood group AB 8.75% and blood group O 26.68%. Blood group B had the highest frequency followed by blood groups O and then A. Blood group AB had the least. The Rhesus-positive and Rhesus-negative

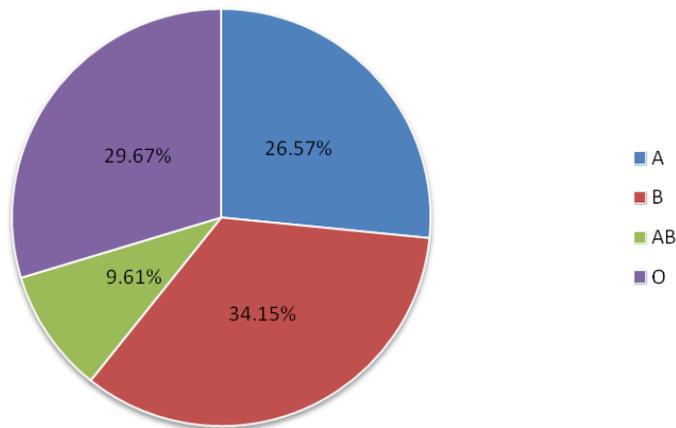


Figure 1. ABO blood group distribution among the population of Chittagong city corporation area.

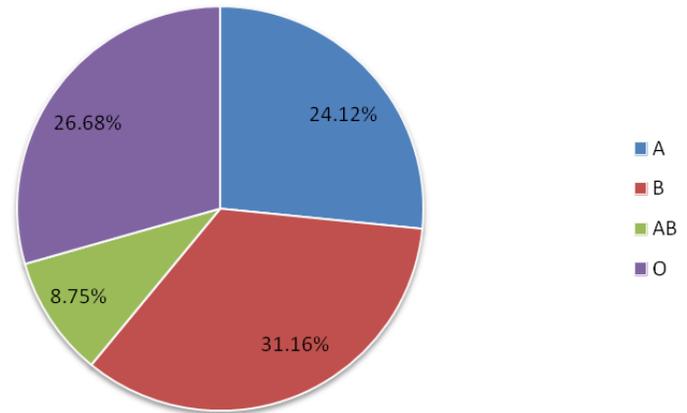


Figure 3. Rhesus-positive blood group distribution among the total volunteers.

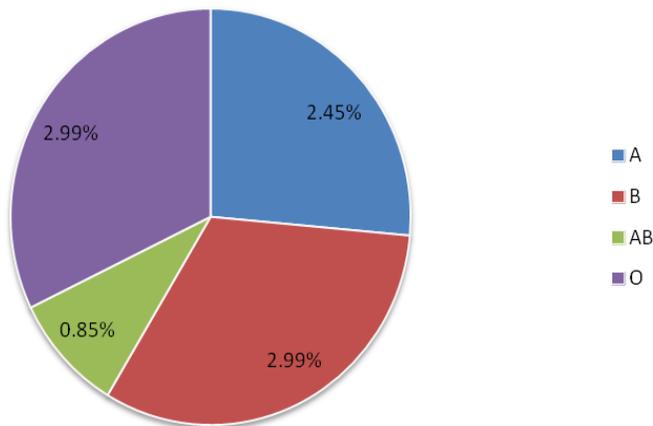


Figure 2. Rhesus-negative blood group distribution among the total volunteers.

vary among the ABO blood group. Rhesus positive has the highest frequency (90.72%) while Rhesus negative has the lowest frequency (9.28%). Table 2 shows the distribution of Rhesus blood groups by sex among the participants. The frequency distributions of ABO blood group based on Rhesus blood group is also shown in Figure 4. The percentages of the ABO blood group and Rhesus blood group varies significantly.

