GLOBAL JOURNAL OF BIO-SCIENCE AND BIOTECHNOLOGY

www.scienceandnature.org

# BIOGENETICAL STATUS OF FOUR ENDOGAMOUS POPULATIONS OF SAUNDIK VAISHYA COMMUNITY OF MUNGER DISTRICT (BIHAR) IN INDIA

Saurabh Birla[1*], Sandeep Kumar Tata[2], Kamal Kishor Sinha[3]
[1]Department of Zoology, RD & DJ College, Munger, TMBU, Bhagalpur, Bihar, India.
[2]Department of Botany, TMBU, Bhagalpur, Bihar, India.
[3]Munger University, Munger, Bihar, India.
*Corresponding author email: saurabhbirla89@gmail.com

**ABSTRACT**
Bio-genetical status of four endogamous populations of Saundik Vaishya community of Munger district (Bihar) was studied using three anthropogenic parameters *viz.* ABO blood groups, Rh blood groups and PTC taste ability. The Saundik Vaishya communities of Munger district (Bihar) have contributed immensely to the economic growth and development of the district. Genetic fitness studies on this community were performed 40 years back. So, it is very important to know the current status and hence the temporal changes that might have occurred over this long period of time difference. In general, blood group B is more frequent in all the four populations and blood group AB is the least. Most of the people of this community were Rh +ve except for few who were Rh-ve. PTC tasters were approximately 10% more in number than non tasters. The results are in close proximity to the researches performed earlier. Our findings indicate that forty years of time gap is not sufficient to cause any temporal change in these parameters. Our findings suggest that these data would be useful in medical diagnosis and genetic counseling.

**KEYWORDS**: Biogenetical Status, Temporal Changes, Saundik Vaishya, Genetic Fitness, PTC, ABO blood groups & Rh blood groups.

## INTRODUCTION

Genetic variability is the common feature of all living organisms including human beings. The existence of genetic variation in human is caused by many factors along with selection, migration, temporal variation, gene flow and genetic drift (Bhasin *et al*., 1992). The importance of these factors in understanding genetic variation has been described earlier in details (Vogel and Motulsky, 1986). Every human population has a unique structure which can be studied in terms of its distribution, size, age and sex composition. Populations of the same ethnic origin living in different geographical regions appear to show variation in biological characters. Genetic similarity between populations shows the common origin of the gene pool. The genetic heterogeneity between populations indicates the diversity or isolation by some unknown barriers (Pandey *et al*., 2013). Genetic mechanisms on morphogenetic traits are still not clearly understood. It is seen to occur with variable frequency in different populations and thus is useful in evaluating and analyzing the evolutionary forces and classification (Das and Sengupta 2003). Blood groups and phenylthio-carbamide (PTC) are the most studied genetic traits among human populations around the world. In most of these studies, PTC taste sensitivity was described as a bimodal autosomal trait inherited in a simple Mendelian recessive pattern. ABO blood group is the most studied blood groups followed by Rhesus factors (Rh). Persons are classified into groups A, B, AB or O depending on the antigens present on their red blood cells (Knowles *et al*. 2002). Information from the study of these traits is useful to biologists, geneticists, anthropologists and clinicians (Chibuisi *et al*., 2010). A number of genetic traits have been used to explain genetic differences among human populations to study susceptibility to certain diseases/disorders. For instance, in ABO blood group system, individuals are classified into A, B, AB and O blood types and differences have been reported among these groups in relation to susceptibility to a number of diseases (Panda *et al*., 2011; Pelzer *et al*., 2013; Igbeneghu *et al*., 2015). Studies among Indian populations have shown wide genetic diversity. It is characterized by gradients of gene frequencies of uneven distribution of very high or low frequencies of characters scattered in populations (Malhotra and Vasulu, 1993; Majumdar and Mukharjee, 1993).

Blood groups are found on the surface of red blood cells (Anstee *et al*., 2010). The two main blood group systems in transfusion practice are the ABO system and the Rhesus (Rh) system. The ABO is the most important blood group system in human blood transfusion because the A and B antigens are highly antigenic and both anti-A and anti-B are readily present in the serum of individuals who lack the corresponding antigen (Dean *et al*., 2005).

