

Body Mass Index and Hypertension in Adolescents

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Abstracts: The ongoing rise in the prevalence of Pre-hypertension & hypertension in adolescent is considered to be accompanied with the childhood overweight and obesity. Body Mass Index is one of the indicators which positively correlate with the hypertension (HTN) in adolescents. The study was conducted to establish prevalence of HTN in adolescents with Body Mass Index (BMI). The study was conducted in 450 adolescents children from the age 10 to 19 yrs. range. Blood Pressure and Anthropometric data were collected and analysed. **Result:** Our Result shows that 9.8% Patient were at risk of overweight and 1.6% were overweight with striking feature that 14.6% early adolescents were overweight. 10.8% of adolescent female and 11.7% males were having BMI more than Normal. Prevalence of Pre-hypertension and hypertension were 7% and 5.60% respectively. Pre-hypertension and hypertension were more prevalent (19.6% & 27.4%) in adolescents having BMI \geq 85 percentile for the age and sex then adolescents having BMI below 85th percentile. (5.5%, 2.8%) **Conclusion:** By our study we can conclude that the prevalence of Pre HTN and HTN is directly related to Body Mass Index (BMI). Overweight and obesity may give rise to pre HTN and HTN and should be considered as an alarming feature, and in turn we can prevent prevalence of Essential HTN in adults. Intervention at this age by change in the life style at the earliest can be of greater help. Reduction in the intake of High calorie Diet like Junk Food and initiation of exercise, Meditation and Yoga to the Borderline adolescent will definitely decrease the incidence of HTN. Further study is required to establish direct relation of BMI and HTN so as to prepare useful charts and tables. [Joshi H NJIRM 2014; 5(5):100-105]

Key Words: Body mass Index, Hypertension

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Introduction: Adolescence word is derived from Latin word 'Adolescere' meaning "to grow up". According to UNICEF it is 'the sequence of events by which an individual is transformed into a young adult by series of biological changes'.

Adolescents comprise 22% of total population. It has not only a huge socio- economic impact but also great impact on National Health Indicators. Adolescents represent a positive force in society, now and for future. Adolescent age Boys and girls have various problems. Systemic Hypertension in these children is one of the serious aspect and it is an established predictor of Adult Hypertension leading to organ damage and complications. An increasing number of healthy children and adolescents across the world are being diagnosed with Hypertension ¹.

The normal blood pressure values for children and adolescents are depending on age, gender, height, Body Mass Index and are available in standardized tables. Primary hypertension was rarely found in children, but now a days is common with obese adolescents. Prevalence of Hypertension is related

to Body Mass Index ². The chances of Hypertension are more in adolescents as the BMI increases.

Increasing prevalence of Hypertension in Adolescents may be due to changes in life style such as reduced physical activity and exercise, increased intake of high calorie food, use of Alcohol beverages, and smoking, mental stress and sleep deprivation³. Secondary cause of Hypertension in children is more likely renal parenchyma disease and renovascular disease.

Material and Method: In conducting this prospective study a total No. of 450 Adolescent children were identified. They were grouped as Early 10 to 13 yrs., Middle 14-16 yrs. and Late 17-19 yrs. according to WHO guideline. The birthdates were confirmed by school Registration & Birth Certificates. Blood Pressure and other anthropometric data were collected. Blood Pressure was measured by using standardized sphygmomanometer with appropriate size cuff covering two third of the arm. The B.P. was measured with child in sitting position, with arm at level of heart and after a 5 minute rest. If the

systolic and/or Diastolic B.P. were in higher range of Blood Pressure than additional readings were obtained at an interval of 1-3 weeks. The lowest of these reading was recorded.

The BMI (Body Mass Index) was calculated by the Formula $BMI = \text{weight (kg.)}/\text{height (m}^2\text{)}$. In our study to identify B.P. percentile, initially height percentile of the child was obtained by using Height Percentile table. Then the values were referred in B.P. percentile table corresponding to the child's sex, age & height percentile. Then according to value the child was classified in the specific category.

