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RESEARCH ARTICLE

SOCIO-DEMOGRAPHIC DETERMINANTS ASSOCIATED WITH IRON DEFICIENCY ANEMIA IN MENSTRUATING ADOLESCENTS IN RURAL POPULATION.

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Abstract

Background: The objective of the study was to study the correlates of anaemia like Body Mass Index, number of bleeding days and menstrual pattern of anaemic menstruating adolescent girls.

Methods: Out of the total 624 adolescent girls, 588 menstruating adolescent girls studying in selected eight schools of Handignur PHC were included in the study. At baseline, structured questionnaire was administered to collect the socio-demographic information, knowledge and practice regarding anaemia and its prevention. Measurement of height and weight was done.

Results: Prevalence of anaemia in menstruating adolescent girls was 94.6% (95% CI 92.83 to 96.37)

Conclusions: Majority of the girls are consuming diet deficient in iron. In order to prevent the complications of anaemia during pregnancy and child birth and also the maternal deaths, all the adolescent girls' anaemia needs to be corrected before they get married.

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Introduction:-

One of the most common global public health problem is anaemia, affecting both developing and developed countries with major impact on human health as well as social and economic development¹. Intake of low iron in the diet throughout infancy and childhood results in high prevalence of anaemia in childhood^{2, 3}. For girls anaemia begins in childhood, worsens during adolescence and gets aggravated during pregnancy. With the onset of menstruation and associated blood loss, there is further increase in prevalence and severity of anaemia in adolescent girls². Adolescent girls are particularly more prone to get affected by anaemia because after first year of life they are growing faster than the growth at any time of life. Early marriage and adolescent pregnancy aggravate anaemia and result in poor iron stores in the offspring². In South Asia, anaemia contributes to about 80 percent of the maternal deaths⁴. Thus, there is a vicious cycle of anaemia from generation to generation.

Methods:-

A prospective study was carried out at amongst the menstruating adolescent girls of government schools situated in Handignur Primary Health Centre area. Adolescent girls who were studying in selected schools of higher primary and high schools of Handignur PHC and consented to participate in the study, attained menarche, in the age group of 12-16 years and having Hb less than 12gm/dl were included in the study. Written informed consent was obtained

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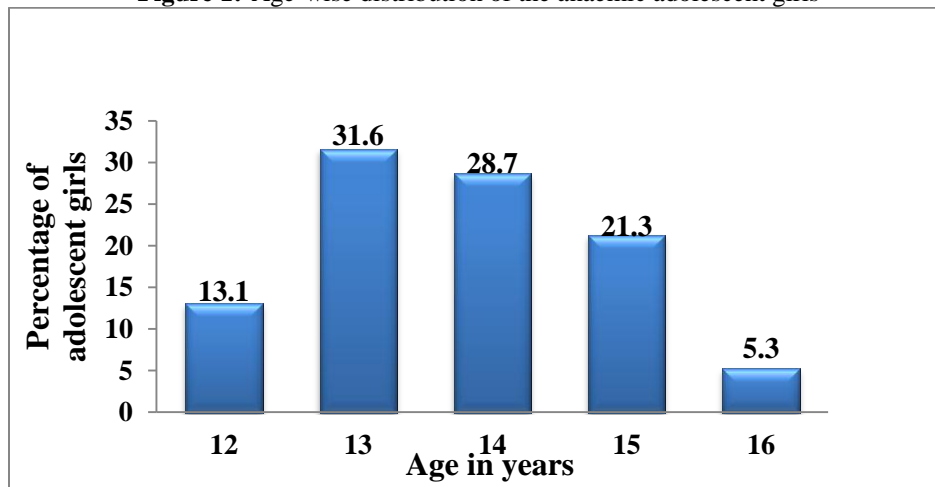
from parents and assent from menstruating adolescent girls. Adolescent girls were evaluated for various socio-economic and demographic determinants as a cause of IDA.

Data collection instrument was developed to collect information regarding age, educational status of parents of adolescent girls, type of diet and family, religion, height and weight. CE certified digital adult weighing machine with the accuracy of 100gms was used to record the weight of adolescent girls. A static height scale marked on the wall was used to measure height of the adolescent girls after standardization. To detect type of anaemia at baseline, Standard method of two glass slides was used. Haemoglobin was estimated by cyanmethaemoglobin method at baseline. Data was analyzed by SPSS 16.0 version. The results were expressed as mean \pm standard deviation. P value <0.5 was taken as statistically significant.

