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Original Research Article

Study of Obesity & Hypertension in Adolescents: Correlation with Body Mass Index, Lipid & Glucose Profiles and with Anthropometric Indices

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Abstract:

Background: The present study is taken to screen the incidence of obesity & hypertension in adolescent population and its association with lipid profile, glucose profile & anthropometric indices. Early detection of childhood obesity is important as it provides an opportunity to take corrective measures and prevent complications.

Methods: This is a cross-sectional study of the adolescent. 400 adolescents is selected out the patients admitted in pediatric ward for treatment of specific ailments. They are divided into 4 groups based on the Blood pressure and BMI measurements

Results: The association between BMI and systolic blood pressure was found statistically significant (p value 0.002). The association between BMI and diastolic blood pressure was found also statistically significant (p value 0.004). Mean FBS in over weight patients was 113.40±3.94 mg/dl. The association between BMI and FBS was found statistically significant (p value 0.003). Mean Hb1Ac in over weight patients was 5.60±0.64%. The association between BMI and Hb1Ac was also found statistically significant (p value 0.005). Mean Cholesterol in over weight patients was 211.88±23.84 mg/dl. The association between BMI and total cholesterol was found statistically significant (p value 0.001). Mean HDL in over weight patients was 34.01±1.43 mg/dl. The association between BMI and HDL was found statistically significant (p value 0.004). Mean LDL in over weight patients was 136.95±12.35 mg/dl. The association which was significantly higher in overweight children. (p value 0.002s). Similarly, the mean Triglyceride in over weight patients was 170.95±34.99 mg/dl. The association between BMI and triglyceride was found statistically significant (p value 0.003).

Conclusion: Obesity and overweight have become worldwide epidemic. The prevalence of overweight and obesity among children has increased markedly in the last two decades. Our study support that obesity/overweight is prevalent in rural area also for which dietary habits & physical inactivity are the major contributors. Hypertension, lipid derangement & hyperglycemia can lead to significant morbidity presently as well as in future.

Keywords: BMI, Triglyceride, LDL, Obesity.

Introduction

Obesity and overweight have become worldwide epidemic and there is an urgent need to access to the problem of childhood obesity and overweight across country, using a standardizing international standard. The recent phenomenon of nutritional transition with "westernization of food" typical of many developing countries have caused a significant rise in obesity even among population that were unaware of this preventable problem until some years ago, not only in metro cities but also in cities like Jaipur (Rural). In 2016 more than 1.9 billion (3.9%) were overweight. Of these over 65 million (13%) were obese. 41 million children under the age of 5 were overweight or obese in 2016. Over 340 million children & adolescent aged 5-19 were overweight or obese. [1]

Obesity during childhood is associated with a number of risk factors, including hyperinsulinism, insulin resistance, hypercholesterolemia, hypertriglyceridemia, reduced levels of high-density lipoprotein (HDL), hypertension, cardiovascular diseases, increased risk of cervical, ovarian, endometrial and other associated cancers of breast, thyroid, oesophagus, pancreas & gall bladder, risk of musculoskeletal problem, PCOS risk and obstructive sleep apnoea risk. [2]

The present study is taken to screen the incidence of obesity & hypertension in adolescent population and its association with lipid profile, glucose profile & anthropometric indices. Early detection of childhood

obesity is important as it provides an opportunity to take corrective measures and prevent complications.

Material and Methods

Study Design: This is a cross-sectional study of the adolescent.

Inclusion Criteria

- Age between 10 to 18 years
- Adolescents with informed consent

Exclusion Criteria

- Children aged below 10 years and above 18 years.
- Present or past history suggestive of cardiovascular, respiratory or any other chronic systemic illness
- Children not willing to give consent to participate in study

Results

Most common age group in our study is 12-15 years, where total 44.25% cases are found, followed by 15years (27.75%) of cases. Male predominance over female with male to female ratio is 1.76:1

Table 1: Overall prevalence of overweight and obesity as per WHO-BMI for age percentile charts

WHO-BMI for age percentile charts	No.	Percentage
Severe thinness (<3 percentile)	2	0.50
Thinness (>3- ≤15 percentile)	56	14.00
Normal (>15-<85 percentile)	291	72.75
Over weight (≥85-<97 percentile)	45	11.25
Obesity (≥97 percentile)	6	1.50
Total	400	100

In our study, we found that 2 candidates (0.50%) were severe thinness, 56 candidates (14.00%) were thinness, 291 candidates (72.75%) were in normal (healthy) group, and 45 candidates (11.25%) were overweight while 6 candidates (1.50%) were obese.

