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Original Research Article

Haematological Profile of Adolescents at a tertiary care centre in Konkan region of Maharashtra state, India

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ABSTRACT

Introduction: Lack of studies and information on hematological parameters for adolescent population (10-19 yrs) is obvious on extensive research. In adolescent stage, nutritional deficiency is more common, more so in girls which are vulnerable to anaemia. Assessment of Hematological parameters in young, growing population is important in determination of normal values worldwide and for identification of anemia.

Methodology: The present study was a cross sectional, observational, retrospective study. The study period is of 1 year and 3 months (1st January 2020 to 31st March 2021). This study is based on hematological profile of 250 Adolescents (aged 10-19 years). For each of the adolescents, a blood sample by venipuncture was derived in an EDTA vacutainer. The blood sample was used to determine both the complete blood count and peripheral smear findings in each case. The automated hematology analyzer "Horiba Yumizen 500" was used to measure the variables of full blood count. All the data was tabulated in Microsoft excel sheet and analyzed using descriptive statistics.

Results: In our study, out of 250 cases studied, Males were 95 (38%) and females were 155 (62%). According to Age distribution, maximum cases were in 17-19 years of age group (57.6%) and minimum cases were in 10-13 age group (19.2 %). The haemoglobin level among these adolescents ranged from 12-18 gm/dl (52.4%) . 28.8% cases were present in 10-12 gm/dl range . The hemoglobin level <10 gm/dl were present in 18.8% cases. RBC count ranged from 4.20-6.00 millions/cu mm in the maximum cases of adolescents with 69.2%. In the present study, the hematocrit range in adolescents (10-19 yrs) age group, the maximum cases (66.8% cases) show <39% haematocrit. Cases with MCV between 76-100 fl, 69.6% cases were seen. The level of MCV count <76 fl , cases of adolescents were 27.6%. In the present study, MCH count <32 pg was seen in 90.4% adolescents. MCH level >35 pg was seen in 0.8% cases. MCHC count >34 g/dl was seen in 53.6% cases, whereas <26 gm/dl seen in 0.8% cases. The total leucocytes count less than 4,000 cell/mm3 was present in 7.2% cases, whereas a total leucocytes count more than 11,000 cell/mm3 was present 26% cases. Maximum cases had platelet count range from 150000 to 4,50,000 /cu mm. 2.4% cases show thrombocytopenia. Thrombocytosis was noted in 4.45% cases.

Conclusion: Nutritional deficiency anaemia was more prevalent in adolescent girls in this region. Anaemia was seen more in girl adolescents compared to boys. Hematological parameters were better in boys compared to girl adolescents in this region.

Keywords: CBC, hematology, adolescents, anaemia

INTRODUCTION

Adolescence begins at the age of 10 years of age and continues till he or she reaches 19 years of age.1-3 This growing phase includes changes in many physical and physiological parameters. The nutritional needs are increased in this phase.[1-4]

In adolescent stage, nutritional deficiency is more common, more so in girls which are vulnerable to anaemia.4-6 In adolescents, the worldwide anaemic prevalence is of 15%. Anaemia in Indian adolescents comprises around 21% of its population. The adolescents gain up to 40-50% of skeletal muscle mass, 20% of their adult height and around 20% of adult weight.[6,7]

In India, adolescent girls, form a vulnerable group due to increasing iron demand during adolescence, low socio-economic status and low literacy rate. Thus, it is pertinent to start strategies to improve socio-economic status and educate on nutritional adequacy in adolescence. High rates of dietary iron and folate deficiency, miscarriages, low birth weights and maternal mortality account for anaemia in adolescent girls.[6-8]

Despite the high rate of prevalence, the awareness of anaemia and its treatment are relatively low, suggesting a nationwide need for preventing anaemia in India in order to avert and prevent complications of anaemia. Very few studies have been done on anaemia in adolescent population in India. Hence, the present research is done with the objective of assessing the clinico-haematological profile of anaemia in adolescents in a tertiary care hospital of Konkan coastal Maharashtra state, India.

MATERIAL AND METHODS

This is a cross sectional, observational, retrospective study. This study is conducted at Hematology section, Department of Pathology in B.K.L.Walawalakar Hospital, Konkan region, Maharashtra state, India.

The aims and objectives were: 1) To Study the hematological profile of Adolescents patient in a tertiary care hospital. 2) Analyze the difference in hematological profile with regard to age and gender of adolescents.

