

Content available at: <https://www.ipinnovative.com/open-access-journals>

IP Archives of Cytology and Histopathology Research

Journal homepage: <https://www.achr.co.in/>

Original Research Article

Study of Spectrum of anemia in various age groups

Varsha Pandey^{1,*}¹Dept. of Pathology, Pt. J.N.M. Medical College, Raipur, Chhattisgarh, India

ARTICLE INFO

Article history:

Received 05-07-2021

Accepted 27-08-2021

Available online 16-09-2021

Keywords:

Anemia
Morphology
Microcytic
Hypochromic
Macrocytic
Normocytic
Hemolytic

ABSTRACT

Introduction: Anemia is major health problem world-wide especially in developing countries. Globally 1.62 billion persons are affected. It has grave consequences on human health. The present study evaluates the severity and morphology of anemia in various age groups in rural population.

Aims & Objectives: 1): To study degree and severity of anemia in study population; 2): To study distribution of anemia in various age groups; 3): To study morphological spectrum of anemia in study population.

Methods and Materials: The study includes 792 patients having low concentration of hemoglobin for their age & sex. The other hematological parameters and morphology were analyzed.

Observation & Result: In our study, females constituted 72.6% (575/792) of study population and male constituted 27.4% (217/792) of population. Pediatric patients (up to 15 years of age) constituted 10% of study population. Out of 792 anemic patients, 439 (55.4%) were having moderate anemia, 228 (28.7%) were having mild anemia & 125 (15.78%) were having severe anemia. Out of 792 anemic patients, 384 (48.4%) were having microcytic hypochromic anemia, 296 (37.37%) were having normocytic normochromic anemia, 84 (10.6%) were having macrocytic anemia and 3.5% were having hemolytic anemia. Out of 792 anemic patients, 439 (55.4%) were having moderate anemia, 228 (28.7%) were having mild anemia & 125 (15.78%) were having severe anemia.

Discussion: In our study anemia was more common in females as compared to males constituting majority of study population which is in concordance with other studies also. Moderate anemia was more common in study population as well as in various sub-groups being in concordance with other studies too. Morphologically microcytic hypochromic anemia was the most common type of anemia especially in adult females. Pregnant females were found to have normocytic normochromic anemia predominantly. Most of the cases of hemolytic anemia was found in children <15years. Similarly macrocytic anemia was found more commonly in adult males.

Conclusion: Anemia is the most hematological abnormality found in daily practice, though found in all age groups but quite higher in females. The main objective for diagnosing anemia is to make clinician aware so that they can take measures to prevent and control anemia.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Anemia is a global public health problem. It is most common haematological finding encountered in routine practice. Although it affects both developing and developed

countries but is more common in developing countries. It has major consequences on human health as well as social and economic development. It is associated with poor outcome in many diseases. It occurs in all age groups, but is more common in age group with increased demand like in pregnant women and young children. Globally, anemia

* Corresponding author.

E-mail address: varshanema@live.com (V. Pandey).

affects 1.62 billion people throughout the world which constitute 24.8% of the population. The highest prevalence is found in preschool-age children and the lowest prevalence is in men.¹

The study is under taken to evaluate the burden and severity of anemia in rural population and to study their morphological spectrum.

2. Aims & Objectives

1. To study distribution of anemia in various age groups
2. To study degree and severity of anemia in study population
3. To study morphological spectrum of anemia in study population

3. Methods and Materials

The study included 792 patients of all age groups and of both the sexes having low concentration of hemoglobin for age and sex over the period of two months (May and June 2016). The anemia was defined as according to WHO guidelines (Table 1). The hematological parameters included hemoglobin, RBC count, MCV, MCH, MCHC, RDW were measured by electronic hematology analyzer. The morphological analysis was done on peripheral smear stained by Leishman stain.

4. Observation & Results

In our study, the anemia is found to be more common in females as they constituted 72.6% (575/792) of study population. Out of 575 females, 81.21% (476/575) were non-pregnant women, 11.65% (67/575) were pregnant and 7.13% (41/575) were belonged to pediatric age group (<15 years of age).

Males constituted 27.4% (217/792) of study population. Out of 217 males, 82.02% (178/217) were adult males and 17.9% (39/217) belonged to pediatric age group.

Paediatric patients (<15 years of age) constituted 10% (80/792) of study population. Among pediatric patients anemia is slightly more common in females 51.25% (41/80) as compares to males 48.75% (39/80).

