

Research article

The study of blood pressure profile and Body Mass Index among children in a rural setting

Shivaprakash N.C and Shiny Veetus*

Department of Pediatrics, Adichunchanagiri Institute of Medical Sciences, India

***Correspondence Info:**

Dr. Shiny Veetus

Room no: 31, Kalpatharu Bhavana

Adichunchanagiri Institute of Medical Sciences

BG Nagara, Mandya district.

E-mail: shynzlibra@gmail.com

Abstract

Introduction: Hypertension is a common disease associated with high morbidity and mortality. The disease is a silent threat to the health of the people all over the world. It is suggested that hypertension has its origin in childhood but goes undetected unless specially looked for this period. Documentation of such findings will increase the awareness and lead to preventive strategies to contain the morbidity and mortality burden of hypertension in our country.

Materials and Methods: A cross-sectional observational study was done among school going children between the age groups of 10 to 12yrs in BGS School, Bellur.

Results: It was noted that there was a strong correlation between the Body mass index and the blood pressure profiles in children.

Conclusion: If the trends towards adult hypertension can be recognized in childhood, it may be possible to alter the life style and prevent systemic hypertension as well as related complications.

Keywords: BMI, Blood pressure, Hypertension

1. Introduction

Measurement of blood pressure is not routinely employed in our country in various health check up programmes and studies pertaining to blood pressure of school going Indian children are still inadequate. Children and adolescents with blood pressure greater than the 90th percentile for a given age have roughly a threefold greater likelihood of becoming adults with hypertension compared to those whose blood pressure is at or below the 50th percentile. In addition to age, gender, height, weight and body mass index are also known to influence blood pressure levels in childhood and adulthood.^{1,2,3,4} Documentation of such findings will increase the awareness and lead to preventive strategies to contain the morbidity and mortality burden of hypertension in our country. The global prevalence of hypertension is increasing as per a recent analysis of worldwide data. In India, prevalence of hypertension has increased by 30 times in urban populations over 25 years, and by 10 times in rural populations over 36 years. Blood pressure is well known to increase from birth to adulthood.

Normal BP distribution show lowest levels in the early days of life. Blood pressure gradually increases from very low levels at birth and reaches comparable levels to that of an adult by late adolescence.

Several studies have attempted prediction of future BP levels and cardiovascular risk from BP and anthropometric measurements made during infancy, childhood and adolescence. Researchers have also examined the association of secular trends in adiposity and BP during childhood and adolescence.

Studies have also reported BP variations by ethnicity during childhood and adolescence Zhang *et al* recently published a cross sectional study of 8568 Asian children in the age group 7-18 years from China.⁵

The study underlines the important role of body mass index in influencing the BP levels during childhood and adolescence. In addition to adiposity, height also plays a role in the age related changes in BP seen during childhood. Rosner *et al* recently published a study that examined the role of height in progression of BP during childhood.⁶

The independent role of weight and height in influencing BP was explored in a recent study by Ma *et al* from china.⁷ In addition to predicting adult BP, childhood BP is also known to predict other factors that are related to cardiovascular risk in later life. Globally adiposity levels among all age groups are showing an increasing trend. Several studies support the theory that the roots of hypertension extends back to childhood. Further studies are needed to determine whether this pattern can be altered through intervention during childhood.

1.1 Aims and Objectives

1. To work out normal blood pressure tables for a group of children in a school who are dependent for routine health care on this rural medical institution.
2. To find out the relation of blood pressure with body mass index in the study group.

2. Materials and Methods

A cross-sectional observational study was done among school going children between the age groups of 10 to 12yrs in BGS School, Bellur. Consent was obtained from the parents to enroll them to the study. All measurements included in the study was conducted in the school campus during school hours. All children were requested to rest for ten minutes in the examination room.

All three measurements (height, weight and blood pressure) were measured using a mercury sphygmomanometer. Blood Pressure was measured in sitting position with the subject's right hand resting on the examining table. The blood pressure measurements were taken at the right arm for consistency.

