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A study on obesity among teenagers in Bhubaneswar city of Odisha

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Abstract

The present study was undertaken in Bhubaneswar city of Odisha to assess the degree of association of bodily factors like age, height, weight, mid arm circumference, chest circumference, waist circumference, thigh circumference, waist-hip ratio (W/H) with Body Mass Index (BMI). The sample size was 120 out of which 60 boys and 60 girls were selected purposively. The subjects were teenagers between 13 to 18 years. They were grouped into early teenagers (13-15 years) and late teenagers (16-18 years).

It was observed that age, mid arm, chest, waist, hip and thigh are showing significant positive correlation among themselves, whereas height of the respondents exhibited significant negative correlation with age, weight, mid arm, chest, waist, hip, thigh except waist/hip ratio. It was revealed through path analysis that body weight had the highest direct positive effect (0.955) on BMI in both boys and girls group. Age, mid arm, chest, waist, and hip and thigh attribution had indirect contribution towards BMI via body weight. The residual effect (0.158) indicated that the most of the important attributes included had major contribution for BMI.

Keywords: Obesity, teenagers, body mass index, correlation, path analysis

1. Introduction

India was undergoing a rapid epidemiological transition. The burden of chronic diseases was overtaking the burden of infectious diseases. The World Health Organization (WHO) describes over weight and obesity as one of the today's most important public health problem causing annually to 2.6 million deaths worldwide every year thus designating obesity as a global epidemic. Research result revealed that 50-80% of obese children will continue as obese adults with health risks such as hypertension, type 2 diabetes, cardiovascular diseases, arthritis and behavioral problem etc. Adult obesity was as high as 35 per cent in Egypt while in USA obesity among children and young adult was 13 per cent. On the other hand the obesity among children was found to be 15.3 million in china followed by India (14.4 million). These obese children will become obese adolescents and adults in their latter part of life, thus concerning health hazard in the country.

Obesity is defined as a complex, multi factorial chronic disease which involves the interaction of both genotype and environment. Prevalence of obesity among teenagers is a major problem in developed and developing countries. It is a product of energy imbalance (imbalance between energy intake and energy output) in the body. Body mass Index (BMI) is a measure of weight in relation to height (kg/m^2) indicating an approximation of total body fat. Also body fat can be measured by waist circumference.

Basing on the BMI value the National Institute of Health classified persons into under-weight (≤ 19 for women and <20 for men), normal (20to24), over-weight (25to 29), obese (30to 39), and extremely obese (≥ 40). Besides BMI, waist measurement is also an indicator of obesity. The WHO states that abdominal obesity as measured by Waist Hip Ratio (W/H) is above 0.90 for males and above 0.85 for females.

Keeping above facts in view, the present study was undertaken in Bhubaneswar city of Odisha to study the magnitude of obesity among teenagers of both boys and girls, assess the degree of association among physical attributes such as age, height, weight, mid-arm, chest, waist, hip, thigh, waist hip ratio and BMI, and measure the direct and indirect effects of physical attributes leading to obesity.

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2. Materials and Methods

Primary data was collected through a pre-tested and validated questionnaire distributed to 120 teenagers belonging to the age group of 13 to 18 years by applying random sampling technique. The teenagers were grouped into early teenagers (13 to 15 years) and late teenagers (16 to 18 years). 60 samples comprising of 30 boys and 30 girls from each teenage category were taken for the study. The investigation was undertaken in Bhubaneswar city in Khordha district of Odisha state.

Information on age, height, weight, thigh, mid arm, chest, waist, hip, waist-hip ratio (W/H) was collected from teenagers of both boys and girls. Weighing machine was used to record the weight in kg of the respondents without footwear. Height, mid arm, chest, waist, hip, thigh, were measured in cm using measuring tape. BMI was calculated using the formula $\text{weight}/\text{height}^2$ (kg/m^2). Waist hip ratio was calculated from the measurements. The data was analyzed and estimated

correlation values were tested against table values (Fisher & Yates, 1967) [4]. In the present investigation, BMI was taken as the “effect” with other attributes like height, weight, mid arm, chest, waist, hip, thigh and waist/hip ratio related to obesity as causal factors. The path coefficients were estimated indicating the basic relationship between correlations and path coefficients in a system of correlated causes (Wright 1921, Dewey & Lu, 1959) [10, 3].