Results:-

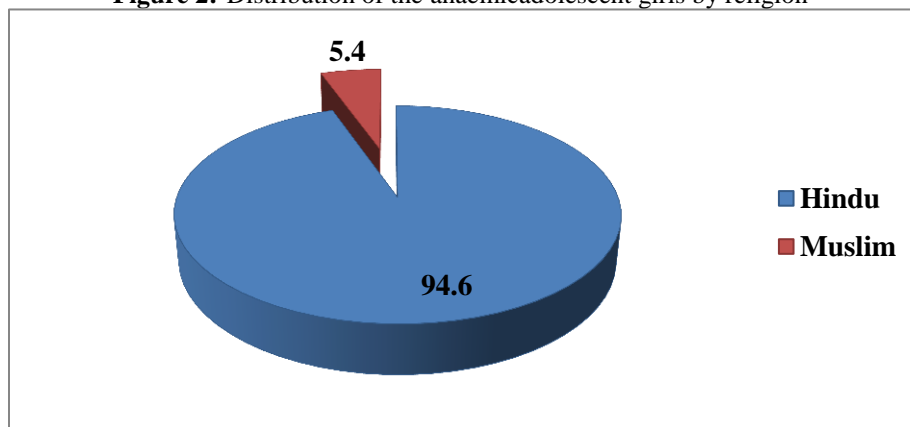
Age: Out of 588 adolescent girls, 186(31.6%) were 13 years old, followed by 169(28.7%) 14 years, 125(21.3%) 15 years and 77(13.1%) 12 years. Only 31(5.3%) were 16 years old.

Figure 1:-Age-wise distribution of the anaemic adolescent girls



Religion:-Majority 556 (94.6%) were Hindus and only 32(5.4%) were Muslims.

Figure 2:-Distribution of the anaemic adolescent girls by religion



Educational status:-

222(37.8%) of mothers of adolescent girls had primary education, 186(31.6%) were illiterate, 120(20.4%) had secondary education and 60(10.2%) had higher secondary education. One hundred and ninety eight (33.7%) of fathers of adolescent girls had secondary education, 190(32.3%) had primary education, 160(27.2%) had higher secondary education, 38(6.5%) were illiterate and only 2(0.3%) were graduates.

Figure 3:-Educational status of mothers of anaemic adolescent girls

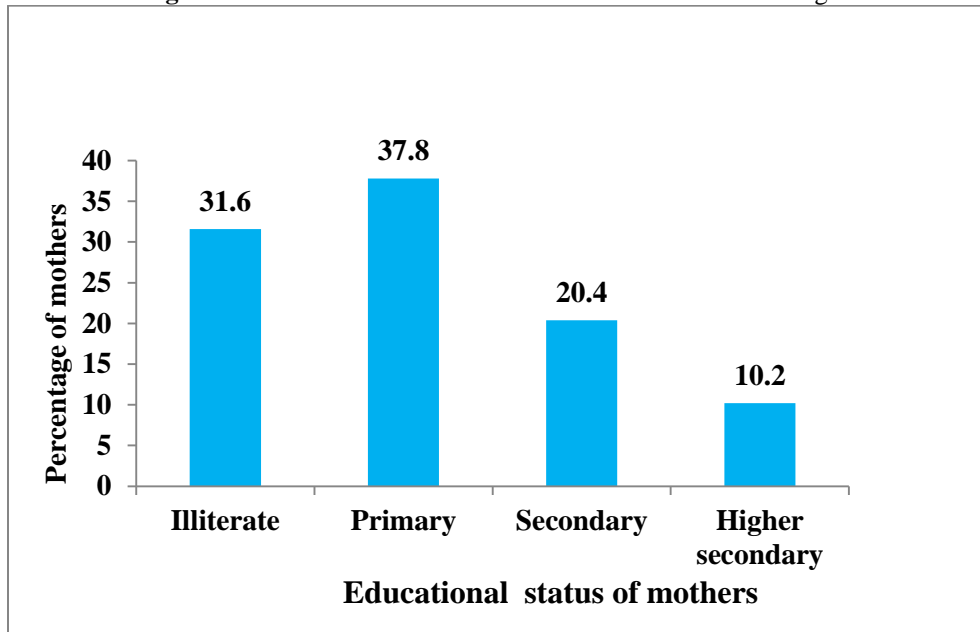
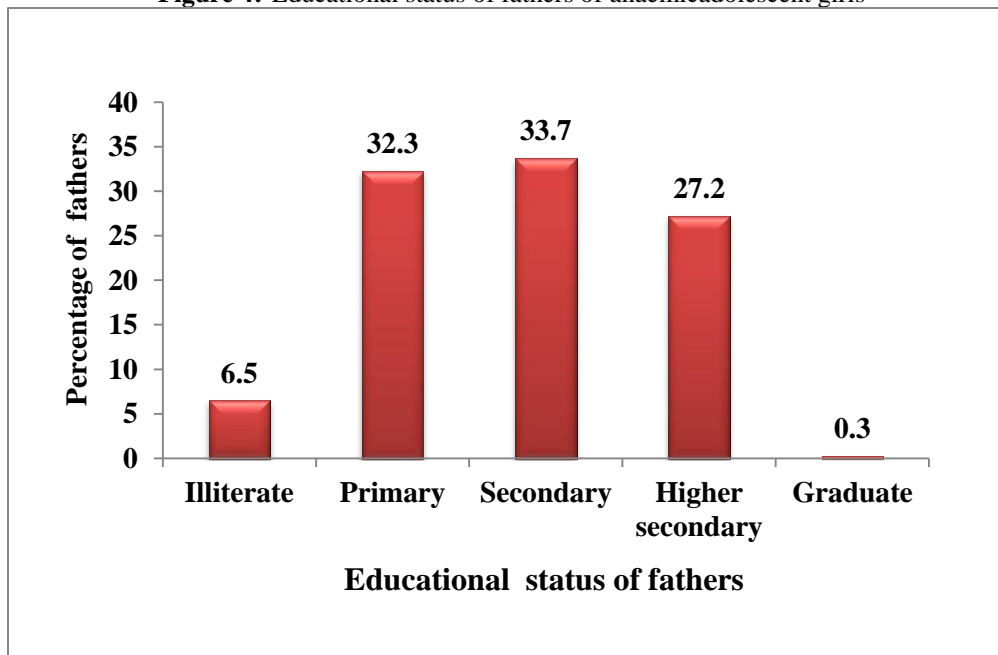


