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Biochemistry

STUDY OF PREVALENCE AND PATTERNS OF SOME HEMOGLOBINOPATHIES IN CHANDRAPUR DISTRICT

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ABSTRACT

Background: Hemoglobinopathies are considerable health problem in central india particularly in Chandrapur district due to lack of awareness and insufficient screening programs. Data regarding prevalence of different patterns of abnormal hemoglobins in different age groups and sex of positive cases in this region is scarce.

Aim: In view of facts described above, it was decided to determine prevalence of different patterns of abnormal hemoglobins in different age groups and sex of positive cases in Chandrapur district.

Methodology: The study is laboratory record based and having about 510 screened individuals coming to the OPD and IPD of Government Medical College and Hospital Chandrapur in last few months of the year 2016. All the samples were tested for sickle solubility test and then subjected to hemoglobin electrophoresis for pattern confirmation followed by HPLC.

Result: prevalence of hemoglobinopathies was 41%. Our study shows female preponderance (54%) over male (46%) regarding abnormal hemoglobins. The most of the positive cases of our study were found in adult age group (>19yrs). Prevalence percentage of AS and SS pattern of hemoglobin was 33%. AS pattern of abnormal hemoglobin was the commonest pattern in pediatric age group. It was followed by HPFH and SS hemoglobinopathy While prevalence of both AS and SS pattern were high (34%) seen in adolescent age group. Prevalence of SβT, βT trait, βT and SF were 12%, 6%, 3%, 9% respectively.

Conclusion: This study provides data about the prevalence of different patterns of hemoglobinopathies in different age group which is scarce as far as Chandrapur district is concerned. Most of the cases are detected in adult age group proves that there is lack of awareness about hemoglobinopathies in this region. More screening programs, sufficient and effective diagnostic and therapeutic facilities are required for early detection of cases and lower the morbidity and mortality due to hemoglobinopathy particularly in central India.

KEYWORDS : Hemoglobinopathies, Sickle cell anemia, Thalassemia, Hb, HbS, HbβT, HbSβT, HPFH, SFHb

INTRODUCTION:

Hemoglobinopathies, particularly the sickle cell anaemia, β-thalassemiasare a considerable health problem in central India and contribute significantly to morbidity and mortality due to lack of research, awareness and proper diagnostic fascilities. Hemoglobinopathies are inherited disorderscharacterized by abnormalities both quantitative and qualitative in the synthesis of haemoglobin[1]. It comprises sickle cell anaemia (SCA), thalassaemia (βT) and variant haemoglobins. Sickle cell anaemia (SCA) and thalassaemia (βT) are genetic disorders caused by point mutation[1] . These are prevalent largely in tropical countries including India. Thalassemias are single gene disorders that transmit from parents to offspring from one generation to another affecting 5% of world populations.[2] In India, they are responsible for the largest number of genetic disorders and hence are of great public health problem. In India major concerned haemoglobinopathic disorders are sickle cell anaemia and β-thalassaemia. Among the several abnormal haemoglobin molecules, HbS, HbβT, HbSβT, HbE and HbD, these are widely prevalent in India.[1]

The sickle cell disease is caused by a mutation in the globin gene that changes the sixth amino acid from glutamic acid to valine in β chain of hemoglobin. B- *Thalassemia* arise from mutations that impair production or translation of globin mRNA, leading to deficient globin chain biosynthesis. In 2006, WHO has reported that there were about 20-25 million individuals are affected with homozygous sickle cell disease worldwide of which 5 to 10 million are in India[3].

Although data of study of sickle cell disease in eastern Maharashtra region is sufficient, but information regarding pattern of haemoglobinopathies including β-thalassemia and other abnormal haemoglobins in central india particularly in Chandrapur district of Maharashtra is scarce. It seems that very few such screening programmes for hemoglobinopathies has been held in eastern districts of Maharashtra .[4]In view of this it will be useful to know the information regarding age/sex wise prevalence and pattern of hemoglo0binopathies in this region.

Aim of study: To determine prevalence of hemoglobinopathiesand study the some patterns of abnormal hemoglobinsin different age group/ sex of peoples irrespective of castein Chandrapur District of Maharashtra using HB electrophoresis and HPLC testing system.