3. Results and Discussions

The mean values of 10 attributes of two groups of teenagers of both boys and girls presented in Table 1, indicates that the mean values for boys were found to be higher than that of girls in respect of all the attributes studied. Average value of BMI inferred that all the boys and girls are considered to have normal health. However, in comparison to boys girls are considered under abdominal obese having waist/hip ratio >0.85 .

Table 1: Mean Value of Attributes of Respondents

S. No	Attributes	BOYS			GIRLS			Pooled over BOYs & Girls
		LAG	HAG	Pooled Over	LAG	HAG	Pooled Over	
1	Age	14.37	17.13	15.75	14.10	16.53	15.32	15.53
2	Height (in cm)	163.97	173.50	168.73	156.83	157.50	157.17	162.95
3	Weight (in Kg)	55.23	73.17	64.20	47.17	56.80	51.98	58.09
4	Mid arm (in cm)	30.23	36.63	33.43	27.13	32.90	30.02	31.73
5	Chest (in cm)	84.50	95.27	89.88	82.07	91.00	86.53	88.21
6	Waist (in cm)	83.27	93.70	88.48	77.37	88.27	82.82	85.65
7	Hip (in cm)	91.83	101.73	96.78	89.40	101.67	95.53	96.16
8	Thigh (in cm)	52.50	60.03	56.27	49.67	57.93	53.80	55.03
9	Waist/Hip	0.980	0.890	0.899	0.864	0.867	0.866	0.882
10	BMI	20.50	24.405	22.454	19.142	23.181	21.162	21.808

Estimation of correlation coefficient among 10 attributes with respect to different groups of teenagers for both boys and girls provides useful information on obesity (Table 2a-dand Figure1 a-g). BMI showed significant positive correlation with chest, waist, hip, thigh, weight and mid arm in that order in both the age group of boys and girls. On the other hand BMI exhibited negative correlation with waist/hip ratio.

Also it is observed that bodyweight of the respondents of all groups of boys and girls showed significant positive correlation with mid arm, chest, waist, hip and thigh. *Inter Se*

correlation among mid arm, chest, waist, hip and thigh were found to be significantly positive. In Lower Age Group of Boys & Higher Age Group of Boys Table 2(a), Lower Age Group of Girls & Higher Age Group of Girls Table 2(b) and in pooled over age group of girls Table 2(c), BMI showed negative correlation with height, but in case of pooled over age group of boys showed positive correlation with height. However BMI showed significant positive correlation with waist/hip ratio in case of girls but exhibited negative correlation in case of boys irrespective of age group.

Table 2: Correlation Coefficient among 10 factors studied for different groups of Boys & Girls
(a) Lower (above diagonal) and Higher (below diagonal) age group of Boys

LAGB HAGB	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	BMI
Age		0.094	0.010	-0.187	0.027	0.045	0.022	-0.103	0.052	-0.028
Height	-0.143		0.219	0.068	0.038	-0.022	0.025	-0.063	-0.133	-0.149
Weight	0.470**	0.149		0.761**	0.947**	0.924**	0.947**	0.922**	-0.152	0.925**
Mid arm	0.562**	-0.111	0.897**		0.735**	0.765**	0.757**	0.720**	-0.064	0.743**
Chest	0.488**	0.024	0.949**	0.904**		0.928**	0.943**	0.929**	-0.188	0.952**
Waist	0.425*	0.046	0.939**	0.878**	0.958**		0.929**	0.893**	0.100	0.931**
Hip	0.543**	-0.113	0.903**	0.868**	0.896**	0.876**		0.944**	-0.287	0.947**
Thigh	0.535**	-0.228	0.776**	0.823**	0.851**	0.784**	0.861**		-0.212	0.963**
W/H	-0.179	0.330	-0.091	-0.163	-0.157	-0.054	-0.255	*-0.376		-0.130
BMI	0.517**	-0.339	0.875**	0.911**	0.885**	0.863**	0.906**	0.860*	-0.286	