The study period is of one year and three months (1st January 2020 to 31st March 2021). This study is based on hematological profile of 250 Adolescents (aged 10-19 years). For each of the adolescents, a blood sample by venipuncture was derived in a 5 ml tube containing an anticoagulant, ethyl diamine tetra acetic acid (EDTA).

The blood sample was used to determine both the complete blood count and peripheral smear findings in each case. The automated 5-part hematology analyzer "HORIBA" was used to measure the variables of full blood count.

RESULTS

Total 250 adolescents aged 10 to 19 yrs age where included in this study over 1 year and 3 months. Table No.1 shows that gender-wise distribution of adolescents in our study. Boys were 38% and Girls were 62%.

Table-1: Gender-wise distribution of Adolescents (10-19 years of age)

Gender	Percentage (%)	Number of cases
Male	38	95
Female	62	155
Total	100	250

Table No.2 shows the age (10-19 yrs) distribution of adolescents. Maximum cases were in 17-19 years of age group (57.6%), in 14-16 yrs age group there were 23.2% cases and 19.2% cases in 10-13 yrs of age group.

Table-2: Gender-wise distribution of Adolescents

Age	Percentage	Number of adolescents
10-13	19.2	48
14-16	23.2	58
17-19	57.6	144
Total	**100**	**250**

Table No.3 shows values of Hb (g/dl) in Adolescents. Maximum cases were in 12-18 g/dl range (52.4%). Out of 250 cases, moderate anaemia cases (Hb:7-10 g/dl) were 10.4% while mild anaemia cases (Hb:10-12 g/dl) were 28.8%. 8.4% cases had severe anaemia due to Hb<7g/dl.

Table-3: Hb level in Adolescents

Hb Level (gm/dl)	Percentage	10-13 yrs	14-16 yrs	17-19 yrs
<7	8.4	5	6	10
7-10	10.4	4	6	16
10-12	28.8	19	13	40
12-18	52.4	16	33	82
>20	0.00	0	0	0
Total	**100**	**48**	**58**	**144**

Table No.4 shows values of RBC count. In the level of RBC count <4.20 millions/cumm, cases of adolescents were 27.5%. In 4.20-6.00 millions/cumm RBC range, cases of adolescent were 69.2% (maximum cases). 2.4% cases had RBC count >6.00 millions/cumm.

Table-4: Values of RBC count in Adolescents

Level of RBC (millions/ mm3)	Percentage	10-13 yrs	14-16 yrs	17-19 yrs
<4.20	27.6	12	15	44
4.20-6.00	69.2	38	34	10
>6.00	2.4	0	1	5
Total	**100**	**48**	**58**	**144**

Table No.5 shows packed cell volume (PCV in %) in adolescents (10-19 yrs). Maximum cases are in <39% PCV value (66.8% cases).The level of PCV count 39-52%, cases were 32.8%.

Table-5: Values of PCV (%) in Adolescents

PCV in %	Percentage	No. of cases
<39	66.8	167
39-52	32.8	82
>52	0.4	1
Total	**100**	**250**

Figure No.1 show values of MCV count in adolescents. Cases with MCV 76-100 fl, 69.6% (174 adolescent) cases were seen. The level of MCV count <76 fl , cases of adolescents were 27.6% (69 cases). MCV>100 fl comprised 2.8% cases (7 cases).

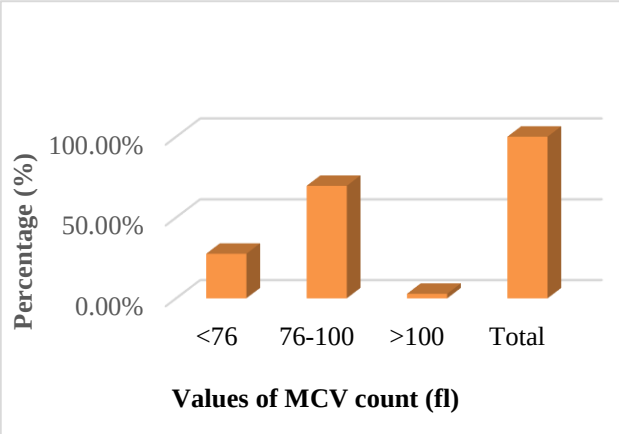

Fig-1: Values of MCV count (fl) in Adolescents

Figure No.2 shows values of MCH count in adolescent cases. Cases with MCH <32 pg were 90.4% (226 cases). In the MCH range of 32-35 pg, cases of adolescents were 8.8% (22 cases) and fewer cases (2 adolescents) when MCH level >35 pg (0.8%).