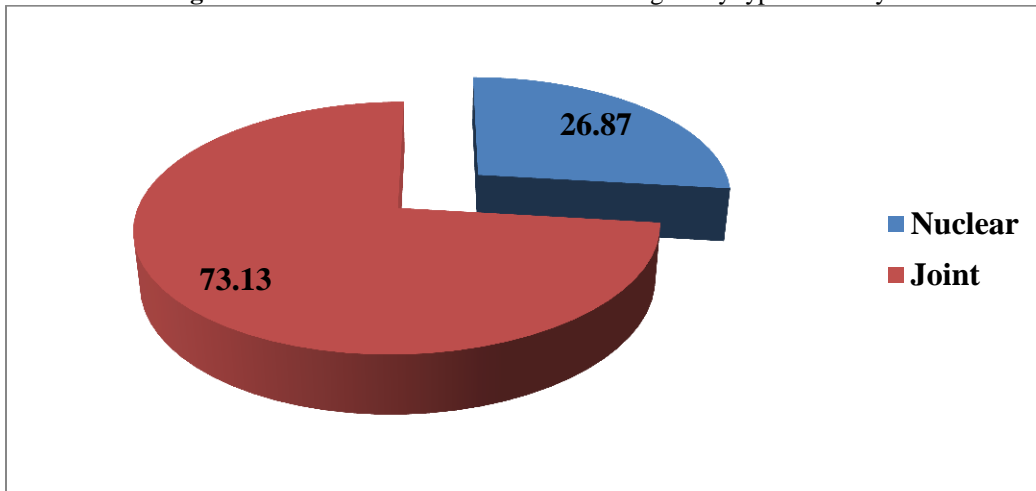
Figure 4:-Educational status of fathers of anaemic adolescent girls



Type of family:-

Majority 430 (73.13%) of adolescent girls were from joint family and 158 (26.87%) were from nuclear family.