Systolic or Diastolic BP equals to 95th percentile of gender, age and height, for 3 or more occasion is defined as Hypertension in children. Stage I hypertension (HTN) refers to B.P. from 95th percentile to 99th percentile plus 5 mm of Hg. Stage II HTN refers to values above stage I HTN.⁴ Pre-Hypertension (Pre HTN) is defined as systolic or diastolic B.P. that are equal to 90th percentile but <95th percentile.

Results: B.M.I Evaluation: Stage: The B.M.I evaluation according to the stage of adolescents findings shows that out of 450 patients, 44 patients (9.8%) were at risk of overweight and 1.6% (7) were overweight. A striking feature is that Early adolescent were more at risk of overweight (11.3% and 3.3%).

Table 1:

Adolescent Stage	At risk of overweight	Overweight	Total
Early	17 (11.3%)	5 (3.3%)	150
Middle	15 (10.0%)	2 (1.3%)	150
Later	12 (8.0%)	9 (0.1%)	150
	44 (9.8%)	7 (1.6%)	450

9.7% of Female Adolescent and 9.8% male were at risk of overweight and 1.1% of female and 1.9% males were overweight showing less significance in B.M.I due to sex.

10.8% of the Adolescent female and 11.7% of males were having Body Mass Index (BMI) more than normal in the study.

Table 2:

BMI More than Normal		
	Female	Male
In this Study	10.8%	11.7%
R.Goyal ⁵ et al	10.8%	17.2%

A similar observation was noticed by R.Goyal et al⁵ in their study that 10.8% adolescent girls and 17.2% adolescent males had BMI more than normal.

Table 3: Blood Pressure Evaluation

Adolescent Stage	Pre-hypertension	Hypertension	Total
Early	4(2.7%)	3 (2%)	150
Middle	13 (8.7)	9 (6%)	150
Late	15 (10%)	13 (8.7%)	150
Total	32 (7.1%)	25 (5.6%)	450

As shown in Table 3. Prevalence of Prehypertension and hypertension were 7.1% and 5.6% respectively in adolescent patients.

Prevalence of prehypertension and hypertension both were highest (10% & 8.7%) in late stage of Adolescent and lowest (2.7% and 2% respectively) in early Adolescent. This increase in B.P. in late adolescent can be due to increase body mass.

Isolated systolic diastolic and systolic as well as diastolic Hypertension was seen in 0.7% (3), 1.6% (7), and 3.30% (15) of adolescenter.

Table 4:

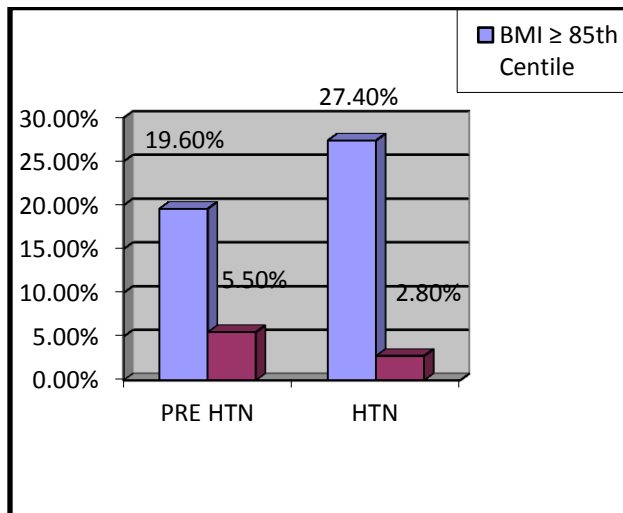
	Isolated Systolic HTN	Isolated Diastolic HTN	Systolic & Diastolic HTN
In this Study	0.7%	1.6%	3.3%
University of Pittsburgh Medical Centre, U.S.A ⁶	2.7%	2.0%	1.7%
R Goel et al ⁷	2.7%	2%	1.7%