Blood types are dependent upon a series of multiple alleles. There are two antigens A & B which are found in the blood of men that determine the blood group to which individuals belong. IA and IB are mutant alleles and show co-dominance with each other but both are dominant over the wild type allele *i* (Gardener *et al*., 2001). People with both A & B antigens in their blood belong to blood group AB and have a genotype 'IAIB'. Those with antigen A only belong to blood group A and may be genotypically expressed as 'IAIA' or 'IAi'. Individuals who have antigen B may have genotype 'IBIB' or 'IBi' and have blood group B. Many people lack both the antigens and are related to the fourth group 'O'. These people have genotype 'ii'. In this series of alleles 'i' is recessive to

both the genes 'IA' and 'IB'. These genes are responsible for the production of antigens A and B respectively. They are co-dominant to each other (Tangpu and Reshma 2018). The gene coding for the ABO blood group lies on chromosome 9q34 (Dean *et al*., 2005).

The Rh blood group, the second most important blood group system in transfusion, derives its significance from the high immunogenicity of the D antigen commonly referred to as Rhesus factor present on the surface of red blood cell (Flegel *et al*., 2007). Persons who have the D antigen are known as Rh positive individuals while those who lack it are referred to as Rh negative (Knowles *et al*., 2002). Rh positive (Rh+ve, with genotype, 'RR' or 'Rr') is dominant over Rh negative (Rh–ve with genotype 'rr'). The Rhesus (Rh) blood group system is a complex consisting of several blood group antigens; the most important of which is antigen D commonly referred to as Rh factor. Like the ABO blood group, the Rhesus blood group has been associated with a number of diseases. Rh negative individuals being more susceptible than their Rh positive counterparts (Flegr *et al*., 2015). Rh system of blood group is very much interesting owing to its allelic nature and also for its role in the haemolytic disease of new born.

Phenylthiocarbamide (PTC) is a crystalline solid which has a bitter taste to persons who possess the dominant gene (TT or Tt) and tasteless to those who lack it (tt). Phenylthiocarbamide (PTC) taste sensitivity has been used as a tool to trace family lineages and population migration patterns and it was previously used in paternity testing before the advent of DNA markers (Mattes *et al*., 2004). It is also known that saliva plays an important role in the gustatory responses. It has been shown that there are wide differences in the capacity of different individuals to taste phenylthiocarbamide (PTC) & such differences are considered to have a genetic base (Harris and Kalmus, 1949).

The present research is oriented to unravel the temporal changes in the genetic composition with the help of genetic markers like ABO, Rh blood groups and phenylthiocarbamide taste (PTC) ability that might have occurred during the last four decades. The relative usefulness of tasters & non-tasters proportion and mean threshold values in population comparison has been studied (Reddy 1988). It was found that the relationships observed between populations would be more in conformation with their genetic relationship than phenotypic proportions irrespective of the difference in age, sex compositions and environmental factors.

During the last four decades, numerous studies have been carried out on the genetic composition of various endogamous population groups in India like-Rajputs (Mukhopadhyay and Kshastriya 2004; Pattanayak *et al*., 2006; Meitei and Kshatriya 2010; Warghat *et al*., 2011), Scheduled Caste population (Patni and Yadav 2003; Sidhu *et al*., 2003; Pandey *et al*., 2012, 2013), OBC (Prabhakar *et al*., 2005; Reddy and Reddy, 2005; Dore Raj and Reddy 2010 ) and Muslim population ( Ara *et al*., 2008; Rai and Kumar 2010; Pandey *et al*.,2013).

The present paper is to represent the temporal changes in genetic traits *viz*. ABO blood groups, Rh blood groups and PTC taste ability during the last four decades, if any, between four endogamous groups of Saundik Vaishya community of Munger district in Bihar. Since the studies on these communities have been done long time back (Sinha, K.K. 1982). Hence, we want to update the data in order to observe the temporal changes (if any) that, might have occurred over a long period of time difference.