DISCUSSION

The present study has been carried out to determine the distribution pattern of ABO and Rh-D blood groups in common people of Chittagong City Corporation. The knowledge of the blood groups and Rhesus factor is important in evolution, related to diseases and environment, essential in blood transfusion, organ

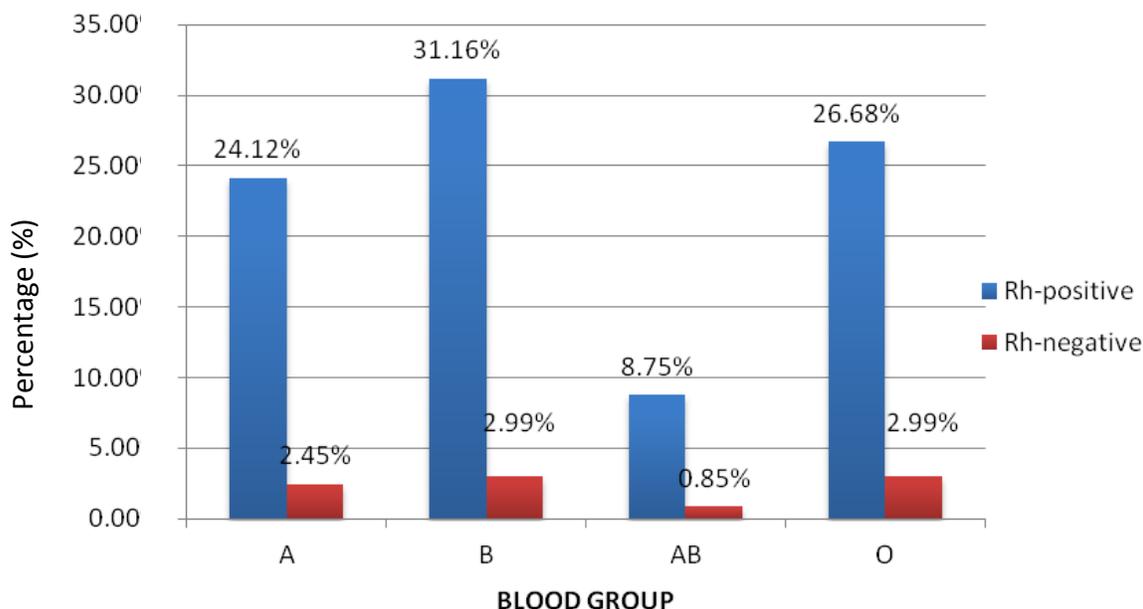
transplantation, forensic pathology, anthropology and training ancestral relation of human (Khurshid et al, 1992), and also helps to prevent complications due to Rhesus incompatibility (Bamidele et al., 2013).

This study showed that among the common people of Chittagong city corporation area, blood group B was the commonest followed by O. The distribution pattern of A, B, O, and AB were 26.57, 34.15, 29.67 and 9.61% respectively. The study regarding the distribution of ABO and Rhesus Blood Group systems among the people of central part of Bangladesh was first done in 1975 by Rahman (1975) where blood group B was found most predominant among the population. Another study (Pathan et al., 2008) conducted in the rural and urban areas of Bangladesh showed the similar results of predominant blood group B (35.54%) followed by blood group O (32.57%). These findings are almost similar to that of common people in the current study. However, study in South East and Western part of Bangladesh demonstrated the most frequent blood group was O (Majumder and Roy, 1982; Hussain et al., 1990).

There are several factors such as genetic and environmental factors on variation of blood group frequency in different parts of the world. Comparative study on data among the different studies in the Indo-Pak sub-continent revealed that there was an equal dominance of group B and O (Khan et al., 2004). Studies in Pakistan explored that B blood group predominated in many regions of Punjab and Multan, Swat, Gilgit, and Rawalpindi/Islamabad, while in Sindh and in Baluchistan, group O was predominated (Sultana et al., 2013; Khattak et al., 2008). Study in India showed group O is the predominant followed by B, A and AB (Das et al., 2001; Reddy and Sudha, 2009; Periyavan et al., 2010). However, in contrast, other studies showed group B is the most prevalent followed by group O, A, and AB (Chandra and Gupta, 2012; Nanu and Thapliyal, 1997).

Table 2. Distribution of Rhesus blood groups by sex among the participants.

Gender	Rh-positive	Rh-negative	Number of volunteers
Male	772	79	851
Female	78	8	86

**Figure 4.** Distribution of ABO blood group among total volunteers based on rhesus blood group.

Data from neighboring country Nepal, revealed different structure of higher frequency of group A (Pramanik and Praminic, 2000). In Australia (Australian Red Cross Blood service, 2013), Britain (Frances, 2002), and USA (Mourant et al., 1976), group 'O' and 'A' were the commonest followed by B and 'AB'. In African subcontinent phenotypic frequency order is as follows; O>A>B>AB. The phenotypic frequency order is quite similar in Europe and Africa (Table 3).