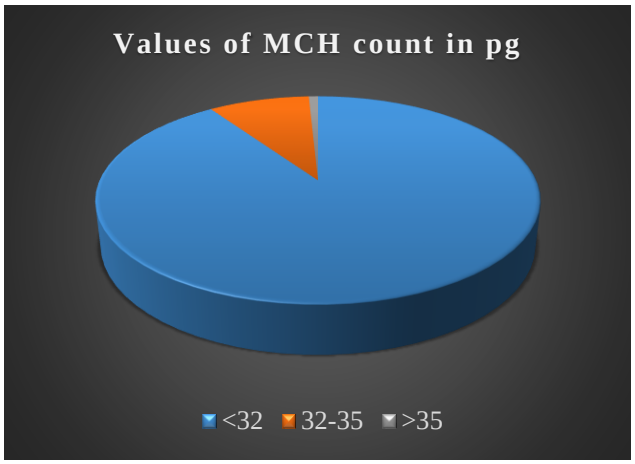

Fig-2: Values of MCH count (pg) in Adolescents

Values of MCHC level in adolescents showed following results. In >34 g/dL range, cases of adolescents where 53.6% (134 cases). The level of MCHC between 26-34 g/dL, cases of adolescent where 45.6% (114 cases) and 0.8% (2 cases) in range <26 g/dL.

Table No.6 shows values of WBC count in adolescents. 4,000-11,000 cells/cumm range, included 66.8% cases. In the range of >11,000 cells/cu mm, cases of adolescents were 26% and 7.2% in <4,000 cells/cu mm range of WBC count.

Table-6: Values of WBC count in Adolescents

WBC values (cell/cu mm)	Percentage	No. of Pts
<4,000	7.2	18
4,000-11,000	66.8	167
>11,000	26	65
Total	**100**	**250**

Figure No.3 shows the distribution of RBC morphology in adolescents. 80% (200 adolescents) cases showed morphology as Normocytic Normochromic (NCNC) while 16% (40 adolescents) cases had Microcytic Hypochromic (MCHC) RBC morphology. The Macrocytic (MAC) cases were 10 cases (4%).

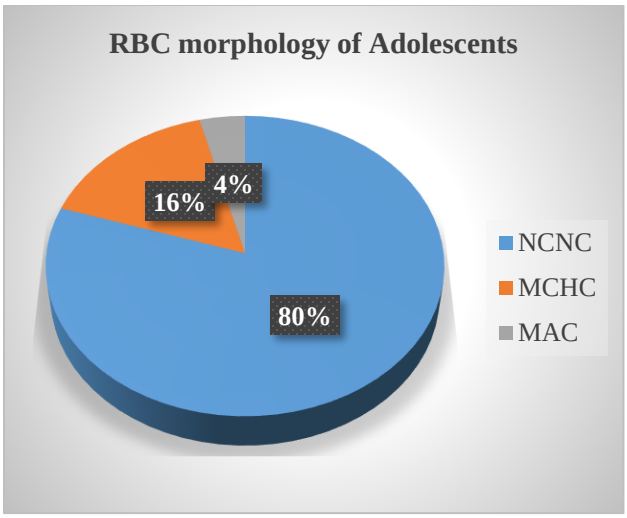

Fig-3: RBC morphology of Adolescents

Figure No.4 shows the distribution of WBC morphology. 33.6% cases (84 adolescents) had normal WBC morphology (WNL). The 18.4% cases (46 adolescents) had neutrophilia, 8.8% cases (22 adolescents) had lymphocytosis, 6% cases (15 adolescents) had eosinophilia. Leucocytosis (TLC: >11000/cu mm) was seen in 26% cases (65 adolescents). 7.2% cases (18 adolescents) had leukopenia (TLC:<4000/cu mm).

