



A COMPARISON OF SELECTED ANTHROPOMETRIC PARAMETERS AND VITAL SIGNS IN ADOLESCENT GIRLS WITH REFERENCE TO HEMOGLOBIN STATUS

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ABSTRACT

Anemia is common in young girls of urban population due to unhealthy food habits and inadequate physical activity. According to WHO 'anemia is the decreased ability of the red blood cells to provide adequate oxygen to body tissues. Poor health or risky behaviors during adolescence can have negative impacts on health in adult life. Adolescent nutrition is therefore important for supporting the physical growth of the body and for preventing future health problems. To assess influence of varying Hb status on selected anthropometric parameters and vital signs of adolescent girls in Gwalior city this study was conducted on 222 adolescent girls in the age group of 17-19 years. Adolescent girls were divided in three categories based on the Hb status estimated by Sahli's method. Group I, II and III represented adolescents with normal Hb range, adolescents with mild anemia and moderate anemia respectively. Anemia was detected by ICMR classification. Selected anthropometric and vital parameters were recorded and compared employing SPSS version 2020. Comparison of mean percent difference of anthropometric and vital parameters in adolescents with normal Hb range and adolescents in moderate category of anemia indicated a considerable change in Weight, BMI, W/H ratio, MUAC, Hb, Systolic BP, Pulse and SpO₂ which was statistically insignificant. There was a statistically significant difference between (W/H Ratio, Systolic BP and RR) among the different Hb level groups as demonstrated by one-way ANOVA. Systolic BP of the normal group indicated statistically significant difference from the moderate group ($p=0.001$) and mild group ($p=0.009$) on employing Tukey post hoc test. Statistically significant Hb levels ($p<0.05$) perform differently for W/H ratio, Systolic blood pressure and RR.

KEYWORDS : Adolescents, Anemia, Hemoglobin, Nutritional status, Health

INTRODUCTION:

Adolescents aged 10–19 years constitute around one sixth of the world's population and account for 6% of the global burden of disease and injury, and suffer over 1.2 million deaths each year (1). Adolescence is a period of transition from childhood to adulthood, a time when many important social, cultural, economic and biological events take place which set the stage for adulthood. Adolescents (10–19 years of age) comprise almost 22% of India's population. (2)

Anaemia is the major public health problem among adolescent girls of age 10-19 years. The reason for high incidence of anaemia among the adolescent girls is increased requirement during growth spurt, menstrual loss, low intake of iron rich food and erratic eating habits.(3)

Anemia is a formidable public health problem among children and women worldwide, specially, among developing countries like India. According to WHO 'anemia is the decreased ability of the red blood cells to provide adequate oxygen to body tissues. It may be due to a decreased number of red blood cells, a decreased amount of a substance in red blood cells which transports oxygen (haemoglobin) or a decreased volume of red blood cells' (4). The purpose of study was to find out whether anthropometric parameters and vital signs of adolescent girls are influenced by hemoglobin status of adolescent girls in Gwalior city.

METHODOLOGY:-

The Present study was conducted on a sample of 222 Adolescent girls in the age group of 17-19 years. The sample was derived using purposive random sampling method from 4 Govt.Girls Colleges of Gwalior city representing there major areas of the city after obtaining Prior permission from Head of the Institution and parents of the adolescents. An interviewer-administered questionnaire was used to collect data. Adolescent girls were divided in three categories based on the Hb status estimated by Sahli's method. Each category was comprised of 75 adolescents. Group I, II and III represented adolescents with normal Hb range, adolescents with mild anemia and moderate anemia respectively (ICMR grading). A written consent of voluntary participation was obtained from each girl and parents were informed about the same.

Anthropometric Measurements like Weight, Height, BMI, W/H Ratio, and MUAC were recorded following standard protocol and instruments. Vital signs were like BP, RR, Pulse rate, SpO₂ were also observed and recorded using standard methods. To study whether anthropometric parameters and vital signs are influenced by hemoglobin status of adolescent girls the data was statistically analyzed.