This study suggests blood group order similar to the reports of other Indian subcontinent countries. But it differs from the reports of the middle-east countries (Table 3). The present investigation demonstrated similarities with the findings of previous research done in Bangladesh. The implication of this study finding is that Blood group B and O are readily available among the population of Bangladesh, and it is advantageous for the population in the event of blood transfusion. The higher proportion of blood group B and O is also advantageous from the point of pancreatic cancer. Previous studies have shown that the frequency of blood group A was significantly higher among people suffering from pancreatic cancer (Greer et al., 2010). It also indicates that one out of five of the studied population is probably

at elevated risk of pancreatic and other types of cancer. For instance, early independent studies showed association of rectal, cervical, leukemia, pancreatic, breast, ovarian, gastric cancers among individuals with blood groups A, AB, or B more likely to have elevated risk of pancreatic cancer than individual belonging to blood group O (Wolpin et al., 2009; Greer et al., 2010; Amundadottir et al., 2009)

This study also found that, Rh (+ve) blood group is dominant in Chittagong which is consistent with the available data from previous reports of other population in Bangladesh. Moreover, Rh (+ve) group remains higher than Rh (-ve) group throughout the world (Table 4).

Conclusion

This study showed higher frequency of group B followed by group O, A and AB which reflects the same blood group pattern with the previous studies conducted in Bangladesh. Rh blood group system is also similar to other previous studies. Study of blood grouping not only generates a simple database but also create a great social awareness about self-blood grouping and safe

Table 3. Order of blood groups (ABO) studied in different populations across the world.

Population		Blood group order	Reference
Asia	Swat (Pakistan)	B>O>A>AB	Khattak et al. (2008)
	India	O>B>A>AB	Khattak et al. (2008)
	Gujrat (Pakistan)	O>B>A>AB	Anees and Shabir (2005)
	Bangladesh	B>O>A>AB	Rahman (1975)
Middle-East	Kuwait	O>A>B>AB	Al-Bustan et al. (2002)
	Saudi Arabia	O>A>B>AB	Khattak et al. (2008)
Africa	Kenya	O>A>B>AB	Lyko et al. (1992)
	Sudan	O>A>B>AB	Khalil et al. (1989)
	Nigeria	O>A>B>AB	Falusi et al. (2000)
Europe	Britain	O>A>B>AB	Frances (2002)
	Hungry	O>A>B>AB	Tuaszik (1995)
	Turkey	O>A>B>AB	Akbas et al. (2003)
Asia	This study	B>O>A>AB	-

Table 4. Frequency of Rh blood groups studied in different populations across the world.

Population	Rh+ (%)	Rh- (%)	Reference
Pakistan	91.40	8.60	Anees et al. (2007)
India	94.45	5.50	Khattak et al. (2008)
Bangladesh	97.4	2.6	Haque et al. (2013)
Saudi Arabia	93.00	7.00	Khattak et al. (2008)
Nigeria	94.30	5.70	Falusi et al. (2000)
USA	85.00	15.00	Khattak et al. (2008)
Britain	83.00	17.00	Khattak et al. (2008)
Germany	95.00	5.00	Akbas et al. (2003)
This study	90.72	9.28	-

blood transfusion among the population of a country. This study will serve as a reference for other studies particularly to the geneticists and to the clinicians especially in the planning of blood transfusion programs since they play integral role of the genetic profile of the Bangladeshi population.

ACKNOWLEDGEMENT

The authors express their sincere thanks to the authority of International Islamic University Chittagong for providing financial help and laboratory facilities. They also thank the Authority of Chittagong Railway Building and District Commissioner of Chittagong for giving permission to carry out the research work. They are also

grateful, and will never forget all the participants involved formally or informally for their consciousness and spontaneous participation in this study.

Conflict of interest

The authors declare that there are no conflicts of interest.