## SUBJECTS & METHODS

The study was done on Saundik Vaishya community of Munger district (Bihar), India. To investigate the temporal changes in biogenetical status of Saundik Vaishya community, a survey was conducted over a period of nine months (January 2018 to September 2018). A total of 876 non related individuals of both gender were randomly selected from four sub castes belonging to Saundik Vaishya *viz*. Dhaneshwar (234), Kalal (222), Jaiswal (2010) and Biahut Kalwar (B. Kalwar) (210) inhabiting different villages/cities of Munger district (Bihar). They formed the experimental subjects. In no case two persons belonging to the same family were subjected to test the below mentioned Mendelian traits. The consent of the parents and guardians of the children were obtained. The permission of the community leaders and school authority was obtained before the commencement of the study. The following three parameters have been studied:

a) ABO blood groups
b) Rh blood groups
c) PTC taste ability

ABO and Rh blood group antigen tests were performed by standard tile techniques along with standard controls. They were performed on saline washed red cells using commercially prepared monoclonal anti-A, anti-B and anti-D according to the manufacturer's instructions (Arkray Healthcare Pvt. Ltd, India). Phenylthiocarbamide (PTC) taste perception was determined using PTC strips (0.0143 mg of PTC /strip) obtained from PL Precision Laboratory, PTC paper strips, USA. Briefly, each participant was given a PTC taste strip and a filter paper (as control) and was asked to put each on their tongue and allow to be soaked in their saliva before describing their perception to each strip. Taste description of each participant was recorded.

## RESULTS & DISCUSSION

The first suggestion about the genetics of ABO blood groups came from Epstein and Ottenberg (1908). Hirszfeld and Hirszfeld (1918) initiated the study of different populations on the basis of ABO system of classification. Since then this trait has been widely utilised for the study of different populations by many investigators in India (Ansari *et al*., 1978; Sinha 1982; Pandey *et al*., 2003, 2012, 2013; Mathivanan *et al*., 2015; Tangpu *et al*., 2018).

The results (Table –1 & Figure –1) suggest that the blood group 'B' is most frequent in all the populations (ranging from 41.40% among Kalal to 48.20 among Jaiswal). The next common blood group is 'O', which ranges from 28.40% (among Kalal) to 33.20% (among Jaiswal). The blood group 'A' is more common in Kalal (20.40%) and less so in the Jaiswal (13.20%). The 'AB' blood group is least frequent in all four populations. The average frequency of 'AB' blood group is 7.76% only.

The results (Table–1 & Figure –2) suggest that the overall frequency of the Rh –ve subjects in all the populations is

very low, which is but natural. The frequency of Rh –ve for Dhaneshwar, Kalal and Biahuts Kalwar is more or less very close to each other (3.84%, 3.60% and 3.33% respectively). For Jaiswal the frequency of Rh – ve is least (1.90 %).

**TABLE 1:** Distribution (in %) of ABO blood groups, Rh –ve blood groups and PTC Tasters in four Saundik Vaishya Community

| Vaishya Population | Number Surveyed | Blood – 'A' | Blood – 'B' | Blood – 'AB' | Blood – 'O' | Rh –ve | PTC taster |
|---|---|---|---|---|---|---|---|
| Dhaneshwar | 234 | 19.60 | 42.40 | 8.40 | 29.60 | 3.84 | 55.12 |
| Kalal | 222 | 20.40 | 41.40 | 9.80 | 28.40 | 3.60 | 54.05 |
| Jaiswal | 210 | 13.20 | 48.20 | 5.40 | 33.20 | 1.90 | 55.71 |
| Biahut Kalwar | 210 | 18.60 | 43.20 | 7.80 | 30.40 | 3.33 | 58.57 |