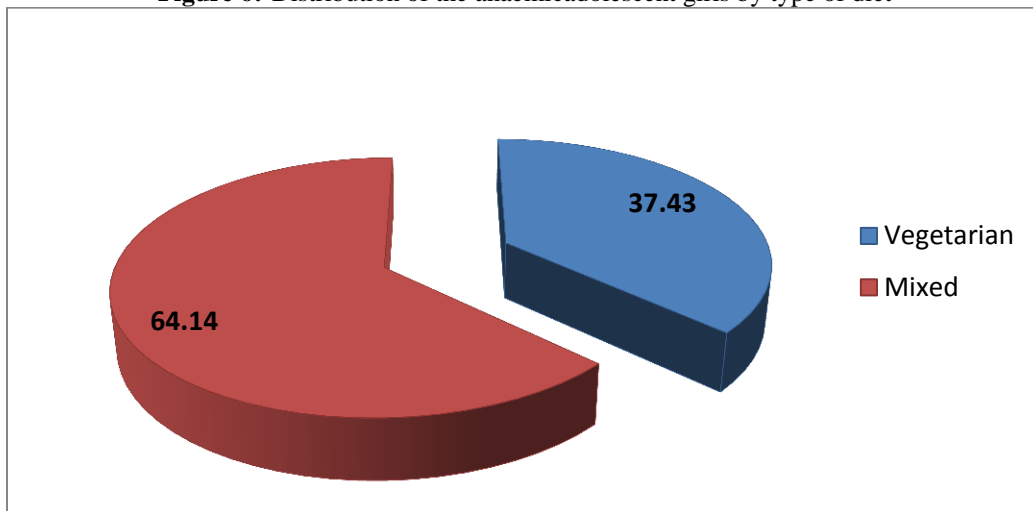
Figure 5:-Distribution of anaemic adolescent girls by type of family



Type of diet:-

Maximum 365(64.14%) of adolescent girls were consuming mixed diet whereas 213(37.43%) were following vegetarian type of diet.

Figure 6:-Distribution of the anaemic adolescent girls by type of diet



Anthropometric measurements and Body Mass Index:-

Figure 7: Age and mean height of the anaemic adolescent girls:-

Height by age of adolescent girls depicts that there was consistent increase in the height of adolescent girls from 12 to 16 years of age; however the maximum increase in height was from 13-16 years. The mean height of 16 years girls was 1.52 m whereas it was 1.30 m for 12 years old girl. Both the table and graph shows the 95% confidence interval at each age.

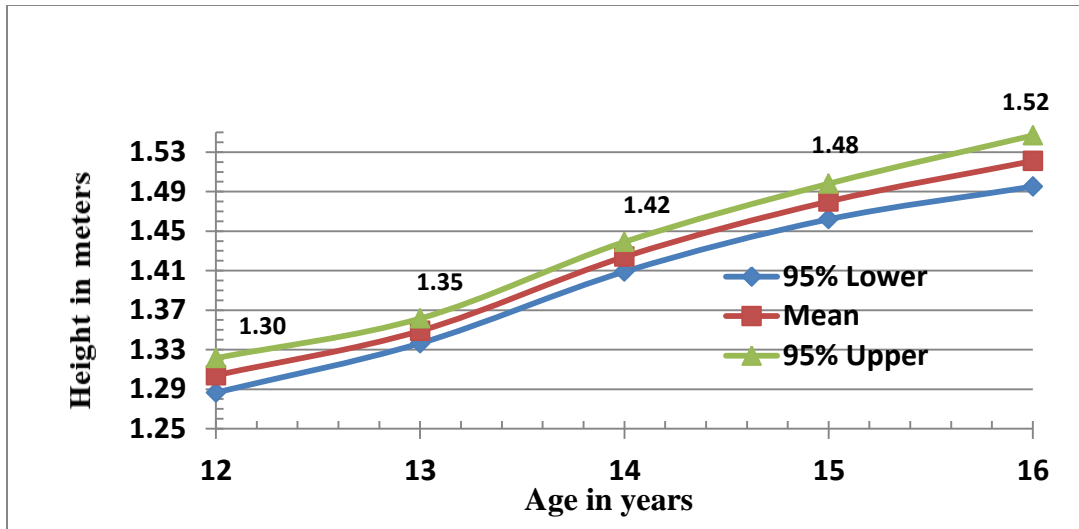


Figure 8:-Mean weightof theanaemicadolescent girls by age

Mean weight of the adolescent girls at different age groups reveals that, maximum weight gain has been between the age group of 13-14 years, mean weight of the girls at 14 years was 40.48 kg whereas mean weight of the girls at 13 years was 32.78kg. Mean weight gain from 13-14 years was 7.7 kg. There has been gradual increase in the mean weight from 13-16 years.