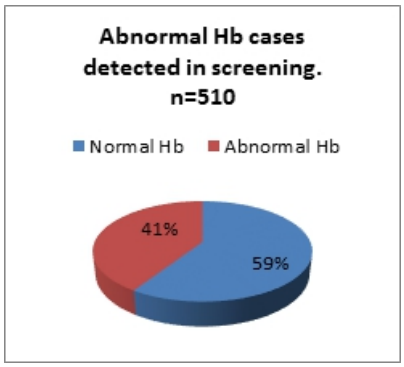
METHODOLOGY:

The study was retrospective and laboratory record based. Present study having about 510 screened individuals coming to the OPD for investigations of anaemia and IPD of Government Medical College and Hospital Chandrapur in last few months of the year 2016. Out of them most are the closed relative of each other.The study population is belongs to Chandrapur district of Maharashtra and most of them are living in rural areas.Necessary consentswere obtained from individuals before subjecting them to the tests.

5-ml intravenous blood samples of all individuals werecollected in EDTA tubes. All the samples were tested for sickle solubility test and then subjected to hemoglobin electrophoresis on cellulose acetate at pH 8.4using Tris-buffer for pattern confirmation.Further HPLC was carried out toidentify carriers of both sickle haemoglobin as well as β-thalassaemia. HbA_2, HbF, HbSand other haemoglobin variants were quantitated by applying samples to HPLC.

A value of more than 3.5 % for HbA2 was considered as the cut off point for determination of β-thalassaemia trait.. HbA2, HbF, and HbS were estimated by graphs obtained from densitometry of Hbpattern. The sample with turbidity and opaque was considered positive for sickle cell and thalassaemia.The data were collected and number of abnormal hemoglobin cases detected. Only positive (for hemoglobinopaty) cases were analyzed using Microsoft Excel software program.

OBSERVATION ANDRESULT:



(Hb = Hemoglobin)Fig.1 shows that 208 subjects were found to have hemoglobinopathies out of 510 subjects screened . The prevalence was 41%.

Total number of Cases of abnormal Hb detected out of 510 subjects	Male	Female
208	96	112

Table No.1: It shows that females were found to be affected more than males in this study.

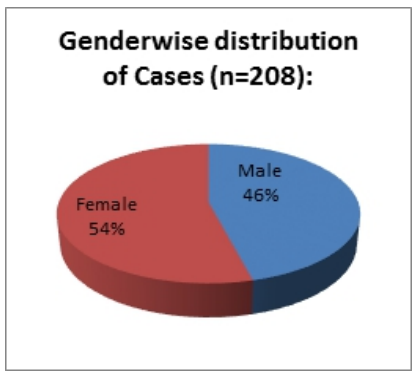


Fig:2 shows sex wise distribution of positive cases in which female comprises 54% and male was 46% in this study.

Patterns of abnormal Hb	Number of cases (n=208)	% among People screened (510)	% among positive cases (208)
AS	68	13	33
SS	68	13	33
SβT	26	5.09	12
SF	19	3.7	09
βT TRAIT	12	2.3	06
HPFH	08	1.5	04
βT	07	1.3	03

(AS= heterozygous sickle cell trait, SS= homozygous sickle cell disease, SβT= sickle beta thalassemia, SF=increased fetal SHb, βT= β thalassemia, HPFH=Hereditary persistant fetal hemoglobin)

Table No.2: It shows numbers and percentages of different patterns of hemoglobinopathy.

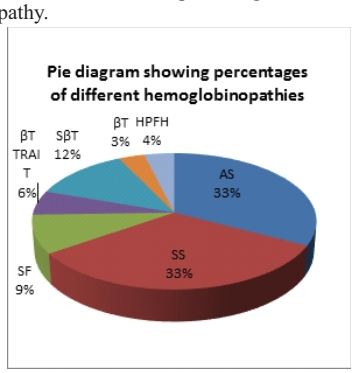


Figure no.3 shows highest and equal prevalence percentage of AS and SS pattern of hemoglobins (33%) while lowest prevalence of β-thalassemia among total 208 cases of hemoglobinopathies.