Out of 792 anemic patients 55.4% (439/792) were having moderate anemia, 28.7% (228/792) were having mild anemia and 15.78% (125/792) were having severe anemia. Severe anemia was more common in adult non-pregnant females. Pediatric population and pregnant females were having moderate anemia predominantly (Table 3).

F-Test for equal variances in the two way classification was applied and it was found that there is significant difference between age with grading of anemia (p value = 0.01).

Out of 792 anemic patients, 48.4% (384/792) were having microcytic hypochromic anemia. 37.37% (296/792) were having normocytic normochromic anemia. 10.6%

(84/792) were having macrocytic anemia and 3.5% (28/792) were having hemolytic anemia. Microcytic hypochromic anemia constituted almost 50% of study population followed by normocytic normochromic anemia.

Hemolytic anemia was common in non-pregnant adult females followed by pediatric patients (up to 15 years of age). Macrocytic anemia was common in non-pregnant adult females followed by adult males.

F-Test for equal variances in the two way classification was applied and it was found that there is no significant difference between age with respect to morphological spectrum grading of anemia (p value = 0.05) and vice versa (p value- 0.08).

5. Discussion

Anemia is the most common hematological finding in day to day practice. It can be defined as a reduction in the concentration of hemoglobin or oxygen carrying capacity of blood below the lower limit with respect to age, sex and altitude. To establish the presence and severity of anemia, hemoglobin concentration and packed cell volume is measured.⁴ In our study we used hemoglobin values in EDTA venous samples measured by electronic cell counters to establish anemia.

Anemia is not a disease rather it is an objective sign for presence of disease. It is caused by wide variety of causes but the most common cause of anemia in India is iron deficiency.¹ Anemia is an indicator of poor nutrition and health. In pregnancy, anemia increases the risk of maternal and fetal mortality as well as morbidity. Abortions, premature births, post-partum hemorrhage and low birth weight are strongly associated with anemia in pregnancy. In India, 20-40% of maternal deaths are attributed to anemia. Anemia can be caused or aggravated by parasitic infestations e.g., malaria, intestinal parasites. Iron deficiency may impair cellular responses and immune functions and thus increase susceptibility to various types of infections.⁵ The negative consequence of anemia on physical performance particularly work productivity in adults is of major concern. This has great impact on the economy of the country and thus make the diagnosis of anemia important.⁶

The main objective for diagnosing anemia is to make clinician aware so that they can take measures to prevent and Control anemia. Apart from measurement of Hb concentration, the causes of anemia should also be identified as these may vary in population.¹ However, in our study etiologies of anemia have not been covered due to limited resources.

Anemia though common in all age groups but more commonly found in females of reproductive age groups, children and pregnant females. In our study, female constituted 73% of population. In study by Srinivasamurthy, Gerado Alvarez-Uria et al, Gupta S K et al, females

Table 1: Haemoglobin concentrations (g/dL) for the diagnosis of anemia and assessment of severity according to the World Health Organization.^{2,3}

Age (Months/years)	Non-anemia (Hb in gm/dl)	Mild Anemia (Hb in gm/dl)	Moderate Anemia (Hb in gm/dl)	Severe Anemia (Hb in gm/dl)
6 months -59 months	11.0	10-10.9	7-9.9	<7
5-11 Years	>= 11.5	11-11.4	8-10.9	<8
12-14 Years	>=12.0	11-11.9	8-10.9	<8
Non-Pregnant Women (15 years of age and above)	>= 12	11-11.9	8-10.9	<8
Pregnant Women	>= 11	10-10.9	7-9.9	<7
Men (15 years of Age and Above)	>= 13	11-12.9	8-10.9	<8

Table 2: Distribution of study population according to age and sex (n=792)

Age Groups	Number of Patients		Total Number
	Male	Females	
06 Months – 59 Months	2.27% (18)	1.89% (15)	4.26% (33)
05-15 years	2.65% (21)	3.28% (26)	5.95% (47)
>15 year (Pregnant females)	-	8.5% (67)	8.5% (67)
>15 year (Non-Pregnant females)	-	58.96% (467)	58.96% (467)
>15 years (Males)	22.5% (178)	-	22.5% (178)
Total	27.4% (217)	72.6% (575)	100% (792)

Table 3: Grading of anemia in study population.