Table 5:

	Hypertension
In this study	5.6%
I saha et al	6.4%
R. Goel.et al	6.4%

As shown in Table 5. Total 5.6% of Adolescents were having Hypertension. The similar observation were made by I.Saha et al⁸ and R. Goel et al.⁹

Table 6: BMI & Blood Pressure



As shown in Table 6 it is evident that pre-hypertension & hypertension (19.6% and 27.4%) is more common in adolescent having BMI ≥ 85th percentile for the age and sex than adolescents having BMI below 85th percentile (5.5% and 2.8% respectively).

Percentage of hypertension in adolescent children is related to the BMI. (Body Mass Index). Incidence of Hypertension in adolescents increases as the Body Mass increases.

Discussion: Hypertension is a major risk factor for cardiovascular and cerebro vascular disease. Studies indicate that Blood Pressure increases with age.¹⁰. Population based epidemiological studies show that Primary hypertension is far more common amongst apparently healthy children. Although the prevalence of hypertension is for less in children & adolescents a than in adults, there are enough evidences to suggest that the roots of Essential, Hypertension extends into childhood.¹¹ Today, an increasing number of a healthy children

and adolescents across the world are being diagnosed with HTN.

Normal Blood Pressure values for adolescents are depending up on age, gender and height and are available in standardized tables. Primary Hypertension once was considered to be less common in Pediatric age, is seen more often particularly in obese patients. Some other factors like life style changes, including decreased physical activity, increased intake of high calories, use of caffeinated & alcohol beverages, smoking, tobacco and sleep deprivation may be responsible for HTN in adolescents.¹²

Obesity and overweight are the most common factors for hypertension in children. BMI (Body Mass Index) is one of the significant indicator to define obesity, in this study we utilized BMI to determine reaction between HTN & obesity. Several studies have focused on validation of various anthropometric measure for assessing fatness and seen to recommend mostly BMI.¹³

As shown in Table I in this study 9.80% adolescents were at risk of overweight and 1.6% were overweight. It is evident that early adolescents were more at risk of overweight & obese (11.3% and 3.30% respectively).

9.7% of female and 9.8% of the males were at risk of overweight and 1.1% of females and 1.9% males were overweight. This indicates that the sex of adolescent does not affect the obesity.

Table 2 shows that 10.8% of adolescent females and 11.7% males were having BMI more than normal in this study. Similar observations were by R. Goyal¹⁴ et al that 10.8% adolescent girls and 17.2% boys had BMI more than normal.

Obesity in adolescents is a major public health problem in developed countries and in some parts of developing countries too. It is growing nutritional concerns in country like India, which are witnessing Nutritional Transition (Popkin et al).¹⁵

Obesity in adults is known to be a major risk factor for many non-communicable diseases and especially hypertension and cardiovascular.

Disorders. Childhood obesity too, has important health consequence for children and is a major antecedent of adult obesity.¹⁶

Persistence of childhood obesity into adulthood has been shown by several studies by Rolland¹⁷, catcher et al, siervoge¹⁸ et al and serdula¹⁹ et al.

Guo et al²⁰ in his study have shown that overweight during childhood, especially beyond 8 yrs., is an important risk factor for overweight at the age of 35 years. Obesity in adolescents is not only associated with hypertension and abnormal lipid profile, but also shows clustering of risk factors for cardio vascular disorders.²¹

In our country prevalence of obesity in adolescents is 6 to 8% in a study by kapil et al²² and as high as 16-18% reported by Ramchandran et al.²³

As obesity is an important factor in hypertension, and BMI most valid indicator we have selected BMI as indicator of obesity and studied its relation with hypertension.

Prevalence of prehypertension and hypertension were 7.1% and 5.6% respectively in adolescents in the study (Table 3). Similar observations by I. Saha et al.²⁴, R. Goel et al²⁵ and university of Pittsburgh medical centre²⁶ as shown in (table 4) reveals the significance of Hypertension in adolescents.