Age in years	SA	SS	βT Trait	SβT	SF	HPFH	βT
0 to 12	16	12	4	0	9	12	2
13 to 19	12	12	0	2	5	0	4
> 19	40	44	42	24	5	0	1

Table no.3: It shows number of cases of different hemoglobinopathiesdetected in different age groups. Subjects were divided in 3 age groups, pediatric group (0-12 yrs), adolescent (13-19yrs) and adult (>19 yrs).

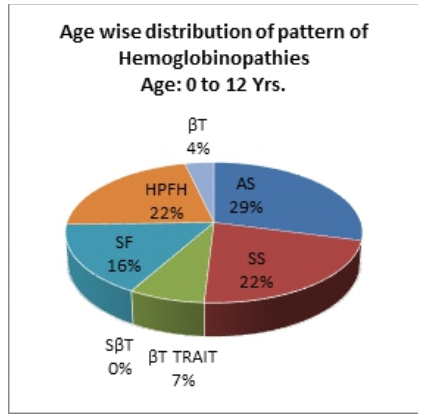


Figure no.4 revealed that ASpattern of abnormal hemoglobin was the commonest pattern in pediatric age group. It was followed by HPFH and SS hemoglobinopathy.

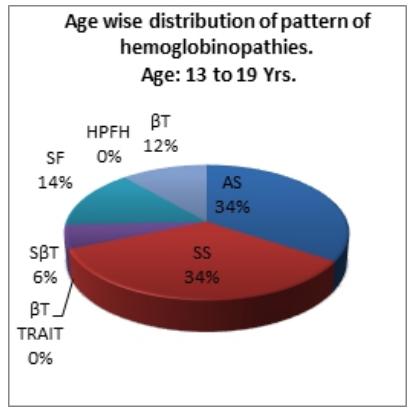


Figure no. 5 shows that high and equal prevalence of SA and SS pattern were seen in adolescent age group of this studysubjects.While cases ofβT trait and HPFH were not seen in this age group.

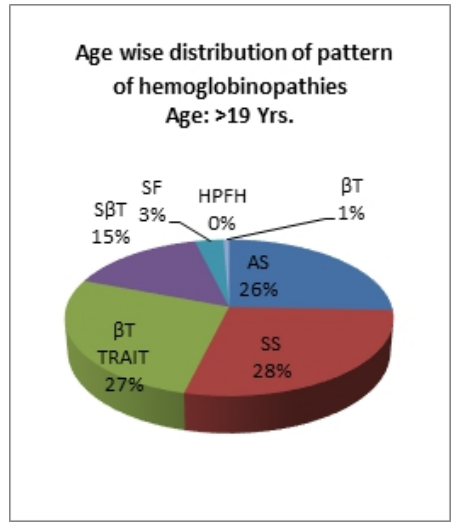


Figure no.6 shows prevalence of β Thalassemia trait was as high as sickle hemoglobins in adult group of cases. Also sickle beta thalassemia cases are significant in number (15%).

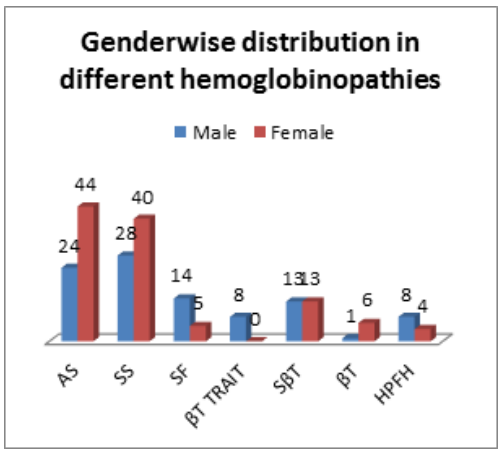
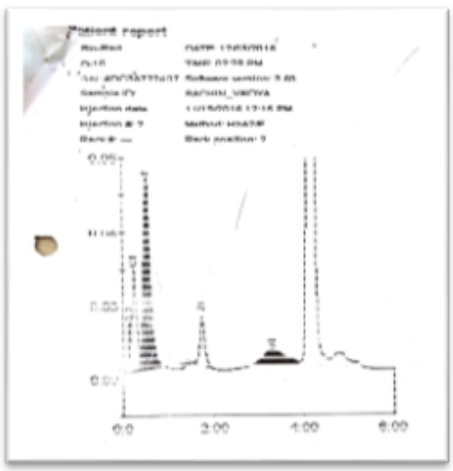
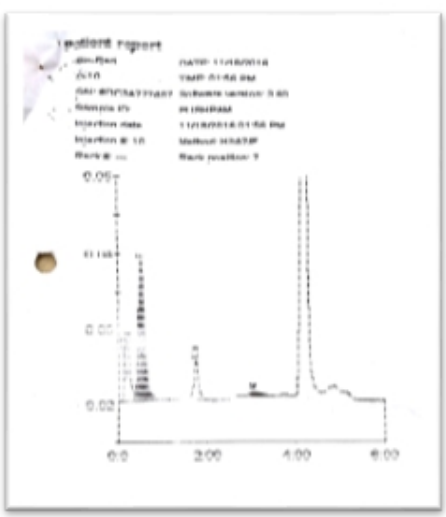