2.1 Inclusion criteria: Children from the ages of 10 to 12 were included in the study.

2.2 Exclusion Criteria:

1. Those children unwilling for study

2. Those who were absent during the time of conduction of study due to any reason.
3. Children with any acute or chronic illness and psychological abnormality.

3. Observations and discussion

Blood pressure, height and weight of 300 students were recorded. The mean systolic blood pressure in males in this study was 107.2 mmHg, while the mean systolic blood pressure in the study done by Archbald *et al* for the same age was 107.38.

The mean diastolic blood pressure in males were found to be 72.1mmHg, while the diastolic blood pressure in the study done by Archbald *et al* was 61.1mmHg.⁸

In females the mean systolic blood pressure was 100.2mmHg. The mean systolic blood pressure as per study done by Agarwal *et al* was 106.9mmHg. The mean diastolic blood pressure was found to be 67.2, where in the study done by Archbald *et al* the mean was 61.6 mmHg.⁹

Weight is a strong correlate and is more variable than height among children. Many reports indicate that for a given age, blood pressure levels are higher in larger children, whether tall or obese. It was observed that as the weight increased there was a gradual increase in both systolic and diastolic blood pressure. The BMI of the children were calculated with the formula mass (kg)/height(m²).

To define childhood overweight/obesity, we used age- and sex-specific cut off points for BMI recommended by the IAP. Childhood pre-hypertension was classified according to height, sex, and age tables from the National High Blood Pressure Education Program.

According to this the children were grouped under 4 categories as underweight, normal weight, overweight and obese with the BMI values of less than 18.5, 18.5-25, 25-30 and more than 30 respectively.

Among 300 students, 48 were underweight, 235 were normal, 15 were overweight and 2 were obese according to their BMI. These BMI values were then converted to percentiles such that BMI more than 85th percentile was considered overweight while those more than 95th percentile for age were considered as obese.

Table 1: BMI of the children

BMI	Total number of students	Boys	Girls
<18.5	48	20	28
18.5-25	235	100	135
25-30	15	5	10
>30	2	2	0

It was noted that there was a strong correlation between the Body mass index and the blood pressure profiles in children. Out of the 17 children who had a BMI of more than 25, 10 children had an increase of blood pressure more than the 90th percentile for the age, which was the pre hypertension range. The remaining 7, although did not have a blood pressure in the notifiable range, it was noted to be higher than other children with normal BMI.

Table 2: Blood pressure of the children

BMI Percentile	Blood pressure			total
	<90 th	90 th -95 th	>95 th	
<5 th	48(16%)	-	-	48 (16%)
5 th -25 th	54(18%)	-	-	54(18%)
25 th -50 th	55(19%)	-	-	55(18.4%)
50 th -75 th	108(38%)	-	-	108(36%)
75 th -85 th	17(7%)	1(8%)	-	18(6%)
85 th -95 th	5(2%)	10(77%)	-	15(5%)
>95 th	-	2(15%)	-	2(0.6%)
Total	287(100%)	13(100%)	-	300(100%)

Table 3: Blood pressure variation of the children

BMI	Blood Pressure		Total Children
	Increased BP	Normal BP	
BMI>25	10	7	17
BMI<25	1	282	283
-	-	289	300

The chi square value is 155 with degree of freedom =1 and p value <0.005. This means that the result we obtained is highly significant statistically.

This strongly supports the study done Aziz *et al*¹⁰ in which he studied 301 students and stated that the children with a correlation of blood pressure, BMI and lipid profile were termed as high risk individuals in future.