(b) Lower (above diagonal) and Higher (below diagonal) age group of Girls

LAGG HAGG	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	BMI
Age		-0.227	0.183	0.162	0.028	0.219	0.063	0.358	0.328	0.306
Height	-0.145		0.080	-0.293	0.002	-0.062	0.112	-0.322	-0.289	*-0.380
Weight	-0.318	0.304		0.859**	0.911**	0.890**	0.890**	0.819**	0.358	0.878**
Mid arm	-0.269	0.211	0.787**		0.840**	0.838**	0.786**	0.826**	0.413*	0.917**
Chest	-0.293	0.189	0.938**	0.779**		0.820**	0.815**	0.773**	0.336	0.847**
Waist	-0.276	0.141	0.941**	0.675**	0.930**		0.840**	0.750**	0.627**	0.847**
Hip	-0.292	0.213	0.942**	0.763**	0.888**	0.880**		0.677**	0.106	0.777**
Thigh	-0.235	0.117	0.794**	0.679**	0.711**	0.742**	0.749**		0.409*	0.890**
W/H	-0.082	-0.083	0.313	0.084	0.384*	0.542**	0.080	0.240		0.448*
BMI	-0.264	-0.156	0.867**	0.662**	0.864**	0.895**	0.844**	0.746**	0.387*	

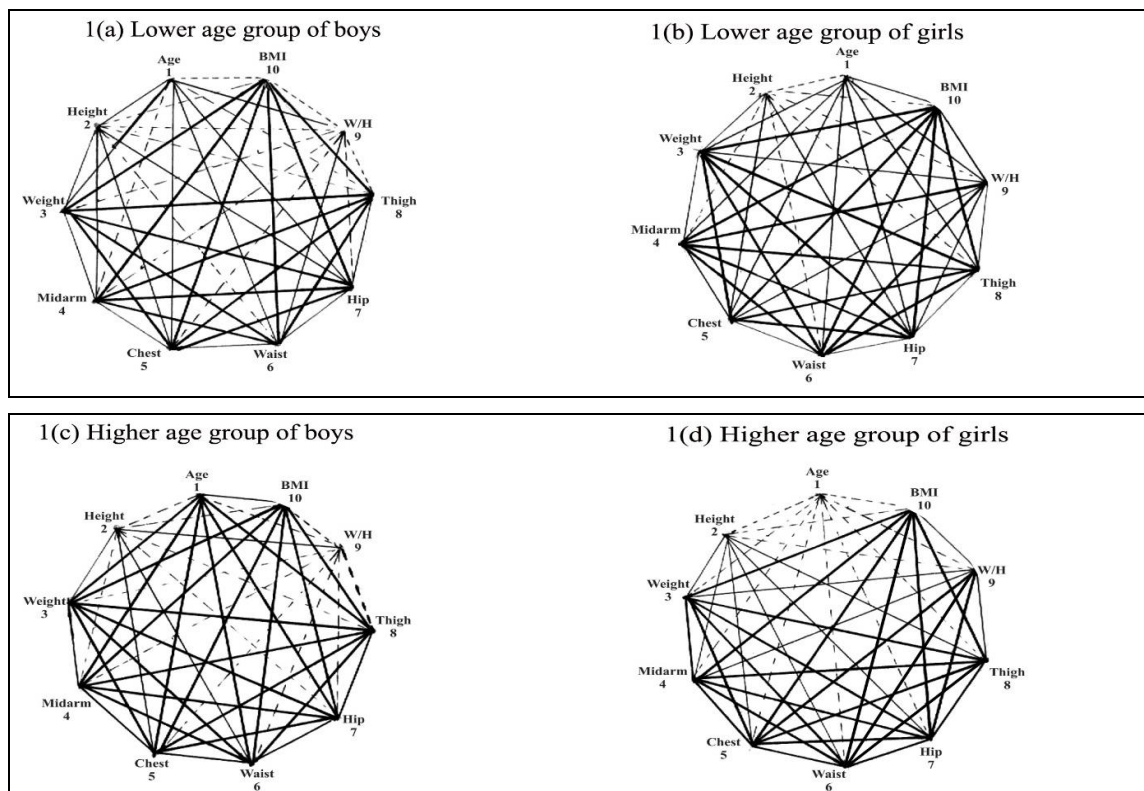
(c) Pooled over age group of Girls (above diagonal) and Boys (below diagonal)