RESULTS

Table: 1 Mean Difference(%) of Various Parameters of Adolescents having Normal Hb and Mild Anemia

Parameters	Normal Hb	Mild anemia	% difference
Weight	47.18	46.63	1.17
BMI	19.72	19.9	0.9
WHR	0.75	0.76	1.33
MUAC	23.78	23.35	1.82
Hb	11.71	10.28	13.01
Systolic BP	106.66	103.75	2.76
Diastolic BP	65.46	63.33	3.3
Pulse	85.69	87.18	0.86
RR	22.82	25.62	11.56
SpO ₂	98.18	97.95	0.11

Table:2 Mean Difference(%) of Various Parameters of Adolescents having Normal Hb and Moderate Anemia

Parameters	Normal Hb	Moderate anemia	% difference
Weight	47.18	44.04	6.88
BMI	19.72	18.67	5.47
W/H Ratio	0.75	0.73	2.7
MUAC	23.78	22.59	5.13
Hb	11.71	8.82	14.07
Systolic BP	106.66	103.28	3.21
Diastolic BP	65.46	63.33	3.3
Pulse	85.69	88.04	2.76
RR	22.82	25.25	10.11
SpO ₂	98.18	97.65	0.54

Table :3

Descriptive Table								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		

Age	Normal	75	18.11	.709	.082	17.94	18.27	17	19
	Moderate	75	18.36	.710	.082	18.20	18.52	17	19
	Mild	72	18.36	.793	.093	18.17	18.55	17	20
	Total	222	18.27	.744	.050	18.18	18.37	17	20
Weight	Normal	75	47.19	7.539	.870	45.45	48.92	33	65
	Moderate	75	44.60	7.958	.919	42.77	46.43	23	65
	Mild	72	46.64	8.730	1.029	44.59	48.69	33	82
	Total	222	46.14	8.122	.545	45.06	47.21	23	82
BMI	Normal	75	19.7291	2.55438	.29495	19.1414	20.3168	14.63	27.92
	Moderate	75	18.8921	2.64282	.30517	18.2841	19.5002	15.15	25.39
	Mild	72	19.9038	3.41825	.40285	19.1005	20.7070	13.92	33.33
	Total	222	19.5030	2.91095	.19537	19.1179	19.8880	13.92	33.33
Waist in cm	Normal	75	67.83	8.093	.934	65.96	69.69	54	91
	Moderate	75	65.97	7.489	.865	64.25	67.70	54	98
	Mild	72	68.69	7.619	.898	66.90	70.48	58	94
	Total	222	67.48	7.788	.523	66.45	68.51	54	98
Hips in cm	Normal	75	89.64	5.862	.677	88.29	90.99	79	105
	Moderate	75	88.56	6.340	.732	87.10	90.02	78	108
	Mild	72	89.81	7.449	.878	88.06	91.56	74	112
	Total	222	89.33	6.565	.441	88.46	90.20	74	112
WHR	Normal	75	.7517	.06976	.00805	.7357	.7678	.65	.95
	Moderate	75	.7348	.04455	.00514	.7245	.7451	.65	.86
	Mild	72	.7615	.05341	.00629	.7490	.7741	.66	.99
	Total	222	.7492	.05773	.00387	.7416	.7568	.65	.99
MUAC	Normal	75	23.79	2.361	.273	23.24	24.33	18	30
	Moderate	75	22.83	2.440	.282	22.27	23.39	17	28
	Mild	72	23.36	2.840	.335	22.69	24.03	18	32
	Total	222	23.32	2.571	.173	22.98	23.66	17	32
Hb	Normal	75	11.7133	.44610	.05151	11.6107	11.8160	11.00	12.40
	Moderate	75	8.8027	.74941	.08653	8.6302	8.9751	7.00	9.80
	Mild	72	10.2889	.31825	.03751	10.2141	10.3637	9.80	10.80
	Total	222	10.2680	1.31339	.08815	10.0943	10.4417	7.00	12.40
Systolic	Normal	75	106.67	6.224	.719	105.23	108.10	90	120
	Moderate	75	103.20	5.492	.634	101.94	104.46	90	120
	Mild	72	103.75	6.152	.725	102.30	105.20	90	120
	Total	222	104.55	6.130	.411	103.74	105.36	90	120
Diastolic	Normal	75	65.47	7.031	.812	63.85	67.08	50	80
	Moderate	75	63.33	8.275	.955	61.43	65.24	40	80
	Mild	72	63.33	8.049	.949	61.44	65.22	40	90
	Total	222	64.05	7.831	.526	63.02	65.09	40	90
Pulse	Normal	75	85.69	15.427	1.781	82.14	89.24	60	116
	Moderate	75	88.04	16.905	1.952	84.15	91.93	60	140
	Mild	72	87.18	15.797	1.862	83.47	90.89	55	131
	Total	222	86.97	16.016	1.075	84.85	89.09	55	140
RR	Normal	75	22.83	4.485	.518	21.79	23.86	2	33
	Moderate	75	25.25	5.089	.588	24.08	26.42	14	37
	Mild	72	25.63	9.992	1.178	23.28	27.97	12	98
	Total	222	24.55	7.003	.470	23.63	25.48	2	98
SpO2	Normal	75	98.19	1.193	.138	97.91	98.46	92	99
	Moderate	75	97.65	3.331	.385	96.89	98.42	73	99
	Mild	72	97.96	1.996	.235	97.49	98.43	85	99
	Total	222	97.93	2.350	.158	97.62	98.24	73	99