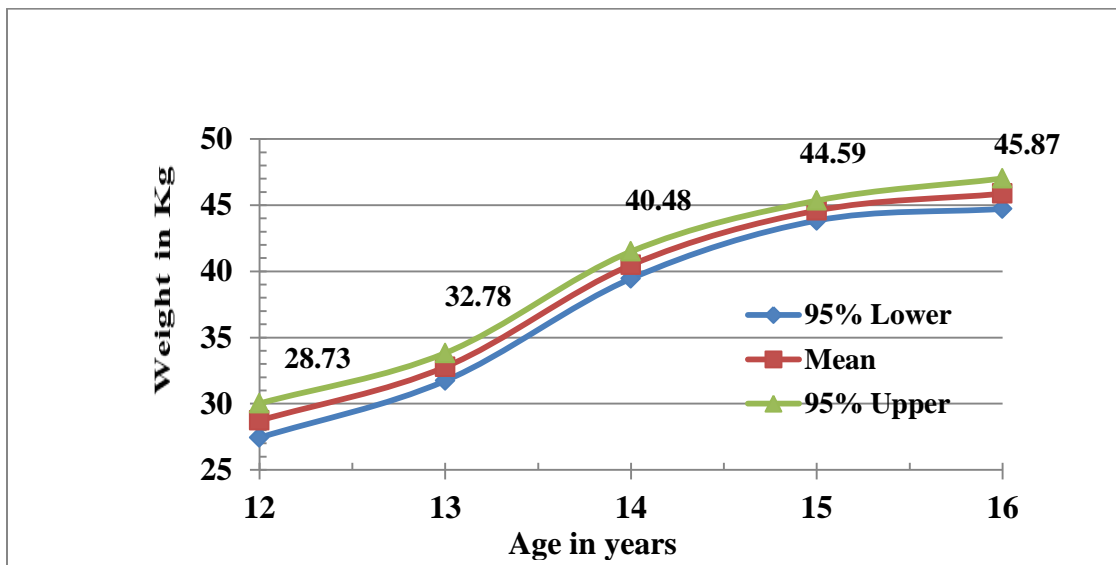


Figure 9:-MeanBody Mass Indexoftheanaemicadolescent girls by age

Mean BMI of the adolescent girls of 12 and 13 years was below normal (<18) whereas for the girls of 14, 15 and 16 years was within the normal range (18- 24.99). Maximum increase in Mean BMI was from 13 to 14 years. Thirty one girls of 16 years of age group had the mean BMI 19.92 which was slightly less than that of 15 years.

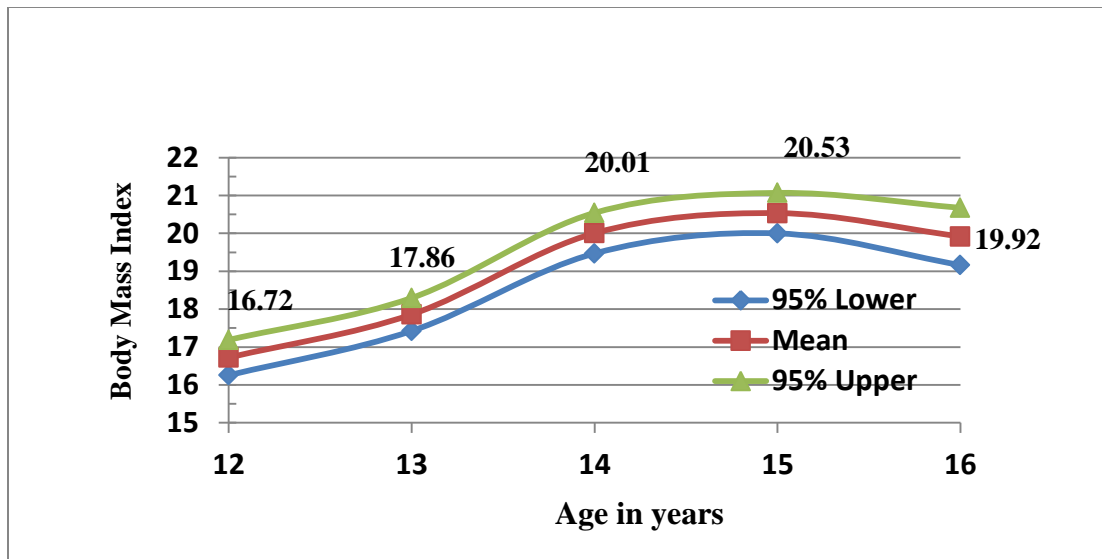


Table 1:-Comparison of mean height and Body Mass Index of adolescent girls with WHO standards⁵

Age in years	Number	Mean height		Mean BMI	
		Mean	WHO Standard	Mean	WHO Standard
12	77	130	151.2	16.72	18.0
13	186	135	156.4	17.86	18.8
14	169	142	159.8	20.01	19.6
15	125	148	161.7	20.53	20.2
16	31	152	162.5	19.92	20.7

There is an increase in the mean height of adolescent girls as the age advanced minimum being 130cms for 12 years and maximum 152cms for 16 years. When these figures were compared with WHO child growth standards, our subjects were much more stunted in height at all the age groups. In comparison with WHO child growth standard our subjects mean BMI was slightly less for 12 and 13 years but almost same for 14, 15 and 16 years.