Boys Girls	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	BMI
Age		-0.018	0.364**	0.551**	0.369**	0.467**	0.514**	0.470**	0.071	0.424**
Height	0.473**		0.226	0.050	0.130	0.082	0.173	0.010	-0.177	-0.174
Weight	0.650**	0.444**		0.845**	0.942**	0.933**	0.928**	0.847**	0.298*	0.899**
Mid arm	0.688**	0.342**	0.896**		0.845**	0.823**	0.862**	0.809**	0.193	0.813**
Chest	0.568**	0.295*	0.954**	0.866**		0.914**	0.890**	0.792**	0.330**	0.891**
Waist	0.555**	0.284*	0.945**	0.861**	0.955**		0.907**	0.813**	0.500**	0.907**
Hip	0.571**	0.233	0.929**	0.857**	0.937**	0.913**		0.811**	0.091	0.867**
Thigh	0.568**	0.174	0.875**	0.836**	0.914**	0.862**	0.927**		0.262*	0.840**
W/H	-0.130	0.160	-0.116	-0.142	-0.150	-0.063	-0.220	*-0.283		0.365**
BMI	0.499**	0.019	0.897**	0.840**	0.924**	0.905**	0.930**	0.913**	-0.245	

(d) Pooled over Age group & Sex

Total B&G	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	BMI
Age										
Height	0.320**									
Weight	0.546**	0.532**								
Mid arm	0.633**	0.383**	0.883**							
Chest	0.495**	0.282**	0.911**	0.849**						
Waist	0.531**	0.319**	0.925**	0.854**	0.934**					
Hip	0.546**	0.199*	0.853**	0.827**	0.910**	0.892**				
Thigh	0.530**	0.182*	0.823**	0.816*	0.856**	0.838**	0.865**			
W/H	-0.047	0.181*	0.048	0.013	-0.001	0.118	-0.133	-0.084		
BMI	0.478**	0.052	0.861**	0.818**	0.912**	0.902**	0.897**	0.876**	-0.065	