Table 2: Distribution of Cases According to Systolic Blood Pressure (Percentile)

SBP (Percentile)	No.	Percentage
<90 (Normal)	370	92.50
≥90-<95(Prehypertension)	12	3.00
≥95-99+5(Stage 1 hypertension)	18	4.50
>99+5(Stage 2 hypertension)	0	0.00
Total	400	100

According to systolic blood pressure (percentile), 92.50% patients have normal systolic blood pressure, while 3.00% patients have pre-hypertension, 4.50% patients have stage 1 hypertension and no patients have stage 2hypertension.

Table 3: Distribution of Cases According to Diastolic Blood Pressure (Percentile)

DBP (Percentile)	No.	Percentage
<90 (Normal)	355	88.75
≥90-<95 (Prehypertension)	25	6.25
≥95-99+5(Stage 1 hypertension)	20	5.00
>99+5(Stage 2 hypertension)	0	0.00
Total	400	100

According to diastolic blood pressure (percentile), 88.75% patients have normal diastolic blood pressure, while 6.25% patients have pre-hypertension, 5.00% patients have stage 1 hypertension and no patients have stage 2 hypertension.

Table 4: Association between BMI and systolic blood pressure

WHO-BMI for age percentile charts	Systolic blood pressure	
	Mean	SD
Severe thinness (<3 percentile)	111.00	9.90
Thinness (>3- ≤15 percentile)	106.82	9.82
Normal (>15-<85 percentile)	121.25	13.08
Over weight (≥85-<97 percentile)	138.12	14.56
Obesity (≥97 percentile)	120.12	2.14
Total	121.60	14.80

F-value=38.02, p-value=0.001(S)

In our study, we found that mean systolic blood pressure in over weight patients was 138.12±14.56 mm of Hg. The association between BMI and systolic blood pressure was found statistically significant.

Table 5: Association between BMI and diastolic blood pressure

WHO-BMI for age percentile charts	Diastolic blood pressure	
	Mean	SD
Severe thinness (<3 percentile)	71.00	7.07
Thinness (>3- ≤15 percentile)	71.39	7.37
Normal (>15-<85 percentile)	81.04	8.69
Over weight (≥85-<97 percentile)	85.33	4.35
Obesity (≥97 percentile)	84.12	1.14
Total	80.35	8.85

F-value=24.97, p-value=0.001(S)

In our study, we found that mean diastolic blood pressure in overweight patients was 85.33±4.35 mm of Hg. The association between BMI and diastolic blood pressure was found statistically significant.

Table 6: Association between BMI and fasting blood sugar

WHO-BMI for age percentile charts	Fasting blood sugar	
	Mean	SD
Severe thinness (<3 percentile)	84.00	8.48
Thinness (>3- ≤15 percentile)	87.22	7.37
Normal (>15-<85 percentile)	91.57	7.72
Over weight (≥85-<97 percentile)	113.40	3.94
Obesity (≥97 percentile)	128.12	2.10
Total	94.67	11.84

F-value=130.03, p-value=0.001(S)

In our study, we found that mean FBS in over weight patients was 113.40±3.94 mg/dl. The association between BMI and FBS was found statistically significant.

Table 7: Association between BMI and Hb1Ac

WHO-BMI for age percentile charts	Hb1Ac	
	Mean	SD
Severe thinness (<3 percentile)	5.20	0.14
Thinness (>3- ≤15 percentile)	5.26	0.47
Normal (>15-<85 percentile)	5.27	0.38
Over weight (≥85-<97 percentile)	5.60	0.64
Obesity (≥97 percentile)	5.81	0.52
Total	5.33	0.48

F-value=7.74, p-value=0.001(S)

In our study, we found that mean Hb1Ac in over weight patients was 5.60±0.64%. The association between BMI and Hb1Ac was found stastically significant.

Table 8: Association between BMI and total cholesterol

WHO-BMI for age percentile charts	Total cholesterol	
	Mean	SD
Severe thinness (<3 percentile)	137.60	26.02
Thinness (>3- ≤15 percentile)	163.88	19.33
Normal (>15-<85 percentile)	177.58	22.49
Over weight (≥85-<97 percentile)	211.88	23.84
Obesity (≥97 percentile)	255.12	10.33
Total	181.68	28.20

F-value=50.37, p-value=0.001(S)

In our study, we found that mean total cholesterol in over weight patients was 211.88±23.84 mg/dl. The association between BMI and total cholesterol was found statistically significan

Table 9: Association between BMI and HDL

WHO-BMI for age percentile charts	HDL	
	Mean	**SD**
Severe thinness (<3 percentile)	31.95	2.47
Thinness (>3- ≤15 percentile)	39.59	4.83
Normal (>15-<85 percentile)	39.70	4.62
Over weight (≥85-<97 percentile)	34.01	1.43
Obesity (≥97 percentile)	27.12	1.20
Total	38.93	4.98

F-value=29.09, p-value=0.001(S)

In our study, we found that mean HDL in over weight patients was 34.01±1.43 mg/dl. The association between BMI and HDL was found statistically significant.