Table 2:-Distribution of anaemic adolescent girls based on severity of anaemia (WHO classification)

Sr. no	Severity of anaemia	Hb gm/dl	Number	Percentage
1	Mild	11-11.9	59	10.03
2	Moderate	8-10.9	458	77.89
3	Severe	<8	71	12.07
Total			588	100

In this study, maximum number of adolescent girls 458(77.89%) had moderate anaemia, followed by 71(12.07%) severe and 59(10.03%) had mild degree of anaemia.

Table 3:-Distribution of anaemic adolescent girls based on peripheral smear

Sr.no	Type of anaemia and red cell morphology	Number	Percentage
1	Normocytic normochromic	483	82.14
2	Normocytic hypochromic	39	6.63
3	Microcytic hypochromic	59	10.03
4	Dimorphic	7	1.19
Total		588	100

Out of the total 588 adolescent girls studied, majority 483 (82.14%) had normocytic normochromic anaemia, followed by 59(10.03%) microcytic hypochromic, 39(6.63%) normocytic hypochromic and 7 (1.19%) had dimorphic type of anaemia.

Table 4:-Distribution of adolescent girls by number of bleeding days and severity of anaemia

Hb levels (gm/dl)	No. of bleeding days of adolescent girls						Total	
	<3		3-4		5+			
	No.	%	No.	%	No.	%	No.	%
Severe(<8)	9	12.7	56	78.9	6	8.5	71	12
Moderate(8-10.9)	66	14.4	369	80.6	23	5	458	77.8
Mild(11-11.9)	17	28.8	41	69.5	1	1.7	59	10
Total	92	15.6	466	79.3	30	5.1	588	100

$\chi^2=11.10;df=4;p<0.03$

Maximum number of girls 56 (78.9%) with Hb <8 gm/dl and 369 (80.6%) with Hb 8-10.9 gm/dl were having 3-4 days of bleeding. Proportion of girls having <3 days bleeding was highest in mild anaemic girls whose Hb was between 11-11.9 gm/dl. The difference observed was statistically significant. More number of girls with severe and moderate degree of anaemia were bleeding for 3-4 days and more than 5 days compared to those with mild anaemia where the proportion of girls bleeding for less than three days was highest.

Table 5:-Number of bleeding days by age of anaemic adolescent girls

Age in yrs.	No. of bleeding days of adolescent girls						Total	
	<3		3-4		5+			
	No.	%	No.	%	No.	%	No.	%
12	12	15.6	62	80.5	3	3.9	77	100
13	27	14.5	152	81.7	7	3.8	186	100
14	31	18.3	129	76.3	9	5.3	169	100
15	17	13.6	100	80	8	6.4	125	100
16	5	16.1	23	74.2	3	9.7	31	100
Total	92	15.6	466	79.3	30	5.1	588	100

$\chi^2=4.30;df=8;p<0.83$

A total of 466(79.3%) of the adolescent girls were bleeding for 3-4 days. Majority of the girls in each age group had 3-4 days bleeding. Although proportion of girls with less than 3 days bleeding was similar at all the ages, it was highest i.e. 31 (18.3%) for the age of 14 years, lowest being 27(14.5%) for the girls at the age of 13 years. The difference observed was statistically not significant.

Table 6:-Number of bleeding days by Body Mass Index of anaemic adolescent girls

BMI	No. of bleeding days of adolescent girls						Total	
	<3		3-4		5+			
	No.	%	No.	%	No.	%	No.	%
<18.5	38	14.4	212	80.3	14	5.3	264	100
18.5- 24.99	49	17.0	226	78.2	14	4.8	289	100
25+	5	14.3	28	80	2	5.7	35	100
Total	92	15.6	466	79.3	30	5.1	588	100

$\chi^2=0.79;df=4;p<0.94$

Majority of the adolescent girls 466(79.3%) were bleeding for 3-4 days irrespective of their BMI. Proportion of girls bleeding for <3 days has been 38(14.4%), 49(17.0%) and 5(14.3%) in the groups of BMI <18.5, 18.5- 24.99, 25+ respectively. The difference observed was statistically not significant.