**and* significant at 5% and 1% level, respectively.



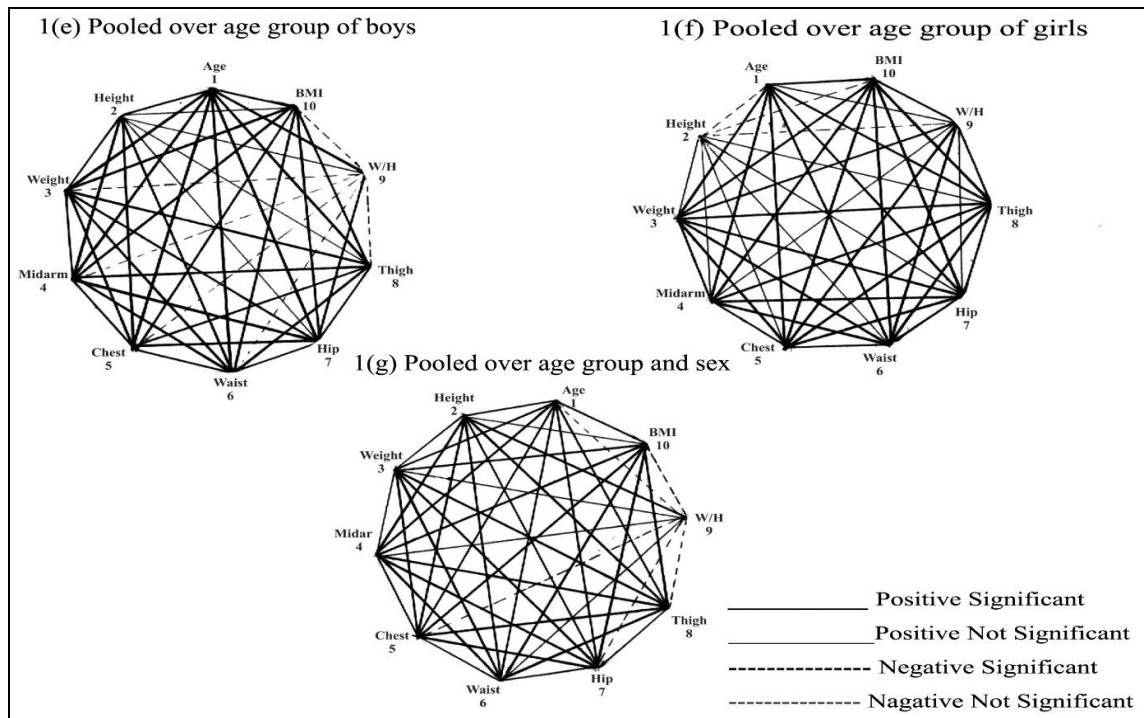


Fig 1(a-g): Correlation among 10 Attributes

The estimates of direct & indirect effects of attributes age wise & sex wise on BMI as presented in (Table 3 a –g) reveals that body weight had major positive direct effect on BMI in case of both boys and girls of lower and higher age group. On the contrary height had negative direct effect on BMI in all groups except lower age group of boys. In Higher Age Group of Girls, Lower Age Group of Girls, Pooled over Age Group of Girls, waist and chest found to be the second

and third direct contributor towards BMI. In Lower Age Group of Boys, chest is the second direct contributor followed by thigh but in Pooled over Age Group of Boys thigh is the second direct contributor followed by chest. However in Pooled over Age Group and Sex body weight had major positive direct effect and also major positive indirect effect via age, height, mid arm, chest, waist, hip, and thigh.

Table 3 Path Analysis Indicating direct (diagonal) and indirect effects of attributes on BMI for different age group of Boys & Girls. (a) Lower Age Group of Boys

Effects of Attributes	Effect via Attributes									
	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	Cor BMI
Age	0.010	-0.029	0.007	-0.003	0.006	0.023	-0.013	-0.017	-0.011	-0.028
Height	0.001	-0.305	0.153	0.001	0.008	-0.011	-0.015	-0.010	0.029	-0.149
Weight	0.001	-0.067	0.699	0.012	0.197	0.471	-0.575	0.153	0.034	0.925**
Mid arm	-0.002	-0.021	0.532	0.016	0.153	0.39	-0.459	0.119	0.014	0.743**
Chest	0.001	-0.012	0.662	0.012	0.208	0.473	-0.572	0.154	0.026	0.952**
Waist	0.001	0.007	0.646	0.012	0.193	0.510	-0.564	0.148	-0.022	0.931**
Hip	0.001	-0.008	0.662	0.012	0.197	0.474	-0.607	0.157	0.060	0.947**
Thigh	-0.001	0.019	0.644	0.012	0.194	0.455	-0.573	0.166	0.047	0.963**
W/H	0.001	0.041	-0.106	-0.001	-0.025	0.051	0.166	-0.035	-0.221	-0.130

P(R) = 0.097, R SQR (%) = 99.05

(b) Higher Age Group of Boys

Effects of Attributes	Effect via Attributes									
	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	Cor BMI
Age	-0.003	0.065	0.467	0.036	-0.066	0.019	-0.048	0.039	0.009	0.517**
Height	0.000	-0.457	0.148	-0.007	-0.003	0.002	0.010	-0.017	-0.016	-0.339
Weight	-0.002	-0.068	0.994	0.057	-0.129	0.042	-0.080	0.057	0.004	0.875**
Mid arm	-0.002	0.051	0.892	0.063	-0.123	0.039	-0.077	0.060	0.008	0.911**
Chest	-0.002	-0.011	0.943	0.057	-0.136	0.043	-0.080	0.062	0.008	0.885**
Waist	-0.001	-0.021	0.933	0.056	-0.130	0.045	-0.078	0.057	0.003	0.863**
Hip	-0.002	0.052	0.898	0.055	-0.122	0.039	-0.089	0.063	0.012	0.906**
Thigh	-0.002	0.104	0.771	0.052	-0.116	0.035	-0.076	0.073	0.018	0.860**
W/H	0.001	-0.151	-0.090	-0.010	0.021	-0.002	0.022	-0.027	-0.049	-0.286