Age Groups	Mild Anemia	Moderate Anemia	Severe Anemia	Total
06 Months – 59 Months	0.8% (07/792)	2.8%(21/729)	0.6%(5/729)	33
05-15 years	1.0%(8/792)	4.2%(31/729)	1.0%(8/729)	47
>15 year (Pregnant females)	0.6% (5/792)	6% (44/729)	2.4%(18/729)	67
>15 year (Non-Pregnant females)	19% (152/792)	36%(263/729)	7.1% (52/729)	467
>15 years (Males)	7%(56/729)	10.9 % (80/729)	5.76%(42/729)	178
Total	28.7% (228/729)	55.4%(439/729)	15.78%(125/729)	792

Table 4:

Age Groups	Normocytic Normochromic anemia	Microcytic Hypochromic Anemia	Macrocytic anemia	Hemolytic Anemia	Total
06 Months – 59 Months	100% (00)	(28/792)	(01/792)	(04/792)	33
05-15 years	(14/792)	(26/792)	(04/792)	(03/792)	47
>15 year (Pregnant females)	(29/792)	(24/792)	(09/792)	(05/792)	67
>15 year (Non-Pregnant females)	(175/792)	(242/792)	(39/792)	(11/792)	476
>15 years (Males)	(78/792)	(64/792)	(31/792)	(05/792)	178
Total	37.37% (296/792)	48.4% (384/792)	10.6% (84/792)	3.5% (28/792)	100% (792/792)

constituted 34%, 49.45% and 82% of study population respectively.^{5,7,8} The increased percentage of females in our study may be due to the inclusion of pregnant females in study and also due to increased inflow of female patients in our set up.

In our study, pediatric patient (up to 15 years) constituted 10% of study population which is almost comparable with the study of Srinivasamurthy in which 18% of study population was constituted by pediatric patients (less than 12 years).⁷

In our study adult males (>15 years) constituted 22.5% of study population. In study by Srinivasamurthy and Gupta S K et al, 30.5% and 18% of study population was constituted by adult males (12-56 years of age) respectively.^{5,7} The results are almost comparable with the two studies.

In our study, mild, moderate and severe anemia was found in 28.7%, 55.4% and 15.78 % cases respectively which is comparable to the results in study by Gupta S K et al, in which mild, moderate and severe anemia was found in 47.54%, 48.61% and 3.77 % cases respectively.⁵ In above mentioned study moderate anemia was most prevalent type as in our studies followed by mild and severe anemia.

In our study, in pediatric age group (up to 15 years) mild, moderate and severe anemia was found in 18.7%, 65% and 16.3 % cases respectively. In study by Gerado Alvarez-Uria et al, most of the pediatric population has mild followed by moderate and severe anemia.⁸ In our study severity of anemia is more in pediatric population raising the need for its intervention.

In our study, most of the adult males (>15 years) were having moderate anemia (44.9%), followed by mild anemia (31.5%) and severe anemia (23.6%). In study by Gupta S K et al, adult males were mostly having mild anemia (16%), followed by moderate anemia (6.61%) and severe anemia (0.77%).⁵ In both the studies rural population was enrolled and most of the males in our study were found to have higher degree of anemia as compared to mild anemia in study by Gupta S K et al. This indicates poor nutrition status even in adult in study population.

In our study, most of the adult non-pregnant females (>15 years) were having moderate anemia (56.3%), followed by mild anemia (32.5%) and severe anemia (11.1%). Among pregnant females, 7.4%, 65.6 and 26.8% were having mild, moderate and severe anemia respectively. In study by Gupta S K et al, most of the females had moderate anemia 42% followed by mild anemia in 31.35% and severe anemia in 3% cases.⁵ The subtle difference may be due to the fact that in study by Gupta S K et al, there is no segregation of pregnant and non-pregnant cases. In study by, Totea et al, 13.1% pregnant females had severe anemia and 60.1% had moderate anemia.⁹ In our study, the percentage of pregnant females having severe anemia was higher (26.8%) as compared to the study by Toteja in which 13.1% pregnant females were having severe anemia. This indicates the

need of focus on prevention and management of anemia in pregnant females in our set up.⁹

In our study, 48.4%, 37.37%, 10.6% and 3.5% were having microcytic hypochromic anemia, normocytic normochromic anemia, macrocytic anemia and hemolytic anemia respectively. In study by Srinivasamurthy 44.5%, 27% and 4.5% microcytic hypochromic anemia, normocytic normochromic anemia, macrocytic anemia respectively was noted.⁷ Microcytic and hypochromic anemia was the most common type in both the studies. Hemolytic anemia was enrolled in study by Srinivasamurthy et al. In the rural population of Chhattisgarh, hemolytic anemia especially Sick cell anemia is quite prevalent.