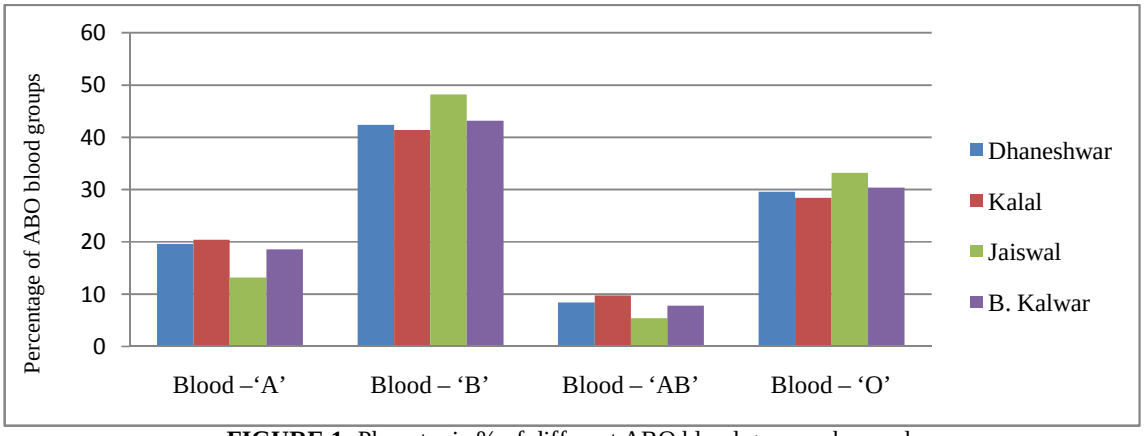


**FIGURE 1:** Phenotypic % of different ABO blood groups observed.

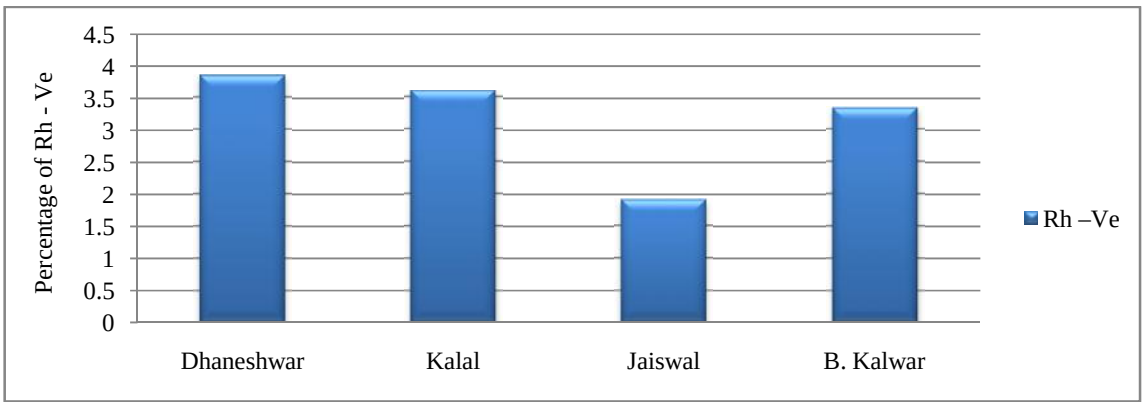


**FIGURE 2:** Phenotypic % of Rh –Ve observed.

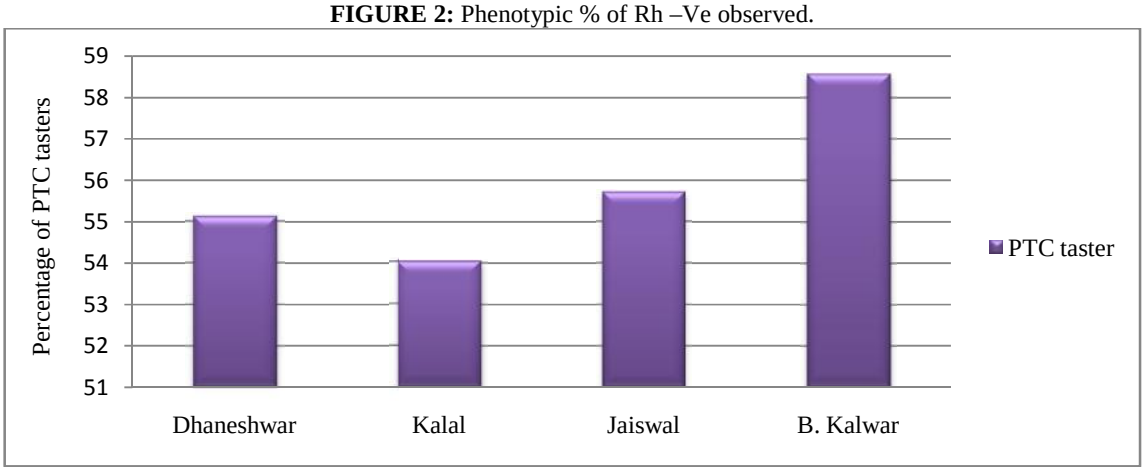


**FIGURE 3:** distribution (%) of PTC tasters and non - tasters among four sub-castes

The dual taste perception of individuals to PTC (phenylthiocarbamide/ phenylthiourea) crystals was first reported in humans (Fox 1932). In an attempt to study the genetic behaviour of the trait, Blakeslee (1932) independently proposed the unifactorial diallelic theory. The frequency of non-tasters varies from one population

to another. Besides this, the distribution of PTC threshold is found to be bimodal (Harris and Kalmus 1949). The study clearly reveals genetic affinities between these four populations. Phenylthiourea synonymous with phenylthiocarbamide can classify human beings, irrespective of age and sex into two classes: tasters and non tasters. The tasters would experience a bitter taste for this compound, whereas the non tasters would find it tasteless. The ability to taste phenylthiocarbamide was conformed as a simple dominant Mendelian character. (Mathivanan and Leelavathi, 2015). Different Indian populations have been studied for this trait, but only a few Bihari populations have been screened so far (Basu *et al*., 1969; Ansari and Sinha 1978; Sinha 1982; Pandey *et al*., 2012 & 2013).

In all the four studied populations, (Table –1 & Figure – 3) it was found that more than 50% of population in each sub-caste is tasters. The highest percentage of tasters is in Biahut Kalwar (58.57%) and the least so in Kalal (54.05%). Our results about the frequency of tasters are within the range recorded so far for the populations of Bihar (Ansari and Sinha, 1978; Sinha 1982). Since the human population has been grouped under taste and non taste sensitivity to PTC, it was Fox (1932) who first detected the great difference between peoples in this respect. This result is in agreement with earlier report (Phookan *et al*., 1974, Kumar *et al*., 1980, Das *et al*., 1983). The ability or inability to taste PTC has long been known to vary among human populations. PTC inheritance in a simple autosomal Mendelian recessive trait observed in our study is in agreement with available information in India, Nigeria and other countries.