REFERENCES

- Akbas F, Aydin M, Cenani A (2003). ABO blood subgroup allele frequencies in the Turkish population. *Anthropol. Anz.* 61:257-60.
- Al-Bustan SA, EL-Zawahri MM, AL-Adsani AM, Bang RL, Ghunaim I, Maher BS, Weinberg S, Marazita ML (2002). Epidemiological and genetic study of 121 cases of oral clefts in Kuwait. *Orthod. Craniofac.*

- Res. 5:154-160.
- Amin-ud-Din M, Fazeli N, Rafiq MA, Malik S (2004). Serological study among the municipal employees of Tehran, Iran: distribution of ABO and Rh blood groups. *Haema* 7(4):502-504.
- Amundadottir L, Kraft P, Stolzenberg-Solomon RZ, Fuchs CS, Petersen GM, Arslan AA, Bueno-de-Mesquita HB, Gross M, Helzlsouer K, Jacobs EJ, LaCroix A, Zheng W, Albanes D, Bamlet W, Berg CD, Berrino F, Bingham S, Buring JE, Bracci PM, Canzian F, Clavel-Chapelon F, Clipp S, Cotterchio M, de Andrade M, Duell EJ, Fox JW Jr, Gallinger S, Gaziano JM, Giovannucci EL, Goggins M, González CA, Hallmans G, Hankinson SE, Hassan M, Holly EA, Hunter DJ, Hutchinson A, Jackson R, Jacobs KB, Jenab M, Kaaks R, Klein AP, Kooperberg C, Kurtz RC, Li D, Lynch SM, Mandelson M, McWilliams RR, Mendelsohn JB, Michaud DS, Olson SH, Overvad K, Patel AV, Peeters PH, Rajkovic A, Riboli E, Risch HA, Shu XO, Thomas G, Tobias GS, Trichopoulos D, Van Den Eeden SK, Virtamo J, Wactawski-Wende J, Wolpin BM, Yu H, Yu K, Zeleniuch-Jacquotte A, Chanock SJ, Hartge P, Hoover RN (2009). Genome-wide association study identifies variants in the ABO locus associated with susceptibility to pancreatic cancer. *Nat. Genet.* 41(9):986-990.
- Anees M, Jawad A, Hashmi I (2007). Distribution of ABO and Rh blood group alleles in Mandi Bahauddin district of Punjab, Pakistan. *Proc. Pak. Acad. Sci.* 44(4):289-94.
- Anees M, Shabir Mirza M (2005). Distribution of ABO and Rh blood group alleles in Gujrat region of Punjab, Pakistan. *Proc. Pak. Acad. Sci.* 42(4):233-8.
- Australian Red Cross Blood service (2013). About blood. Available from: <http://www.donateblood.com.au/about-blood/types>
- Bamidele O, Arokoyo DS, Akinbola AO (2013). Distribution of ABO and rhesus blood groups among medical students in Bowen University, Iwo, Nigeria. *Ann. Biol. Res.* 4(11):1-6.
- Chandra T, Gupta A (2012). Frequency of ABO and Rhesus blood groups in blood donors. *Asian J. Transfus. Sci.* 6(1):52-53.
- Das PK, Nair SC, Harris VK, Rose D, Mammen JJ, Bose YN, Sudersanam A (2001). Distribution of ABO and Rh-D blood groups among blood donors in a tertiary care centre in South India. *Trop. Doct.* 31(1):3147-48.
- Falusi AG, Ademowo OG, Latunji CA, Okeke AC, Olatunji PO, Onyekwere TO, Jimmy EO, Raji Y, Hedo CC, Otukonyong EE, Itata EO (2000). Distribution of ABO and Rh genes in Nigeria. *Afr. J. Med. Sci.* 29:23-6.
- Frances TF (2002). Blood groups (ABO groups). *Common Laboratory and Diagnostic Tests*. 3rd ed. USA: Lippincott, Williams & Wilkins, Philadelphia pp. 19-25.
- Garg P, Upadhyay S, Chufal SS, Hasan Y, Tayal I (2014). Prevalance of ABO and Rhesus Blood Groups in Blood Donors: A Study from a Tertiary Care Teaching Hospital of Kumaon Region of Uttarakhand. *J. Clin. Diagn. Res.* 8(12):FC16-FC19.
- Greer JB, Yazer MH, Raval JS, Barmada MM, Brand RE, Whitcomb DC (2010). Significant association between ABO blood group and pancreatic cancer. *World J. Gastroenterol.* 16(44):5588-91.
- Harmening MD, Firestone D (2005). The ABO blood group system. In: Harmening MN, editor. *Modern Blood Banking and Transfusion Practices*. 5th ed. USA: FA Davis Company, Philadelphia, USA pp 108-32.