P(R) = 0.071, R SQR (%) = 99.5

(c) Lower Age Group of Girls

Effect of Attributes	Effect via Attributes									
	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	Cor BMI
Age	0.087	0.106	0.139	-0.005	0.005	0.048	-0.006	-0.025	-0.044	0.306
Height	-0.020	-0.468	0.061	0.009	0.001	-0.014	-0.010	0.023	0.038	*-0.380
Weight	0.016	-0.037	0.760	-0.028	0.158	0.197	-0.082	-0.058	-0.048	0.878**
Mid arm	0.014	0.137	0.653	-0.032	0.146	0.185	-0.072	-0.059	-0.055	0.917**
Chest	0.002	-0.001	0.692	-0.027	0.174	0.181	-0.075	-0.055	-0.045	0.847**
Waist	0.019	0.029	0.676	-0.027	0.142	0.221	-0.077	-0.053	-0.083	0.847**
Hip	0.006	-0.052	0.676	-0.025	0.141	0.186	-0.092	-0.048	-0.014	0.777**
Thigh	0.031	0.151	0.622	-0.026	0.134	0.166	-0.062	-0.071	-0.054	0.890**
W/H	0.029	0.135	0.272	-0.013	0.058	0.139	-0.010	-0.029	-0.133	0.448*

P(R) = 0.133, R SQR (%) = 98.2

(d) Higher Age Group of Girls

Effect of Attributes	Effect via Attributes									
	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	Cor BMI
Age	-0.022	0.066	-0.313	0.022	-0.024	-0.241	0.233	-0.007	0.033	-0.264
Height	0.003	-0.455	0.300	-0.017	0.016	0.123	-0.163	0.003	0.034	-0.156
Weight	0.007	-0.138	0.986	-0.063	0.078	0.823	-0.721	0.022	-0.127	0.867**
Mid arm	0.006	-0.096	0.776	-0.080	0.065	0.590	-0.584	0.019	-0.034	0.662**
Chest	0.007	-0.086	0.925	-0.062	0.083	0.813	-0.679	0.020	-0.156	0.864**
Waist	0.006	-0.064	0.928	-0.054	0.077	0.874	-0.673	0.021	-0.220	0.895**
Hip	0.007	-0.097	0.929	-0.061	0.074	0.770	-0.765	0.021	-0.032	0.844**
Thigh	0.005	-0.053	0.783	-0.054	0.059	0.649	-0.573	0.028	-0.097	0.746**
W/H	0.002	0.038	0.309	-0.007	0.032	0.474	-0.061	0.007	-0.406	0.387*

P(R) = 0.221, R SQR (%) = 95.12

(e) Pooled over Age Group of Girls

Effect of Attributes	Effect via Attributes									
	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	Cor BMI
Age	0.076	0.007	0.300	-0.052	0.039	0.382	-0.313	0.008	-0.023	0.424**
Height	-0.001	-0.388	0.186	-0.005	0.014	0.067	-0.105	0.001	0.058	-0.174
Weight	0.028	-0.088	0.825	-0.080	0.099	0.762	-0.565	0.015	-0.098	0.899**
Mid arm	0.042	-0.019	0.697	-0.094	0.089	0.673	-0.524	0.014	-0.064	0.813**
Chest	0.028	-0.050	0.777	-0.080	0.105	0.747	-0.541	0.014	-0.109	0.891**
Waist	0.036	-0.032	0.770	-0.078	0.096	0.817	-0.552	0.014	-0.165	0.907**
Hip	0.039	-0.067	0.765	-0.081	0.094	0.741	-0.608	0.014	-0.030	0.867**
Thigh	0.036	-0.004	0.699	-0.076	0.083	0.664	-0.493	0.018	-0.086	0.840**
W/H	0.005	0.069	0.246	-0.018	0.035	0.409	-0.055	0.005	-0.329	0.365**