Thus, it was observed that the frequency of ABO blood group, Rh blood group and PTC taste ability among different castes in India is more or less very close to each other.

## CONCLUSION

In general, blood group B is more frequent in all the four populations and blood group AB is the least. Most of the people of this community were Rh +ve except for few who were Rh-ve. PTC tasters were approximately 10% more in number than non tasters. The results in Table – 1, Figure –1, Figure –2, and Figure – 3 are in close proximity with those of other researches performed earlier (Ansari *et al*., 1978; Sinha, 1982; Pandey *et al*., 2003, 2012, 2013; Mathivanan *et al*., 2015; *Tangpu et al*., 2018).

Thus, it may be concluded that all the four population groups are more or less close to each other. Differences among them are due to their practice of endogamy since long.

## ACKNOWLEDGEMENT

We appreciate the valuable contribution and support of the community leaders and most especially the volunteers who participated in this study. We are grateful to the Saundik Vaishya community of Munger district (Bihar), who participated in this study and without their cooperation this study could not be completed. We would like to thank Miss Runjhun Mishra and Miss Aarti Verma, Research scholar, PG Department of Zoology, TMBU, for their moral support, constant help and suggestions. We are thankful to the Principal, staffs and students of Bhabha Mission Academy, Betwan Bazar, Gola Road, Munger (Bihar). We are also very grateful to the staffs and students of PG Department of Zoology, RD & DJ College, Munger University, Munger (Bihar), India.

**Disclosure of funding:** This study was not funded by any agency. It was personally funded by the corresponding author.

**Conflict of interest:** The authors declare that they have no conflict of interest.

**Ethical approval:** All procedure performed in this study on human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later ethical approval.

**Informed consent:** Informed consent was obtained from all individual participants included in the study.

## REFERENCES

Ansari, N.A., Sinha, S.P. (1978) PTC tasting ability among certain human populations of Santhal Pargana, Bihar

Anstee, D.J. (2010) The relationship between blood groups and disease. Blood, 115: 4635-4643.