- Hussain M, Nandy CK, Kabir KM, Haque KMG (1990). The distribution of ABO and Rhesus (D) blood group systems in greater Chittagong, Noakhali and Comilla (South East zone of Bangladesh). *Med. Today* 2:33-36.
- Khalil IA, Phrykian S, Farr AD (1989). Blood group distribution in Sudan. *Gene Geogr.* 3:7-10.
- Khan MS, Subhan F, Tahir F, Kazi BM, Dil AS, Sultan S, Deepa F, Khan F, Sheikh MA (2004). Prevalence of blood groups and Rh factor in Bannu region (NWFP) Pakistan. *Pak. J. Med. Res.* 43(1):5-7.
- Khattak ID, Khan TM, Khan P, Shah SM, Khattak ST, Ali A (2008). Frequency of ABO and Rhesus blood group in district Swat, Pakistan. *J. Ayub Med. Coll.* 20(4):127-29.
- Khurshid B, Naz M, Hassan M, Mabood SF (1992). Frequency of ABO and Rh (D) blood groups in district Swabi, NWFP, Pakistan. *J. Sci. Tech. Univ. Peshawar* 16:5-6.
- Landsteiner K, Wiener AS (1940). An agglutinable factor in human blood recognized by immune sera for Rhesus blood. *Proc. Soc. Exp. Biol. Med.* 43:223-224.
- Lyko J, Gaertner H, Kaviti JN, Karithi MW, Akoto B (1992). The blood group antigens ABO and Rh in Kenyans. *Hamdard Medicus* 35:59-67.
- Majumder PP, Roy J (1982). Distribution of ABO Blood groups on the Indian subcontinent: A cluster-analytic approach. *Curr. Anthropol.* 23(5):539-66.
- Mourant AE, Kopec AC, Domaniewska-Sobczak K (1976). The distribution of the human blood groups and other polymorphisms. 2nd ed. London: Oxford University Press p 1.005.
- Nandy CK (1986). Frequencies of the ABO blood groups in Jessore (Bangladesh). *J. IPGMR* 1:40-42.
- Nanu A, Thapliyal RM (1997). Blood group gene frequency in a selected North Indian Population. *Indian J. Med. Res.* 106:242-46.
- Nydegger UE, Riedler GF, Flegel WA (2007). Histoblood groups other than HLA in organ transplantation. *Transplant Proc.* 39(1):64-68.
- Pathan AH, Apu AS, Jamaluddin ATM, Asaduzzaman M, Rahman ZM, Rahman A, Rahman MJ (2008). Prevalence of ABO blood groups and Rh factor in Bangladesh. *Bangladesh J. Life Sci.* 20(2):131-35.
- Periyavan S, Sangeetha SK, Marimuthu P, Manjunath BK, Seema DM (2010). Distribution of ABO and Rhesus-D blood groups in and around Bangalore. *Asian J. Transfus. Sci.* 4(1):41.
- Pramanik T, Praminic S (2000). Distribution of ABO and Rh blood groups in Nepalese medical students: a report. *East Mediterr Health J.* 6(1):156-58.
- Rahman M (1975). Incidence of important blood groups in Bangladesh. *Bangladesh Med. Res. Council Bull.* 1(1):60-63.
- Reddy KS, Sudha G (2009). ABO and Rh(D) blood groups among the Desuri Reddis of Chittoor District, Andhra Pradesh. *Anthropologist* 11(3):237-38.
- Sigmon JM (1992). Basic principles of the ABO and Rh blood group systems for hemapheresis practitioners. *J. Clin. Apher.* 7(3):158-62.
- Storry JR (2003). Human blood groups: inheritance and importance in transfusion medicine. *J. Infus. Nurs.* 26(6):367-72.
- Sultana R, Yousuf R, Rahman Z, Helali AM, Mustafa S, Salam A, d Haque M (2013). Study of ABO and RH-D Blood Groups among the common people of capital city of Bangladesh. *Int. J. Pharm. Pharm. Sci.* 5(3):814-816.
- Tuaszik T (1995). Heterogeneity in the distribution of ABO blood groups in Hungary. *Gene Geogr.* 9:169-76.
- Wolpin BM, Chan AT, Hartge P, Chanock SJ, Kraft P, Hunter DJ, Giovannucci EL, Fuchs CS (2009). ABO blood group and the risk of pancreatic cancer. *J. Natl. Cancer Inst.* 101(6):424-31.