A study conducted on "Prevalence and risk factors of hypertension among school going children of Dhaka city" by AFM Mizanur Rehman and Ainum Afroze showed that there was gradual increase in blood pressure with increasing age expect at 8,9 & 12 years in boys and at 9 years in girls. The presence of obesity or family history of hypertension showed significant correlation with systolic and diastolic blood pressure in this study.¹¹

A study conducted on "High rate of obesity associated hypertension among primary school children in Sudan" by Zeena Salman and others concluded that primary school children in urban Sudan exhibited a high degree of overweight and obesity and hypertension among children was more closely linked to obesity than family history that, obesity associated cardiovascular sequelae exist in the developing world at such young age is a harbinger of worsened cardiovascular outcomes in Sub-Saharan Africa in the future.¹²

Another study conducted on "Distribution of blood pressure in school going children in rural area of Wardha district, Maharashtra, India" by Amar Taksande, Puspha Chaturvedi and others concluded that the patterns of increase in systolic blood pressure and diastolic blood pressure, values were different between males and females and among the different age groups. Age, height weight and body mass index were positively correlated with systolic blood pressure and diastolic blood pressure. It is therefore necessary to check the blood pressure regularly to find out the hidden cases of hypertension in children including those from rural are.¹³

4. Conclusion

Measurement of blood pressure is not routinely employed in our country in various health check up programmes and studies pertaining to blood pressure of school going Indian children are still inadequate. Children in upper percentile of blood pressure levels more likely to become hypertensive in adult life.

Similarly those children with high body mass index are more likely to develop hypertension in adult life. If the trends towards adult hypertension can be recognized in childhood, it may be possible to alter the life style and prevent systemic hypertension as well as related complications.

References

1. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics* 2004; 114: 555–76.
2. Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK. Obesity in Indian children: time trends and relationship with hypertension. *Natl Med J India*. 2007 Nov-Dec; 20(6):288-93.
3. Raj M, Sundaram R, Paul M, Kumar K. Blood pressure distribution in Indian children. *Indian Pediatr*. 2010 Jun; 47(6):477-85.
4. Raj M, Sundaram KR, Paul M, Sudhakar A, Kumar RK. Body mass index trend and its association with blood pressure distribution in children. *J Hum Hypertens*. 2010 Oct; 24(10):652-8. Epub 2010 Feb 11.
5. Zhang YX, Wang SR. The relationship of body mass index distribution to relatively high blood pressure among children and adolescents in Shandong, China. *Ann Hum Biol*. 2011 Sep; 38(5):630-4. Epub 2011 Jul 12.)
6. Rosner B, Cook N, Portman R, Daniels S, Falkner B. Determination of blood pressure percentiles in normal-weight children: some methodological issues. *Am J Epidemiol*. 2008 Mar 15; 167(6):653-66. Epub 2008 Jan 29.)
7. Ma J, Wang Z, Dong B, Song Y, Hu P, Zhang B. Quantifying the relationships of blood pressure with weight, height and body mass index in Chinese children and adolescents. *J Paediatr Child Health*. 2012; 48(5):413-8. doi: 10.1111/j.1440-1754.2011.02221.x. Epub 2011 Nov3.)
8. Archibald W.Graham. Blood pressure in children between 5-16yrs. *AM Jr. of Dis. Child* 1945; 69 (4) Apr 203-07.
9. Agarwal V.K. Blood pressure profile in children of age 3-15yrs. *Indian paediatrics* 1983; 20: 921-925.
10. Aziz J, Siddiqui NA, Siddiqui IA, Omair A.Relation of body mass index with lipid profile and blood pressure in young healthy students at Ziauddin Medical University. *J Ayub Med Coll Abbottabad*. 2003 Oct-Dec; 15(4):57-9.
11. AFM Mizanur Rehman, Ainun Afroze, MN Islam “Prevalence and Risk factors of hypertension among school going children of Dhaka city”. *Bangladesh Journal of child health*, 2005; 29(3): 82-87.
12. Zeena Salman, Gregory D Kirk and Mark ‘D’ DeBoer “High rate of obesity associated hypertension among primary school children in Sudan”, *International Journal of hypertension*, Volume 2011: Article ID 629492 5 pages.
13. Amar Taksande, Puspha Chaturvedi, Krishna Vilhekar and Manish Jain “Distribution of blood pressure in school going children in rural area of Wardha District, Maharashtra, India”. *Annals of Pediatric cardiology*. 2008 July- December 1(Z): 101-106.