Table 7:-Menstrual pattern by age of anaemic adolescent girls

Age in yrs.	Menstrual pattern of adolescent girls								Total	
	Heavy and regular		Heavy and irregular		Normal		Scanty			
	No.	%	No.	%	No.	%	No.	%	No.	%
12	59	76.6	14	18.2	2	2.6	2	2.6	77	100
13	134	72	52	28.0	0	0	0	0	186	100

14	118	69.8	38	22.5	10	5.9	3	1.8	169	100
15	94	75.2	23	18.4	8	6.4	0	0	125	100
16	22	71	7	22.6	2	6.5	0	0	31	100
Total	427	72.6	134	22.8	22	3.7	5	0.9	588	100

$\chi^2=24.16;df=12;p<0.05$

Note: Chi square test has been computed after excluding five cases of scanty menstruation

Out of total 588 adolescent girls, 427(72.6%) were having heavy and regular bleeding whereas 134(22.8%) were having heavy and irregular bleeding. Thus majority of the girls 561(95.4%) had heavy and regular or irregular bleeding. Only 22 girls (3.7%) had normal bleeding. In all the age groups more than 70% had heavy and regular bleeding. Proportion of girls having heavy and irregular bleeding has been highest i.e. 52(28.0%) at the age of 13 years, followed by 38(22.5%) at the age of 14 years. Least being 14(18.2%) at the age of 12 years. Comparatively proportion of girls with normal bleeding was slightly higher after the age of 14 years i.e. 10 (5.9%), 8(6.4%), 2(6.5%) for 14, 15, and 16 years adolescent girls respectively. None of the girls of 13 years had normal bleeding. The difference observed was statistically significant.

Table 8:-Distribution of adolescent girls by menstrual pattern and Body Mass Index

BMI	Menstrual pattern of adolescent girls								Total	
	Heavy and regular		Heavy and irregular		Normal		Scanty			
	No.	%	No.	%	No.	%	No.	%	No.	%
<18.5	190	72.0	65	24.6	6	2.3	3	1.1	264	100
18.5- 24.9	213	73.7	60	20.8	14	4.8	2	0.7	289	100
25+	24	68.6	9	25.7	2	5.7	0	0	35	100
Total	427	72.6	134	22.8	22	3.7	5	0.9	588	100

$\chi^2=4.001;df=4;p>0.59$

Note: Chi square test has been computed after excluding five cases of scanty menstruation

In the present study, amongst 264 adolescent girls who were underweight, majority 190(72.0%) had heavy and regular bleeding. Similarly maximum number of adolescent girls with BMI 18.5 to 24.9 and above 25 had heavy and regular bleeding. Sixty five (24.6%) of the girls with BMI less than 18.5 had heavy and irregular bleeding. The difference observed in these three categories of BMI was statistically not significant.

Table 9:-Distribution of adolescent girls based on menstrual pattern and severity of anaemia

Severity of anaemia (Hb levels (gm/dl))	Menstrual pattern of adolescent girls								Total	
	Heavy and regular		Heavy and irregular		Normal		Scanty			
	No.	%	No.	%	No.	%	No.	%	No.	%
Severe (<8)	46	64.8	20	28.2	3	4.2	2	2.8	71	100
Moderate (8-10.9)	338	73.8	102	22.3	16	3.5	2	0.4	458	100
Mild (11-11.9)	43	72.9	12	20.3	3	5.1	1	1.7	59	100
Total	427	72.6	134	22.8	22	3.7	5	0.9	588	100

$\chi^2=2.20;df=4;p>0.34$

Note: Chi square test has been computed after excluding five cases of scanty menstruation

Out of 71 adolescent girls with Hb <8 gm/dl, 46(64.8%) had heavy regular bleeding, 20(28.2%) had heavy irregular bleeding and 3(4.2%) had normal bleeding. Amongst 458 adolescent girls with Hb 8-10.9 gm/dl, 338(73.8%) had heavy and regular, 102(22.3%) had heavy and irregular, 16(3.5%) had normal bleeding. Amongst 59(10%) of adolescent girls with Hb 11-11.9 gm/dl, 43(72.95%) had heavy regular, 12 (20.3%) heavy irregular and 3(5.1%) had normal bleeding. Proportion of girls with heavy and irregular bleeding was more in severe anaemic girls when compared with mild and moderately anaemic adolescent girls. Comparatively less number of adolescent girls who

were severely anaemic had heavy and regular bleeding. The difference observed between the groups was statistically not significant.