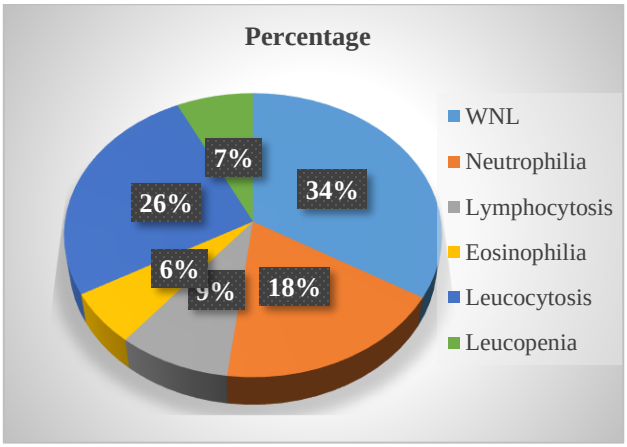

Fig-4: WBC morphology of Adolescents

With respect to platelet count, maximum 223/250 cases (89.2% adolescents) had platelets in normal range (1.5 to 4.5 lakhs per cu mm). 11 cases (4.4%) had thrombocytosis (>4.5 lakhs/ cu mm). 16 out of 250 cases (6.4% adolescents) had thrombocytopenia.

Table No.7 shows the distribution of platelet according to thrombocytopenia grades. Maximum cases showed Grade I and Grade IV thrombocytopenia with 37.5% cases each.

Table-7: Platelet count of thrombocytopenia cases in Adolescents

Grade of Thrombocytopenia	Platelet count (/cu mm)	Percentage	No. of cases
I	1,50,000-75,000	37.5	6
II	75,000-50,000	12.5	2
III	50,000-25,000	12.5	2
IV	<25,000	37.5	6
-	**Total**	**100**	**16**

Table No.8 shows that low Hb level (<12g/dl) seen in girls more than boys. Anemia is seen mainly in age group 14-16 yrs and 17-19 yrs in females compared to males. The difference in low Hb is insignificant in 10-13 yrs age group. Because of menstruation, heavy bleeding, irregular menstruation, Hb level was decreased in girls after 14 yrs age.

Table-8: Gender wise distribution of Hb level in adolescents

Hb level (gm/dl)	10-13 yrs		14-16 yrs		17-19 yrs	
	Boys	Girls	Boys	Girls	Boys	Girls
<7	3	2	1	5	12	8
7-10	3	1	0	6	4	12
10-12	9	10	2	11	10	30
12-18	6	10	10	23	45	37
>20	0	0	0	0	0	0
Total	**21**	**23**	**13**	**45**	**71**	**87**

Table No.9-shows Genderwise distribution of RBC count. Count <4.2 millions/cumm was seen more in girls after 14 yrs of age compared to boys.

Table-9: Gender-wise distribution of level of RBC count in adolescents

Level of RBC count (million/ cu mm)	Age in years					
	10-13 yrs		14-16 yrs		17-19 yrs	
	Boys	Girls	Boys	Girls	Boys	Girls
<4.20	7	5	3	12	16	28
4.20-6.00	10	28	14	20	39	61
>6.00	0	0	1	0	5	1
Total	**17**	**32**	**18**	**30**	**60**	**90**

Table No.10 shows gender wise distribution of WBC count. In >11,000 / cu mm, WBC showed physiological increase in females due to menstrual cycles, hormonal changes. No adolescents had fever or infection.

Table-10: Gender-wise distribution of level of WBC count in adolescents

WBC Count (cells/cu mm)	10-13 yrs		14-16 yrs		17-19 yrs	
	Boys	Girls	Boys	Girls	Boys	Girls
<4,000	2	4	1	0	7	4
4,000-11,000	10	13	10	35	40	62
>11,000	10	11	5	8	10	18
Total	**22**	**28**	**16**	**43**	**57**	**84**

Table No.11 shows that Gender-wise distribution of Platelet grades. Thrombocytopenia and reactive thrombocytosis were seen more in girls than in boys. The normal range of platelets was maximum cases in both genders.

Table-11: Gender-wise distribution of Platelet grades

WBC Count (cells/cu mm)	10-13 yrs		14-16 yrs		17-19 yrs	
	Boys	Girls	Boys	Girls	Boys	Girls
>4,50,000	0	1	0	2	2	3
1,50,000-4,50,000	20	25	18	35	50	75
1,50,000-75,000	0	1	0	2	3	3
75,000-50,000	0	0	0	1	0	1
50,000-25,000	0	1	0	0	0	1
<25,000	0	1	0	1	2	2
Total	**20**	**24**	**18**	**41**	**57**	**85**

DISCUSSION

In the present study, total 250 adolescents were aged 10 to 19 yrs. Girls were 155 out of 250 and boys were 95 out of 250. The ratio of girls : boys was 1.6:1. In the present study, the mean value of RBC, HCT/PCV, Hb, MCV, MCH, MCHC in male and female group showed tendency to increase with the increase of age.