Prevalence of pre-hypertension and hypertension both were highest (10% & 8.7% respectively in the late adolescents and lowest (2.7% and 2% respectively) in early adolescents.

Isolated systolic, isolated diastolic and systolic and diastolic hypertension was seen in 0.7%, 1.6% and 3.3% of adolescents. (Table-5). Pre-hypertension as well as hypertension were more common in males (8.7%, 6%), as compared to Female. (4.9%, 4.9%).

Prehypertension and hypertension were more common (19.6% and 27.4) in adolescents having BMI \geq 85 percentiles for the age and sex than adolescents having BMI below 85th percentile (5.5%, 2.81) (Table 6). This observation suggests that prevalence of hypertension in adolescents was related to the Body Mass Index. More percentage

of adolescents were having hypertension as the Body Mass increases. Similar observation by S.A.Rao et al²⁷ concludes that prevalence of High Blood Pressure was 12% in Boys and 9.7% in girls and it increased with increasing levels of BMI. More precisely this study states that the prevalence & high systolic B1 (HSBP) increased suddenly beyond BMI value of 20 kg./m² in boys and 21.5 kg./ml in girls.²⁷

Robinson RF²⁸ et al in his study states that increased BMI is more common in children with Primary than Secondary Hypertension, earlier onset of primary Hypertension in the adolescent associated with increased BMI.²⁸

XiLu²⁹ from a study of Hypertension in overweight & obese children from School in China states that BMI is positively correlated with systolic & diastolic B.P. Being overweight and obese greatly increase the risk of hypertension in Chinese children and adolescents.

Conclusion: Within the limit of the study the following conclusions can be drawn: 9.8% of adolescents were at risk of overweight and 1.6% were overweight. Early adolescents 910 to 13 yrs.) Were at more risk of overweight. (11.3% & 3.3% respectively).

10.8% of adolescent females and 11.7% of adolescent males were having BMI more than normal.

Prevalence of prehypertension and hypertension were 7.1% and 5.6% respectively, surprisingly both pre HTN & HTN were highest (10% and 8.7%) respectively in late adolescent (17 to 19 yrs.) and lowest (2.7% & 2%) respectively in early adolescent (10 to 13 yrs.)

Isolated systolic, Isolated diastolic and systolic diastolic hypertension were seen in 0.7%, 1.6% and 3.3% of adolescent respectively. Singly high blood pressure measurement should not be documented as hypertension so regular periodic evaluation of B.P in all adolescent should be done for early detection of HTN.

Prehypertension and HTN were more common (19.6% and 27.4%) in adolescents having BMI \geq to 85th percentile for the age and sex than adolescents having BMI below 85th percentile. (5.5%, 2.8%)

The prevalence of adolescents overweight and obesity is indeed increasing and our observations also highlight the fact that obesity is a major factor associated with increased B.P level.

Prevalence of pre HTN & HTN was related to Body Mass Index (Obesity). More percentage of adolescents were having hypertension as the Body Mass increased. Standard tables can be prepared for BMI and Hypertension correlation in adolescents, which can be of much use in detection of Hypertension at early stage. Enough evidences are there to suggest that roots of essential HTN extends in to childhood. Routine screening of Adolescents age group for HTN and to detect it timely BMI can be utilized as an Alarming feature. Today's present scenario where the risk factors for HTN and obesity in children like change in physical activity, pattern, obesity, high calorie intake of food, use of caffeinated and alcohol beverages, smoking and mental stress are present, the assessment of BMI can be of immense help to diagnose HTN.

Our findings highlights that BMI and BP measurement needs to be a routine part of physical examination of school children and that in turn will help to reduce essential HTN in adults, prehypertensive migrating to hypertension and complication of hypertension. Recently Indian Medical Association (IMA) has also launched a project for Prehypertension and changes in life style to reduce patients converting into hypertension from pre HTN stage.

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