P(R) = 0.182, R SQR (%) = 96.69

(f) Pooled over Age Group of Boys

Effect of Attributes	Effect via Attributes									
	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	Cor BMI
Age	-0.019	-0.204	0.633	0.028	0.037	-0.051	0.012	0.062	0.003	0.499**
Height	-0.009	-0.431	0.433	0.014	0.019	-0.026	0.005	0.019	-0.003	0.019
Weight	-0.013	-0.191	0.974	0.036	0.062	-0.088	0.019	0.095	0.002	0.897**
Mid arm	-0.013	-0.147	0.873	0.040	0.056	-0.080	0.018	0.091	0.003	0.840**
Chest	-0.011	-0.127	0.929	0.035	0.064	-0.089	0.019	0.100	0.003	0.924**
Waist	-0.011	-0.122	0.921	0.035	0.062	-0.093	0.019	0.094	0.001	0.905**
Hip	-0.011	-0.100	0.905	0.034	0.060	-0.085	0.021	0.101	0.005	0.930**
Thigh	-0.011	-0.075	0.852	0.034	0.059	-0.080	0.019	0.109	0.006	0.913**
W/H	0.003	-0.069	-0.113	-0.006	-0.010	0.006	-0.005	-0.031	-0.021	-0.245

P(R) = 0.104, R SQR (%) = 98.92

(g) Pooled over Age Group & Sex

Effects of Attributes	Effect via Attributes									
	Age	Height	Weight	Mid arm	Chest	Waist	Hip	Thigh	W/H	Cor BMI
Age	0.021	-0.161	0.522	-0.005	0.033	0.018	0.015	0.035	0.001	0.478**
Height	0.007	-0.505	0.508	-0.003	0.019	0.011	0.006	0.012	-0.002	0.052
Weight	0.011	-0.268	0.955	-0.007	0.060	0.032	0.024	0.055	-0.001	0.861**
Mid arm	0.013	-0.193	0.843	-0.008	0.056	0.029	0.023	0.054	0.001	0.818**
Chest	0.010	-0.142	0.870	-0.007	0.066	0.032	0.026	0.057	0.001	0.912**
Waist	0.011	-0.161	0.884	-0.007	0.062	0.034	0.025	0.056	-0.002	0.902**
Hip	0.011	-0.100	0.815	-0.007	0.060	0.031	0.028	0.057	0.002	0.897**
Thigh	0.011	-0.092	0.786	-0.007	0.057	0.029	0.024	0.066	0.001	0.876**
W/H	-0.001	-0.091	0.046	0.001	0.001	0.004	-0.003	-0.006	-0.014	-0.065

P(R) = 0.158, R SQR (%) = 97.51

4. Conclusion

It is concluded that on the basis of BMI value all the teenagers were found to have normal health. On the basis of waist/hip ratio girls in comparison to boys were considered to have abdominal obese due to their average short height than that of boys. Also obesity did not exhibit any specific association with height. In teenagers of both sex BMI showed significant positive correlation with chest, waist, hip, thigh, bodyweight and mid arm, thus suggesting their importance in managing obesity. Body weight of teenagers showed significant positive correlation with mid arm, chest, waist, hip and thigh. Body weight was found to have major positive direct effect on BMI while via body weight the attributes having major indirect effect were age, height, mid arm, chest, waist, hip and thigh, thus suggesting their role leading to obesity.

5. References

1. Bagudai S. prevalence obesity and hypertension in adolescent school going children. International journal of physiotherapy and research. 2014; 2(6):777-780.
2. Bhattacharya M. Prevalence of over -weight and obesity among adolescent school girls in urban slum. International journal of health science and research. 2015; 5(3):59-65.
3. Dewey OR, Lu KH. A correlation and path coefficient analysis of components of crested wheatgrass seed production. J. Agron.1959; 57:515-518.
4. Fisher RA, Yates WA. Statistical methods for research workers, 12th Edn. Biological monographs and Manuals.1967; 5:130-131.
5. Goel S. Increasing proclivity for junk food among overweight adolescent girls. International research journal biological science. 2013; 2(3):80-84.
6. Kapil U. Prevalence of obesity among affluent adolescents. Indian paediatrics. 2002; 39(5):449-452.
7. Lata A. Prevalence or Obesity and Overweight among high school children. Journal of applied medical science. 2014; 5(2):638-642.
8. Nawab T. Influence or behavioral determinants on the prevalence of over -weight and obesity among school going adolescents. Indian journal of public health. 2014; 58(2):121-124.
9. Ramya HS. Body mass index, waist hip ratio and body fat percentage as early predictors of obesity in adolescents. Current paediatric research. 2017; 21(2):327-334.
10. Wright S. Correlation and causation. J. Agric. Res. 1921; 20:257-287.