Figure no.7 compares the number of cases between male and female.



Chromatograph 1: Sickle β-Thalasemia



Chromatograph 2: shows SS Hb pattern

DISCUSSION:

This is laboratory record based study. All the samples have been screened for hemoglobinopathy with the qualitative solubility test. All the samples were subjected to hemoglobin electrophoresis for pattern confirmation. Positive samples were tested in , high performance liquid chromatography (HPLC) to identify carriers of both sickle haemoglobin as well as β-thalassaemia.Out of 510 individuals screened in govt. Medical college and hospital chandrapur in last few months of year2016, total 208 individuals have to be foundabnormal hemoglobins. We have studied prevalence of different patterns of abnormal hemoglobin in these 208 positive cases.It was reported that most of the screening programs to study prevalence of haemoglobinopathies in different parts of the India used the sickling or the solubility test and followed by Hb electrophoresis to determine the phenotypes. However, in recent yearsHPLC analysis has been accepted widely in many large programs to identify common hemoglobinopathies such as sickle haemoglobin as well as β-thalassaemia[4].

In this study, prevalence of hemoglobinopathies was 41% among screened population. There was 70.36% prevalence rate reported by Tambseet al[21] in north Maharashtra.While Viral M Bhanvadia et al[8]has reported 19.26% prevalence in Gujrat in 2015.While Bhokare S B et al in 2016 reported more than 50% prevalence rate in central India. This indicates that prevalence of hemoglobinopathies is more in Chandrapur district region which is the part of central india as compare to that of Gujrat.

Our study shows female preponderance (54%) over male (46%)regarding abnormal hemoglobins. This findings are very much agreement with Tambse et al.[21]From most of the studies it seems that there is variation in the prevalence of Hemoglobinopathies among males and females as some workers reported that male were more affected than females.[22,25] In this study although we observed that females were affected more in total number of cases but in case of some types of hemoglobinopathies like SFHb, βT Trait and HPFH, number of affected males were more than females (Fig.no.7). Most of the previous studies support our findings.

The most of the positive cases of our study were detectedin adult age group (>19yrs)followed bypediatric age group and least numberfound in adolescentage group(Table no.3).These findings are in favour of many previous study results reported by Arun Deore[20], Balgiret al[12], Mannan et al[27] etc. But frequency of HPFH and SF hemoglobins were found to be highest in pediatric age group. While Uddinet al[26], Tambse et al[9] reported highest number of positive cases in pediatric age group.

Our study has similar findings to that of many previous studies regarding common types of hemoglobinopathies. In this study sickle cell trait (AS) as well as sickle cell disease (SS) found to most prevalent in Chandrapur region. Percentages of number of these two cases in our study were 33% along with raised HBF levels among screened people whereas these were 13% among positive cases. Which is nearly similar to observation reported by Kar et al.[19]Prevalence percentages of these two pattern in different age group in this study were surprisingly more or less same (Figure no 4, 5, 6).