Table 10: Association between BMI and LDL

WHO-BMI for age percentile charts	LDL	
	Mean	**SD**
Severe thinness (<3 percentile)	66.33	12.36
Thinness (>3- ≤15 percentile)	99.13	11.56
Normal (>15-<85 percentile)	110.56	16.31
Over weight (≥85-<97 percentile)	136.95	12.35
Obesity (≥97 percentile)	150.12	1.20
Total	112.71	18.56

F-value=29.09, p-value=0.001(S)

In our study, we found that mean LDL in over weight patients was 136.95±12.35 mg/dl. The association between BMI and LDL was found statistically significant.

Table 11: Association between BMI and Triglyceride

WHO-BMI for age percentile charts	LDL	
	Mean	**SD**
Severe thinness (<3 percentile)	91.23	8.32
Thinness (>3- ≤15 percentile)	106.21	10.23
Normal (>15-<85 percentile)	125.12	14.29
Over weight (≥85-<97 percentile)	170.95	34.99
Obesity (≥97 percentile)	200.12	1.24
Total	113.50	35.04

F-value=29.09, p-value=0.001(S)

In our study, we found that mean triglyceride in overweight patients was 170.95±34.99 mg/dl. The association between BMI and triglyceride was found statistically significant.

Discussion

400 adolescents are selected out the patients admitted in pediatric ward for treatment of specific ailments. They are divided into 4 groups based on the Blood pressure and BMI measurements

According to our study 92.50% patients have normal blood pressure, while 3.00% patients have pre-hypertension, 4.50% patients have stage 1 hypertension, and no patients have stage 2hypertension. Diastolic blood pressure was normal in 88.75% patients have, while 6.25% patients have pre-hypertension, 5.00% patients have stage 1 hypertension, and no patients have stage 2 hypertension in our study. This was similar to a study done by Rey et al [4] in 2007, who observed that systolic or diastolic hypertension was found in 17.3% cases of childhood obesity.

Salvandon et al [5] in 2008 also found that pre-hypertension and hypertension were detected in 7.6% and 7.4% in obese children respectively. Thus, childhood obesity is associated with prehypertension and hypertension.

Prevalence of elevated BP was significantly higher from studies done by Sharma et al. 91 (2015) and Patil and Garg [6] (2014), whereas significantly lower than the study done by Tony et al. [7] (2016).

In our study, we found that mean FBS in overweight patients was 113.40±3.94 mg/dl. The association between BMI and FBS was found statistically significant (p value 0.001). Hb1Ac in overweight patients was 5.60±0.64%. The association between BMI and Hb1Ac was found statistically significant (p value 0.002).

Atabek et al [8] found that 6.6% cases had abnormal fasting glucose level in childhood obesity and 18% obese children had impaired glucose tolerance. Brufani et al [9] did a study and they found impaired glucose tolerance in 11.2% of obese children

Lee et al [10] did a study to evaluate HbA1C as screening test for impaired glucose tolerance in obese children to identify the optimal HbA1C threshold. They observed that 27% patients had impaired glucose tolerance and HbA1C cut off related to impaired glucose tolerance test was 5.8%.

In our study, we found that mean total cholesterol in overweight patients was 211.88±23.84 mg/dl. The association between BMI and total cholesterol was found statistically significant (p value 0.005) in overweight patients was 34.01±1.43 mg/dl. The association between BMI and HDL was found statistically significant (p value 0.001s). LDL in overweight patients was 136.95±12.35 mg/dl. The association between BMI and LDL was found statistically significant. (p value 0.005). Triglyceride in overweight patients was 170.95±34.99 mg/dl. The association between BMI and triglyceride was found statistically significant (p value 0.003).

Zhu et al [11] observed that triglyceride, LDL were significantly higher and HDL was significantly decreased in obese children

Conclusion

Obesity and overweight have become worldwide epidemic. The prevalence of overweight and obesity among children has increased markedly in the last two decades. Our study support that obesity/overweight is prevalent in rural area also for which dietary habits & physical inactivity are the major contributors. Hypertension, lipid derangement & hyperglycemia can lead to significant morbidity presently as well as in future. There is an urgent need to devise a plan to reduce childhood obesity by providing health education to modify behavior & attitude about lifestyle & eating habits. As the incidence of obesity/overweight showed increasing trend, more & more studies are required to find out various metabolic changes & other ill effects to prevent morbidity & mortality.

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