Discussion:-

Although there was an increase in the number of girls as the age advanced, definite pattern was not observed. Out of the total 588 adolescent girls, slightly less than one third girls were of 13 years, the least being at the age of 16 years. This could be perhaps due to the fact that in rural areas the parents do not encourage their daughters to go for higher education after seventh standard. The majority 556(94.6%) of adolescent girls were Hindus. Slightly less than 70% mothers and 93.5% fathers of adolescent girls were literate. When compared with Government of Karnataka figures, the female literacy is similar whereas literacy rates for males has been much higher in our study (Karnataka figure 82.47%)⁶. As against this the literacy rates for females and males at the national level have been lower i.e.59.4% and 82% respectively⁷. Slightly less than three fourths of the adolescent girls belonged to joint family.

Our study revealed that slightly less than two thirds of the girls were consuming mixed diet. As against this other Indian studies revealed that the girls consuming vegetarian diet and having nutritional inadequacy are more likely to be anaemic^{8,9}. Another Indian study has shown that prevalence of anaemia was less in vegetarians consuming green leafy vegetables¹⁰. This could be because in our study the adolescent girls consuming non vegetarian diet have not been regular in taking non vegetarian food in adequate quantity.

Because of the gender bias, the adolescent girls always get the last chance to eat non vegetarian food in the family. Although the mean height of our adolescent girls has increased with increase in age, it has been less when compared with WHO standards. When the mean increase in height was compared with WHO child growth standards, our girls were much more stunted in height at all the ages, the difference being in the range of 10-25cms indicating that all our adolescent girls are malnourished. As against this, the study conducted in Karad, Maharashtra revealed that the mean height of the adolescent girls was higher at 13 and 14yrs and was almost equal to NCHS values¹¹. Although there was gradual increase in mean weight from 12 to 16 years, the increase has been comparatively less between the ages of 15 to 16 years. Several studies conducted at West Bengal and Tamilnadu have also observed the similar results^{8,12}.

In our study, mean BMI for the 12 and 13 years has been less than 18(underweight) whereas the mean BMI of the girls at 14, 15 and 16 years have been within normal range (18.5-24.9). In the nationwide study conducted in the year 2011, mean BMI was higher than the present study and their values were even higher when compared with the WHO reference^{13,14}. When these figures are compared with WHO child growth standard our subjects mean BMI was slightly less for 12 and 13 years but almost same for 14, 15 and 16 years¹⁵.

Prevalence of anaemia in adolescent girls:-

Out of the total 624 adolescent girls of eight Handignur schools, 588(94.6%) adolescent girls were anaemic. Several studies conducted in India have also shown more than 90% of prevalence in adolescent menstruating school girls^{16,17,18}. However in some studies, the prevalence has been as low as 10% to 40%^{19,20,21,22,23,24}.

In our study, maximum number of adolescent girls 458(77.89%) had moderate anaemia, followed by 71(12.07%) severe and 59(10.03%) mild anaemia (Table 4). As against this, more than 50% of the girls in rural area of Raigad district, Maharashtra had mild anaemia and none of the subjects were severely anaemic²⁵. In developing countries like Pakistan and India, prevalence of severe anaemia varied in different studies 22% in Hyderabad (Pakistan) and 2.1% in rural Tamilnadu (India)^{26,27}. Comparatively high proportion of girls with moderate and severe anaemia in our study could be because of heavy bleeding coupled with intake of diet poor in iron and unhealthy practices. Many of these adolescent girls with moderate anaemia are likely to become severely anaemic. Unless these girls are treated with iron supplementation chances of them having maternal complications like preterm delivery and low birth weight babies are high if these girls get married and become pregnant^{28,29}.

More than 80% of the girls in our study had normocytic normochromic anaemia, followed by 59(10.03%) microcytic hypochromic, 39(6.63%) normocytic hypochromic and 7(1.19%) dimorphic anaemia. (Table 3). In our girls it is mainly the nutritional deficiency that has led to anaemia. Whereas in a study conducted in rural area of Maharashtra, the pattern of peripheral smear was different where more than 50% of the girls had normocytic normochromic and 13.11% had dimorphic anaemia²⁵.

Conclusion:-

In India iron deficiency anaemia is most common in the adolescent menstruating girls. In our study majority of the girls are moderately anaemic. Unhealthy practices like open air defecation and barefoot walking are highly prevalent. Majority of the girls are consuming diet deficient in iron. In order to prevent the complications of anaemia during pregnancy and child birth and also the maternal deaths, all the adolescent girls' anaemia needs to be corrected before they get married.

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Declarations:-

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Ethical approval: KLE University

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