Arun Deoreet al[20] reported 4.4 % and 0.9% of prevalence of AS and SS hemoglobin respectively while Manjusha et al[9] reported huge prevalence (63%)of AS hemoglobin in central Maharashtra.Bhokareet al[23] also reported high prevalence of AS Hemoglobin. D Mohantyet al[7] reported that haemoglobinopathies among non-tribal and tribal populations from different cities in Gujarat showed an overall prevalence HbS trait of 6.5 %.ArunDeore et al[20]reported 46 cases of sickle Hb out of 865 among Korku people in central India , of which 4.4% with heterozygous gene AS (Carrier) whereas 0.9% with homozygous recessive gene SS (Disease). Hence from our observation prevalence of HBS is higher in Chandrapur region as compared to other region of India. There have been several previous studies on screening different communities for β-thalassemia. But we have studied prevalence of spectrum of hemoglobins in cases irrespective of communities in Chandrapur district which included all the communities.

Bhaskar Urade[1] had reported the sickle cell trait is the most commonhaemoglobinopathy (5.6 %) followed by β-thalassaemia carrier (2.01%), sickle cell disease (0.15%) HbD trait (0.19 %), HbD homozygous (0.08%) and HbSβT (0.12 %) among spectrum of hemoglobinopathies.While ManjushaTambse et al[9] showed the prevalence of Beta thalassemia heterozygous was 2.3%, and Beta thalassemia homozygous was0.2%.[9]D Mohanty et al[7] reported overall prevalence of β-thalassemia trait was 1.95 % among non-tribal and tribal populations from different cities in Gujarat. Mean prevalence of carriers of beta thalassemia is 3.3% byBalgir et al[12].A large study done among the Sindhis of Nagpur in Maharashtra had shown the

prevalence of β-thalassemia trait to be 16.81 % (Mulchandani et al. 2008)[6]. Considerable differences in the prevalence of β-thalassemia have been shown earlier in different districts of Maharashtra (1–6 %) and Gujarat (0–9.5 %) in western India (Colah et al. 2010)[10]. A large study had conducted on screening for haemoglobinopathies among non-tribal and tribal populations from different cities in Gujarat showed an overall prevalence of β-thalassemia trait of 1.95 %[7].Tribal groups in Maharashtra have shown a prevalence of β-thalassemia trait of 1.6 to 5.6 % (Rao and Gorakshakar 1990)[11] while it was reported 6.3 to 8.5 % among some tribal groups in Orissa (Balgir 2005, 2006)[12] and 9.59 % in the non-tribal populations of Madhya Pradesh in Central India (Chatterjee et al. 2010)[13].

Our study revealed the prevalence of β-thalassemia trait was 6% and that of β-thalassemia major was 3% among cases (Figure no.3) while 2.3% and 1.3% respectively (Table no.2)among total number of screened peoples fromChandrapur district, which is more or less tribal region. Thus it proves thatβ-thalassemia is not uncommon in Chandrapurdistrict in India. Another aspects of these studies is that thalassemia is not confined to tribal population.Again we observed that highest number of cases of β-thalassemia trait found in adult age group (Table no.3). The variation of prevalence of Thalassemia major in different age group were not remarkable.Our study results are not in agreement with the statement of BhaskarUrade[1] who stated that globally the percentage of carriers of thalassaemia is greater than that of carriers of Sickle cell anaemia. In our study , prevalence of βT trait (6%) was quite less than that of AS Hb (33%) among cases.Some previous studies reported earlier that migration may also one of the reasons to carry mutant allele into other population[1]. Bhaskar Urade[1] stated that the spread of Hbβ gene in central India is due to migration of people from north-west i.e., Sindh region of Pakistan during British India. He has found high prevalence of HbS mutation in the central India among the tribal and scheduled caste populations of India.[1]This finding is in agreement with our study.