This descriptive table shows that standard error of the Age, WHR and Hb is approximately 0 which indicates that if we are taking other random sampling even than this mean value repeated.

Table: 4

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Age	Between Groups	3.201	2	1.600	2.944	.055
	Within Groups	119.038	219	.544		
	Total	122.239	221			
Weight	Between Groups	277.948	2	138.974	2.128	.122
	Within Groups	14301.998	219	65.306		
	Total	14579.946	221			
BMI	Between Groups	43.383	2	21.692	2.597	.077
	Within Groups	1829.291	219	8.353		
	Total	1872.674	221			
Waist in cm	Between Groups	285.457	2	142.728	2.383	.095
	Within Groups	13117.971	219	59.899		
	Total	13403.428	221			

Hips in cm	Between Groups	67.958	2	33.979	.787	.457
	Within Groups	9457.038	219	43.183		
	Total	9524.995	221			
WHR	Between Groups	.027	2	.013	4.163	.017
	Within Groups	.709	219	.003		
	Total	.736	221			
MUAC	Between Groups	34.704	2	17.352	2.665	.072
	Within Groups	1425.944	219	6.511		
	Total	1460.649	221			
Hb	Between Groups	317.746	2	158.873	548.120	.000
	Within Groups	63.477	219	.290		
	Total	381.223	221			
Systolic	Between Groups	518.788	2	259.394	7.296	.001
	Within Groups	7786.167	219	35.553		
	Total	8304.955	221			
Diastolic	Between Groups	226.018	2	113.009	1.857	.159
	Within Groups	13325.333	219	60.846		
	Total	13551.351	221			
Pulse	Between Groups	211.300	2	105.650	.410	.664
	Within Groups	56475.479	219	257.879		
	Total	56686.779	221			
RR	Between Groups	343.043	2	171.522	3.580	.030
	Within Groups	10493.808	219	47.917		
	Total	10836.851	221			
SpO2	Between Groups	10.738	2	5.369	.972	.380
	Within Groups	1209.248	219	5.522		
	Total	1219.986	221			

This table shows the output of the ANOVA analysis and reveals whether there is a statistically significant difference between means of anthropometric and vital parameters of mild, moderate and normal Hb group. The values 0.017, 0.001, 0.030, are below 0.05. Therefore, there is a statistically significant difference in the mean W/H Ratio, systolic blood pressure and RR between the different Hb levels taken. To find out which of the specific groups differed Tukey's post hoc test was administered.