Ara, G.Y., Siddique, H., Beg, T., Afzal, M. (2008) Gene diversity among some Muslim population of Western Uttar Pradesh. Anthropologist 10(1):5-9

Basu, A. (1969) The Pahira: A population genetic study. Am. J. Phys.Anthrop, 31: 399-416

Bhasin, M.K., Walter, H., Danker-Hofe, H. (1992) The distribution of Genetical, Morphological and Behavioural Traits among the people of Indian region (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka). Kamla Raj Enterprises, Delhi.

Blakeslee, A.F. (1932) Genetics of sensory threshold–taste for PTC. Proc. Nat. Acad. Sci. Wash, 18: 120-130.

Chibuisi, G. Alimba (2010) Prevalence and gene frequencies of phenylthiocarbamide (PTC) taste sensitivity, ABO and Rhesus factor (Rh) blood groups, and haemoglobin variants among a Nigerian population. The Egyptian Journal of Medical Human Genetics, 11, 153–158

Das, B.M., Sengupta, S. (2003) A note on Some Morphogenetic Variables among the Sonowal Kacharis of Assam. Anthropologist, 5: 211-212.

Das, N.K., Reddy, A.P., Dey, P., Chatterjee, S., Sarkar, J.M., Basu, A. (1983) Red cell enzyme polymorphism among oran. Human Science, 32(1), 57 – 59

Dean, L. (2005) Blood groups and red cell antigens. National Center for Biotechnology Information. https://www.ncbi.nlm.nih.gov/books/NBK2267/.Dibrugarh University, 1974, 3.

Epstein, A.A., Ottenberg, R. (1908) A simple method of performing serum reactions. Proc. New York Path. Soc., 8: 117-125.

Flegel, W.A. (2007) The genetics of the Rhesus blood group system. Blood Transfusion, 5: 50.

Flegr, J., Hoffmann, R., Dammann, M. (2015) Worse health status and higher incidence of health disorders in Rhesus negative subjects. Plo.S one, 10(10), e0141362.

Fox, A.L. (1932) The relationship between chemical constitution and taste. Proc. Nat. Acad. Sci., Wash., 18, 115 – 20

Gardener, E.J., Simmons, M.J., Snustad, D.P. (2001) Principles of genetics. 8th edition John Wiley & Sons (Asia) Pvt. Ltd

Harris, H., Kalmus, H. (1949) The measurement of the taste sensitivity to PTC. Annals of Human Genetics, 15: 24-31

Hirszfeld, L., Hirszfeld, H. (1918) Serological differences between the bloods of different races. The result of researches on the Macedonian front. Lancet, 2:675-679.

Igbeneghu, C., Olisekodiaka, M.J., Okanlawon, B.M., Onuegbu, J.A., Odaibo, A. B. (2015) Nonsecretors of ABH antigens are susceptible to falciparum malaria. SJAMS. 3, 1838-1841

Knowles, S., Pooles, G. (2002) Human blood group systems. In: Practical transfusion medicine. 1 ed. Blackwell Publishing Ltd, UK, pp: 72-93.

Kumar Ra N., Banerjee, M.K., Gandhi, L.P. (1980) Distribution of A1 A2 B O blood groups ABH secretion in saliva and sickle cell trait among the oraons of Madhyapradesh. Journal of the Indian Anthropological Society, 15, 283.

Majumdar, P.P., Mukherjee, B.N. (1993) The genetic diversity and affinities among Indian Populations: An overview. In: Human Population Genetics: A Centennial tribute to J.B.S. Haldane. (ed.) p.p. Majumdar, Plenum Press, New York.

Malhotra, K.C., Vasulu, T.S. (1993) Structure of human populations in India In: Human Population Genetics: A centennial tribute to J.B.S. Haldane (ed.) P.P. Majumdar, Plenum Press, New York. 207-233

Mathivanan, V., Leelavathi, D. (2015) Incidence of ABO blood groups and taste sensitivity to phenylthiocarbamide (PTC) taste ability amid some tribal populations of south India. International journal of novel trends in pharmaceutical sciences, vol. 5; num 4.143-151

Mattes, R.D. (2004) 6-n-Propylthiouracil Taster Status. Genetic variation in taste sensitivity, 229.