In pediatric age group (up to 15 years of age), microcytic hypochromic anemia was most common type of anemia (67.5%) followed by normocytic normochromic anemia (17.5%), hemolytic anemia (8.7%) and macrocytic (6.2%). In study by Srinivasamurthy et al, in pediatric age group (from 0 to 12 years of age) microcytic hypochromic anemia was most common type of anemia (66.6%) followed by normocytic normochromic anemia (30.5%).⁷ In study by Neerja et al, in pediatric age group (from 0 months to 14 years of age), microcytic hypochromic anemia was most common type of anemia (63.5%) followed by normocytic normochromic anemia (17.06%), macrocytic anemia (11.76%) and hemolytic anemia (4.12%).¹⁰ In all the above mentioned studies including our study, microcytic hypochromic anemia, was the most common type of anemia in pediatric age group. This emphasizes the need of prevention in treatment of iron deficiency anemia in the pediatric age group as iron deficiency is most common cause of microcytic hypochromic anemia. In the NFHS-3, only 14.6% of children aged 6-35 months consumed food rich in iron.¹¹ At this age, the effect of iron deficiency on the neurological development can be not totally reversible.^{12,13} Consequently, the Indian Government recommends iron and folic acid to younger children.¹⁴ However, the programme implementation has been poor due to lack of logistic planning and accountability.¹⁴ The cases of normocytic normochromic anemia were almost comparable in study by Neerja et al and in our study.¹⁰ Prevalence of hemolytic anemia is almost twice in our study (8.7%) as compared to study by Neerja et al (4.12%).¹⁰ as state of Chattisgarh is a known sickle cell belt.

In pregnant females, normocytic normochromic anemia was the most (43.2%) followed by microcytic hypochromic anemia (35.8%), macrocytic anemia (13.4%) and hemolytic anemia (7.5%). In study by Salman T S et al 67.85% pregnant women were having microcytic hypochromic anemia and 8.92% pregnant were having normocytic normochromic anemia.¹⁵ In study by Tyagi et al 42% pregnant females were having microcytic hypochromic anemia and 28% pregnant females were having normocytic normochromic anemia and 7% females were having

macrocytic anemia.¹⁶ In study by Melku Mulugeta et al., 76% had normocytic normochromic anemia, 14% had microcytic hypochromic anemia and 4% were having macrocytic anemia.¹⁷ In our study and study by Melku Mulugeta et al., normocytic normochromic anemia was most common type of anemia where as in other two studies microcytic hypochromic anemia was the most common type in pregnant females.^{15–17} The cases of macrocytic anemia were almost comparable with those of study by Tyagi et al., emphasizing need of prevention of not only iron deficiency but also anemia due to deficiency of vitamin B12 and folic acid.

In non-pregnant adult females microcytic hypochromic anemia was most common type of anemia (50.8%) followed by normocytic normochromic anemia (36.76%), macrocytic anemia (8.1%) and hemolytic anemia (2.3%). In study by Srinivasamurthy et al., microcytic hypochromic anemia was found in 60.3% cases, normocytic normochromic anemia in 17.6% of cases and no case of macrocytic anemia as in our study.⁷ This emphasizes the need of focus on iron and folic acid supplements in adult females.

In adult males, normocytic normochromic anemia was most common (43.8%) followed by microcytic hypochromic anemia (35.9%), macrocytic anemia (10.6%) and hemolytic anemia (2.8%). In study by Srinivasamurthy et al., microcytic hypochromic anemia was found in 21.3% cases, normocytic normochromic anemia in 39.3% cases and macrocytic anemia in 11.4% cases.⁷ In study by Mark et al., normocytic normochromic anemia was most common (53%) followed by microcytic hypochromic anemia (33%) and macrocytic anemia (2%).¹⁸ In all the above mentioned studies normocytic normochromic anemia was the most common type of anemia in adults males followed by microcytic hypochromic anemias. The prevalence of macrocytic anemia in our study was almost comparable with that of study by Srinivasamurthy et al., but higher as compared to study by Mark et al.,^{7,18}

6. Conclusion

Anemia is most common hematological abnormality found in hematology laboratory. Anemia though common in all age groups but more common on females especially non-pregnant females of more than 15 years of age. In males anemia is more common in adult age group (>15 years). Severe anemia is found in lesser number of cases but is worrisome in pregnant females. Anemia in pregnancy is associated with adverse consequences both for mother and the fetus. Strict measures should be taken in investigating and screening of pregnant females. Most common type of anemia was the microcytic hypochromic anemia indicating nutritional deficiency in study population especially in females. Macrocytic anemia was the more common in adult males. Hemolytic anemia was most common in children under 15 years of age emphasizing the need of prevention of

sickle cell disorder by screening and premarital counseling as most of the cases were proven to be sickle cell disorder on follow up.

7. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

8. Source of Funding

None.

References

1. World Health Organization. (2008). Worldwide prevalence of anaemia 1993-2005 : WHO global database on anaemia. World Health Organization;. Available from: <https://apps.who.int/iris/handle/10665/43894>.
2. FAO, WHO, World Declaration and plan of Action for nutrition. International Conference on Nutrition. Rome, Food and Agriculture Organisation of the United Nations; 1992. Available from: <http://whqlibdoc.who.int/hq/1992/a34303.pdf>.
3. WHO, UNICEF, UNU. Iron deficiency anaemia: assessment, prevention and control, a guide for programme managers. Geneva, World Health Organization; 2001. Available from: http://www.who.int/nutrition/publications/micronutrients/anaemia_iron_deficiency/WHO_NHD_01.3/en/index.html.
4. Kawthalkar SM. Essentials of Hematology. In: 2nd Edn. New Delhi: Jaypee Brothers; 2013. p. 53.
5. Gupta SK, Agarwal SS, Kaushal R, Jain A, Gupta VK, Khare N, et al. Prevalence of Anemia among rural population living in and around of rural health and training center. *Muller J Med Sci Res.* 2014;5(1):15–8. doi:10.4103/0975-9727.128936.
6. Assessing the iron status of populations: report of a joint World Health Organization/ Centers for Disease Control and Prevention technical consultation on the assessment of iron status at the population level. In: 2nd Edn. Geneva: Geneva, World Health Organization; 2007. Available from: http://www.who.int/nutrition/publications/micronutrients/anaemia_iron_deficiency/9789241596107.pdf.
7. Srinivasamurthy CB. Spectrum of anemia and red cell parameters of patients in a tertiary care hospital in rural South India. *Int J Biol Med Res.* 2013;4(1):2948–51.
8. Uria GA, Naik PK, Midde M, Yalla PS, Pakam R. Prevalence and Severity of Anaemia Stratified by Age and Gender in Rural India. *Anemia.* 2014;2014. doi:10.1155/2014/176182.
9. Toteja GS, Singh P, Dhillon BS, Saxena BN, Ahmed FU, Singh LRP, et al. Prevalence of Anemia among Pregnant Women and Adolescent Girls in 16 Districts of India. *Food and Nutrition Bulletin.* 2006;27(4):311–5. doi:10.1177/156482650602700405.
10. Neerja P, Reddy CB. Prevalence and spectrum of anemia among 3920 pediatric in patients- A cross sectional study. *IAIM.* 2016;3(4):11–4.
11. Arnold F, Parasuraman S, Arokiasamy P, Kothari M. Nutrition in India,” in National Family Health Survey (NFHS-3) India ; 2005-06.
12. Baker RD, Greer FR, On C. Diagnosis and prevention of Iron Deficiency and Iron Deficiency anemia in infants and young children (0-3years of age. *Nutr Am Academy Pediatr.* 2010;126(5):1040–50.
13. Hurrell R. How to ensure adequate iron absorption from iron fortified food. *Nutr Rev.* 2002;60(7 Pt 2):7–15. doi:10.1301/002966402320285137.
14. More S, Shivkumar VB, Gangane N, Shende S. Effects of iron deficiency on cognitive function in school going adolescent females in rural area of central India. *Anemia.* 2013;p. 819136. doi:10.1155/2013/819136.
15. Salman S, Hussein AA. Determina morphological types of anemia in anemic pregnant women in Al Batool Teaching Hospital for maternity and children in Baqubah City Iraq. *Int J Adv Res;*4(5):934–9.

16. Tyagi N, Kaushik A, Khatri A, Deshwal A, Ranga S, Shah WA, et al. Prevalence of Type and severity of anemia in Antenatal cases in a tertiary Care Hospital in North India “ Annals of Woman and child health. *Ann Woman Child Health*. 2016;2(1).
17. Melku M, Addis Z, Alem M, Enawgaw B. Prevalence and Predictors of Maternal Anemia during Pregnancy in Gondar, North west Ethiopia: An Institutional Based Cross Sectional Study”. *Anemia*. 2014;doi:10.1155/2014/108593.
18. Prasanna M, Ruth S, Deepthi S. Spectrum of anemia and red cell indices in adult male patients in a tertiary care hospital. *Sch J App Med Sci*. 2017;5(3E):1079–84.

Author biography

Varsha Pandey, Assistant Professor

Cite this article: Pandey V. Study of Spectrum of anemia in various age groups. <i>IP Arch Cytol Histopathology Res</i> 2021;6(3):197-202.