Post hoc tests:

Multiple Comparisons							
Tukey HSD							
Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Age	Normal	moderate	-.253	.120	.091	-.54	.03
		mild	-.254	.122	.094	-.54	.03
	Moderate	Normal	.253	.120	.091	-.03	.54
		mild	-.001	.122	1.000	-.29	.29
	Mild	Normal	.254	.122	.094	-.03	.54
		moderate	.001	.122	1.000	-.29	.29
Weight	Normal	moderate	2.587	1.320	.125	-.53	5.70
		mild	.548	1.333	.911	-2.60	3.69
	Moderate	Normal	-2.587	1.320	.125	-5.70	.53
		mild	-2.039	1.333	.279	-5.19	1.11
	Mild	Normal	-.548	1.333	.911	-3.69	2.60
		moderate	2.039	1.333	.279	-1.11	5.19
BMI	Normal	moderate	.83693	.47196	.181	-.2768	1.9506
		mild	-.17468	.47685	.929	-1.2999	.9506
	Moderate	Normal	-.83693	.47196	.181	-1.9506	.2768
		mild	-1.01162	.47685	.088	-2.1369	.1136
	Mild	Normal	.17468	.47685	.929	-.9506	1.2999
		moderate	1.01162	.47685	.088	-.1136	2.1369
Waist in cm	Normal	moderate	1.853	1.264	.309	-1.13	4.84
		mild	-.868	1.277	.776	-3.88	2.15
	Moderate	Normal	-1.853	1.264	.309	-4.84	1.13
		mild	-2.721	1.277	.086	-5.73	.29
	Mild	Normal	.868	1.277	.776	-2.15	3.88
		moderate	2.721	1.277	.086	-.29	5.73
Hips in cm	Normal	moderate	1.080	1.073	.574	-1.45	3.61
		mild	-.166	1.084	.987	-2.72	2.39
	Moderate	Normal	-1.080	1.073	.574	-3.61	1.45
		mild	-1.246	1.084	.485	-3.80	1.31
	Mild	Normal	.166	1.084	.987	-2.39	2.72
		moderate	1.246	1.084	.485	-1.31	3.80
WHR	Normal	moderate	.01693	.00929	.165	-.0050	.0389
		mild	-.00979	.00939	.551	-.0320	.0124
	Moderate	Normal	-.01693	.00929	.165	-.0389	.0050
		mild	-.02673	.00939	.013	-.0489	-.0046
	Mild	Normal	.00979	.00939	.551	-.0124	.0320
		moderate					

		moderate	.02673*	.00939	.013	.0046	.0489	
MUAC	Normal	moderate	.960	.417	.057	-.02	1.94	
		mild	.426	.421	.571	-.57	1.42	
	Moderate	Normal	-.960	.417	.057	-1.94	.02	
		mild	-.534	.421	.414	-1.53	.46	
Mild	Normal	-.426	.421	.571	-1.42	.57		
	moderate	.534	.421	.414	-.46	1.53		
Hb	Normal	moderate	2.91067 [†]	.08792	.000	2.7032	3.1181	
		mild	1.42444 [†]	.08883	.000	1.2148	1.6341	
	Moderate	Normal	-2.91067 [†]	.08792	.000	-3.1181	-2.7032	
		mild	-1.48622 [†]	.08883	.000	-1.6958	-1.2766	
	Mild	Normal	-1.42444 [†]	.08883	.000	-1.6341	-1.2148	
		moderate	1.48622 [†]	.08883	.000	1.2766	1.6958	
	Systolic	Normal	moderate	3.467 [†]	.974	.001	1.17	5.76
			mild	2.917 [†]	.984	.009	.60	5.24
Moderate		Normal	-3.467 [†]	.974	.001	-5.76	-1.17	
		mild	-.550	.984	.842	-2.87	1.77	
Mild		Normal	-2.917 [†]	.984	.009	-5.24	-.60	
		moderate	.550	.984	.842	-1.77	2.87	
Diastolic		Normal	moderate	2.133	1.274	.217	-.87	5.14
			mild	2.133	1.287	.224	-.90	5.17
		Moderate	Normal	-2.133	1.274	.217	-5.14	.87
			mild	0.000	1.287	1.000	-3.04	3.04
		Mild	Normal	-2.133	1.287	.224	-5.17	.90
			moderate	0.000	1.287	1.000	-3.04	3.04
Pulse	Normal	moderate	-2.347	2.622	.644	-8.53	3.84	
		mild	-1.487	2.650	.841	-7.74	4.77	
	Moderate	Normal	2.347	2.622	.644	-3.84	8.53	
		mild	.859	2.650	.944	-5.39	7.11	
	Mild	Normal	1.487	2.650	.841	-4.77	7.74	
		moderate	-.859	2.650	.944	-7.11	5.39	
	RR	Normal	moderate	-2.427	1.130	.083	-5.09	.24
			mild	-2.798 [†]	1.142	.040	-5.49	-.10
Moderate		Normal	2.427	1.130	.083	-.24	5.09	
		mild	-.372	1.142	.943	-3.07	2.32	
Mild		Normal	2.798 [†]	1.142	.040	.10	5.49	
		moderate	.372	1.142	.943	-2.32	3.07	
SpO2	Normal	moderate	.533	.384	.348	-.37	1.44	
		mild	.228	.388	.826	-.69	1.14	
	Moderate	Normal	-.533	.384	.348	-1.44	.37	
		mild	-.305	.388	.712	-1.22	.61	
	Mild	Normal	-.228	.388	.826	-1.14	.69	
		moderate	.305	.388	.712	-.61	1.22	