Meitei, K.S., Kshatriya, G.K. (2010) The Study of Rhesus System among the Rajputs and Varlis of Dadra and Nagar Haveli. Anthropologist 12(1): 63-64

Mohan Reddy, B. (1988) PTC taste sensitivity: A study on the relative usefulness on taster non-taster proportions and mean threshold values in population comparison, J. Ind. Anth. Soc, 23, 260-265

Mukhopadhyay, R., Kshatriya, G.K. (2004) Distribution of blood groups among Brahmins and Rajputs of Himanchal Pradesh. Anthropologist 6(4): 293-294.

Panda, A.K., Panda, S.K., Sahu, A.N., Tripathy, R., Ravindran, B., Das, B.K. (2011) Association of ABO blood group with severe falciparum malaria in adults: case control study and meta – analysis. Malaria journal, 10(1), 309

Pandey, B.N., Ranjana Kumari, Anita Mishra, Md. Jahangeer Kumar, D., Ojha, A.K. (2012) Genetic variation and micro-genetic differentiation among tribal populations of Jharkhand, India. Scholarly Journal of Agricultural Science Vol. 2(8), pp.147-156

Pandey, B.N. Jahangeer, M.D., Mall Priyanka (2013) A morphogenetic study of Badhiya Muslims of Purnia District (Bihar), India. Int. J. of Life Sciences, 1 (3): 233-238.

Pandey, B.N., Das, P.K., Husain, S., Anwer, M.R., Jha, A.K. (2003) Genetic studies among seven endogamous populations of the Koshi Zone, Bihar (India). Anthropol Anz. 61(3):269-74

Patni, S., Yadav, A (2003) Blood groups among the Bhoksa of Vikasnagar block of Dehradun, Uttaranchal. Anthropologist 5 (2):137-138.

Pattanayak, I. (2006) Distribution of A1A2BO and Rh blood group among the Rajputs of Uttaranchal. Anthropologist 8 (2): 139-140.

Pelzer, U., Klein, F., Bahra, M., Sinn, M., Dörken, B., Neuhaus, P., Riess, H. (2013) Blood group determinates incidence for pancreatic cancer in Germany. Frontiers in physiology, 4, 118.

Phookan, M.N. (1974) Phenylthiourea test of the Kachari of Assam and their comparison with other mongoloid tries of North East India. Bulletin of Department of Anthropology.

Prabhakar, S.C.J., Gangadhar, M.R., Reddy, K.R. (2005) ABO and Rh (D) blood groups among the Vishwakarmas of Mysore district, Karnataka. Anthropologist 7(1):71-72

Rai, V., Kumar, P. (2010) The incidence of ABO blood group in Muslim population of Uttar Pradesh, India. J. Appl. Biosci. 36(2):191-195

Raj, M.L.D., Reddy, K.R. (2010) The Study of ABO and Rh (D) Blood Groups among the Vishwakarma Population of Mysore District in Karnataka, India. Anthropologist 12(3): 227-228.

Reddy, B.K.C., Reddy, C.S. (2005) ABO and Rh (D) blood group distribution among Voddes, a backward caste population of Andhra Pradesh. Anthropologist 7(3): 235-236

Sidhu, S. (2003) Distribution of the ABO blood groups and Rh (D) factors among the scheduled caste population of Punjab. Anthropologist 5 (3): 203-204

Sinha, K.K. (1982) Fitness and genetic studies among various endogamous human population groups of Bhagalpur. Unpublished PhD thesis. TMBU, Bhagalpur, Bihar, India

Tangpu and Reshma (2018) Analysis of morphogenetic traits among the populations of Rie Mysuru campus to determine the frequency of the phenotype; IESRJ, vol: 4 issue: 5, 77-83.

Vogel, G.N., Motulsky, A.G. (1986) Human Genetics. Springer Verlag, Berlin.

Warghat, N.E., Sharma, N. R., Baig, M.M. (2011) ABO and Rh Blood Group distribution among Kunbis (Maratha) population ofAmravati District, Maharashtra-India Asiatic J. Biotech. Res. 2(04)479-483.