This study also provides information about the prevalence ofhereditary persistant fetal hemoglobin i.e. HPFH which is a rare pattern of abnormalHB. It's prevalencewas 1.5% among study subjects and 4% among positive cases of hemoglobinopathy.We have found all the cases of HPFH in pediatric age group. So it can be considerd that prevalence of HPFH is quite large in Chandrapur region as compared to other cities of india where prevalence rate was to be 0.0000–0.0020% (D. Mohanty et al).[7]

In this study we observed that sickle β-thalassemia (SβT) was the third most frequently detected hemoglobinopathy. Its prevalence was found to be 5.09% and 12% among screened subjects and positive cases respectively. While M. Vasaikar et al[5] and Mrinal Kumar et al[2], Manjusha et al [9] reported less than 1% of SβT prevalence. While results of Bhokare et al[23] supports our findings with their SβT prevalence of 5.4%.SβT patients inheriting sickle thalassemia exhibit features of both thalassemia and sickle cell anemia.[3]Prevalence percentage of SFHb was 3.7% and 9% among total screened subjects and positive cases respectively (Table no.3).

Some of the limitations of thisstudy is small sample size and selection of study subjects for short duration might have missremaining rare patterns of abnormal hemoglobin such as HbE, HbA etc. This study wasconducted to focus only on prevalence of hemoglobinopathies among people irrespective of community or caste comes to the tertiary care hospital and Medical college, Chandrapur.

CONCLUSION:

This study provides valuable information about prevalences of various patterns of hemoglobinopathy among both screened peoples and cases in Chandrapur district.The sickle cell anaemia and β-thalassaemia are the most severe form of hemoglobinopathies. These two forms of inherited abnormalities of haemoglobin variants are prevalent and serious public health problem in central India. High prevalence of abnormal haemoglobins S and HbβT in central India is due to lack of awareness, medical facilities to detect these in early age group.In present study the high prevalence of HbS gene demonstrate that sickle cell anaemia is not confined to specific communities instead it is widely distributed in Chandrapur district. Similarly, present study suggests that remarkable frequency of HbβT, β-thalassemia trait in this part of central India well beyond the Sindh and Punjab regions. We also reported noticeable number of cases of HPFH in this region. We have detected most of the positive cases in adult age group this shows lack of awareness, screening programs and medical fascilities to detect hemoglobinopathies in early ages of people of this district.

More Screening of healthy population is required to determine the prevalence and carrier rates of abnormal hemoglobinin Chandrapurregion. It will be beneficial to know the disease burden for sufficient and effective health service.The most effective remedies to reduce the burden of haemoglobinopathies in India,are genetic counselling, disease awareness program, sensitization of the people specifically in Chandrapur region about prenatal diagnosis and termination of pregnancy having affected foetus etc. Though these disorders are not curable but prevalence can be reduced by population screening, preventive measures which has mentioned in above paragraph and management of haemoglobinopathies can reduces morbidity and mortality ofaffected families.

REFERENCES:

1. Bhaskar P. Urade, Incidence of Sickle Cell Anaemia andThalassaemia in Central India. Open Journal of Blood Diseases, 2012; (2), 71-80.
2. Mrinal Kumar Baeuah ,et al, Pattern of hemoglobinopathies and thalassemias in upper Assam region of North Eastern India: High performance liquid chromatography studiesin 9000 patients. Indian Journal of pathology and microbiology, 2014;57(2)
3. Harrison's Principal of Internal Medicine, 18th edition, 2012: 594-596
4. Roshan B. Colah, Malay B. Mukherjee et al, Sickle cell disease in tribal populations in India. Indian J Med Res, 2015 May; 141(5): 509–515.
5. M. Vasaikar, S. Kanthikar, S. Chavan. Spectrum of hemoglobinopathies diagnosed by HPLC in high prevalence area of north Maharashtra .International journal of pharma and biosciences, 2012; 3(2):B690-697.
6. Mulchandani DV, Fulare MB, Zodpey SP, Vasudeo ND. Prevalence and some epidemiological factors of beta thalassemia trait in Sindhi community of Nagpur city, India. Indian J Public Health. 2008;52:11–15.
7. D.Mohanty, R. B. Colah,et al. Prevalence of β-thalassemia and other haemoglobinopathies in six cities in India: a multicentrestudy.J Community Genet. 2013 Jan; 4(1): 33–42.
8. Viral M. Bhanvadia, AlpeshChavda,et. al. Study of prevalence of hemoglobinopathy in Sindhi community of Jamnagar, Gujarat: A pilot study. International Journal of Medicine and Public Health, 2015;5:349-352.
9. ManjushaPunjajiTambse, Maya Suresh Vasaikar, Sunil SantaramChavan. Patterns and Demographic Distribution of Hemoglobinopathies in North Maharashtra.Annals of Applied Bio-Sciences, 2016;Vol. 3;(2):183-188.
10. S. Sinha, M. L. Black, S. Agarwal, R. Colah,et. Al. Profiling β-thalassaemia mutations in India at state and regional levels: implications for genetic education, screening and counsellingprogrammes.Hugo J. 2009 Dec; 3(1-4): 51–62.
11. Rao, V.R. & Gorakshakar, A.C.Sickle cell hemoglobin, β-thalassaemia and G6PD deficiency in tribes of Maharashtra, India. Gene Geography.1990;(4):131–134.
12. Balgir RS.Spectrum of hemoglobinopathies in the state of Orissa, India: a ten years cohort study.J Assoc Physicians India. 2005 Dec;53:1021-6.
13. Chatterjee N, Mishra A, Soni R, et.al. Bayesian estimates of the prevalence of β-thalassemia trait in voluntary blood donors of central India: a survey. Hemoglobin. 2010;34 (6):548–560.
14. Dash S, Chhanchimi L, Chhakchhuek L, Zomawaia E. Screening for hemoglobinopathies and G6PD deficiency among the Mizos of Mizoram: a preliminary study. Indian J PatholMicrobiol. 2005;48:17–18.
15. Das B, Sengupta S. HbE genotypes and fertility: a study on a Tibeto–Burmese population in Upper Assam, India. Ann Hum Biol. 2008;35:422–431.
16. Das MK, Dey B, Roy M, Mukherjee BM. High prevalence of HbE in 3 populations of the Malda district, West Bengal, India. Hum Hered. 1991;41:84–88.
17. Singh MR, Singh TS. Genetic polymorphism at three loci in two populations of Manipur, India. AnthropolAnz. 2008;66:191–198.
18. Deka R, Reddy AP, Mukherjee BM, Das BM, Banerjee S, Roy M, et al. Hemoglobin E distribution in ten endogamous population groups of Assam, India. Hum Hered. 1988;38:261–266.
19. Kar BC, Satapathy RK, KulozikAE,et.al, Sickle cell disease in Orissa State, India. Lancet 328:1198–1201.
20. Arun U Deore, Subhash B Zade,Distribution of sickle cell gene in korkutribe of central india. National Journal of Community Medicine. Volume, Issue 3, July – Sept 2014 Page 270
21. ManjushaPunjajiTambse*, Sunil SantaramChavan and Maya Suresh Vasaikar Hemoglobin Patterns in Sickle Cell Hemoglobinopathies- A Large Prospective Study in NorthMaharashtra MVP Journal of Medical Sciences, 2017;Vol 4(1), 4-8.
22. Shah Sejal J et al,a profile of cases of hemoglobinopathies at a medical college. National journal of medical research,2012;Volume 2,(2):137-140.
23. Santosh B. Bhokare, Pragati P. Phulgirkar et al, Spectrum of hemoglobinopathies by high performance liquid chromatography with special reference to role of HbA2 levels at tertiary care centre.International Journal of Research in Medical Sciences, 2016 Dec;4(12):5269-5276.
24. Chad Garner, et al,Heterocellular hereditary persistence of fetal haemoglobin affects the haematological parameters of b-thalassaemia trait. British Journal of Haematology, 2003; 123: 353–358.
25. Pratima Verma1, ArchnaGhildiya et al,Prevalence of hemoglobinopathies in different regions and castes of Uttar Pradesh, India -A hospital based study.Asian Journal of Medical Sciences , Sep-Oct 2015 ;Vol 6,(5):21-25.
26. M. MesbahUddin et al, Pattern of B- Thalassemia and other haemoglobinopathies: A cross- Sectional Study in Bangladesh. International Scholarly Research Network ISRN Hematology, 2012;659191:1-6.
27. Mannan A, J Kawsar etal, A demographic approach for understanding the prevalence of B Thalassemia Patterns and other hemoglobinopathies: Selective Study in Chittagong City Perspective. Asian Journal of Biological Sciences, 2013;6(2): 124-130.