*. The mean difference is significant at the 0.05 level.

There was a statistically significant difference between (W/H Ratio, Systolic blood pressure and RR) among the different Hb level groups as demonstrated by one-way ANOVA. Tukey post hoc test shows that the moderate group bears statistically significant difference in W/H Ratio from the mild group ($p = 0.013$). There is no statistically significant difference was noted between the normal and moderate groups ($p = .165$) and between the normal and mild groups ($p = .551$) respectively.

Tukey post hoc test shows that systolic blood pressure of the normal group significantly differed from the moderate group ($p=0.001$) and mild group ($p=0.009$) where as no statistically significance difference was seen between the moderate and mild group ($p=0.842$). In case of RR values of the different groups, Tukey post hoc test indicated that RR of normal group differed significantly from the mild group ($p=0.040$). There is no statistically significance difference between the moderate and normal group ($p=0.083$) and moderate and mild group ($p=0.943$).

DISCUSSION

Anaemia is seen all over the world but its prevalence is more in the developing countries. However, anaemias common in young girls of urban population due to unhealthy food habits and inadequate physical activity. The presents study was undertaken to find out to what extent selected anthropometric and vital parameters are influenced by Hb status.

Anthropometric and vital parameters of adolescent girls in the age group of 17-19 years with reference to the three categories Hb range viz. normal, mild grade of anaemia and moderate grade of anaemia were compared. Data analyses was done employing SPSS version

2020 for cross tabulation and computation. As evident from the results of the current study, mean BMI and MUAC in mild and moderate anaemia group was slightly less (Table 1) when compared to normal group and W/H ratio was lower by 2.7% in moderate group as compared to normal group. A statistically significant difference was noted in W/H Ratio between the moderate and mild group ($p = 0.013$). Our study indicates that none of the adolescents in the three Hb groups were in underweight category thus it is possible that Hb may not have a direct impact on BMI. The results of yet another study showed that BMI had no correlation with hemoglobin, (5)

Lower values for systolic and diastolic blood pressure were noted in mild and moderate anaemia group compared to normal group. Systolic blood pressure of the normal group indicated statistically significant difference from the moderate group ($p=0.001$) and mild group ($p=0.009$). An observational study supported our findings showing positive association between haemoglobin (Hb %) level with systolic blood pressure (SBP) and diastolic blood pressure (DBP) in students. (6)

Marginally higher values of vital parameters like RR and pulse rate was found in mild and moderate groups when compared to normal group followed by a slight difference in SpO2. RR of normal group differed significantly from the mild group ($p=0.040$). This indicates that Hb status may affect vital parameters like RR and pulse rate. It has been reported that decreased Hb content of RBC causes a decreased oxygen carrying capacity of blood, and there is inadequate pumping of the heart. Hence, the persons with anaemia have dyspnoea, palpitation, and angina-like symptoms on strenuous work (7).

CONCLUSION:

Statistically significant Hb levels ($p<0.05$) perform differently for

W/H ratio, Systolic blood pressure and RR. The differences between mean are statistically significant for W/H ratio, systolic and RR. It is realised that prevalence of anaemia in this population is of mild to moderate degree and there is no major influence on anthropometric and vital parameters, therefore this is the time when the adolescents should be made aware of health risk of anaemia. Thus the study needs for further assessment of the aetiology of anaemia so that appropriate interventions may be advocated.

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