In our study, the male adolescents showed significantly higher mean values of RBC compared to girls (4.6 millions/cu mm vs 4.2 millions/cu mm). Mean values of Hb were higher in males compared to female adolescents (13.1 gm/dl vs 11 gm/dl). Hematocrit were higher in males compared to female adolescents (37% vs 34%).

The mean values of MCV in boys were higher than the girls (80.9 fl vs 80 fl) .The mean values of MCH compared between boys and the girls were 27.3 pg vs 27 pg respectively. In our study, the mean values of MCHC showed that boys (34.7 gm/dl) and girls (34.5 gm/dl) had nearly similar values.

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Table-12: Mean values of haematological parameters in adolescent boys (10-19 yrs)

Variable	Boys in our study (95/250)		Boys (Gligoroska JP, et al (2019)[1]	
	Mean	SD	Mean	SD
RBC (millions/cu mm)	4.6	0.7	5.02	0.42
Hb (gm/dl	13.1	2.8	14.08	1.29
PCV (%)	37	7	43.37	3.85
MCV (fl)	80.9	11.5	86.27	4.03
MCH (pg)	27.3	3.5	28.07	1.83
MCHC (gm/dl)	34.7	5	32.53	1.23

In the adolescent study done by Gligoroska JP et al.(2019)1, there were 240 boys and 80 girls. The mean values of RBC, Hb, PCV ,MCV, MCH, MCHC were higher in boys compared to girls. In their study, the values of boys vs girls were : of RBC (5.02 million /cu mm vs 4.72 million /cu mm), value of Hb (14.08 g/dl vs 13.15 g/dl) Hematocrit (43.37% v 40.69%) , MCV and MCH insignificantly higher in the boys compared to girls. Our findings were comparable to this study.

Table-13: Mean values of haematological parameters in adolescent girls (10-19 yrs)

Variable	Girls in our study (155/250)		Girls (Gligoroska JP, et al (2019)[1]	
	Mean	SD	Mean	SD
RBC (millions/cu mm)	4.2	0.7	4.72	0.41
Hb (gm/dl	11	2.1	13.15	1.19
PCV (%)	34	6.6	40.69	3.33
MCV (fl)	80	11	85.40	9.87
MCH (pg)	27	3	27.90	2.84
MCHC (gm/dl)	34.7	5	31.51	4.37

Above table numbers, 12 and 13, show comparison of our adolescent girls and boys vs the other study conducted

in Macedonia (a country in South-east Europe). All the comparative variables were lower in our Indian study compared to these Macedonian adolescents.

Table-14: Comparison: Mean values of hematological parameters in adolescent anemic girls

Characteristic variable	Anemic Girls in study by Goyal P, et al at Karad (2016)7 (Mean ± SD)	Anemic Girls in our study (n=85/155) (Mean ± SD)
MCV (fl)	65.7 ± 11.46	77.80 ± 10.6
MCH (pg)	21.1 ± 3.68	26.25 ± 1.0
MCHC (g/dl)	25.4 ± 4.43	33.38 ± 1.7
Platelet count (lakhs/cu mm)	5,05,360 ± 881	4,23,600 ± 840

Table no.14 shows that Mean values of our study in adolescent anemic girls was slightly better than the variables studied in Karad based study by Goyal P, et al (2016)[7].

In the present study, 85 out of 155 cases were girls. 54.84% were found to be anemic (Hb <12 g/dl), of which 51 (32.9%) had mild anemia (Hb 10.1-12 gm/dl) ,19 (12%) had moderate anemia (Hb 7-10 gm/dl) , 15 (9.9%) had severe anemia (Hb <7 gm/dl).

In the study done by Goyal P et al (2016)7, there were out of 314 subjects. 142 (45.2%) were found to be anemic, of which 57 (40.14%) had mild anemia, 78 (54.92%) had moderate anemia and 7 (4.92%) had severe anemia.

CONCLUSION

This study concludes that 54.84% of the adolescent girls in Konkan based tertiary care centre in Maharashtra are suffering from anemia. Among many factors, low socio-economic status, vegetarian diet, history of deworming, presence of menstruation, irregular menstruation, heavy amount of bleeding during menstruation, more than 5 days of menstruation and underweight girls are significantly associated with the presence of anemia. Thus nutritional deficiency anaemia was more prevalent in adolescent girls in this region.

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