



## STUDY OF PREVALENCE OF HYPERTENSION IN APPARENTLY HEALTHY SCHOOL CHILDREN AGED 10-15 YRS IN KURNOOL

### Paediatrics

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### ABSTRACT

**Objective:** The prevalence of hypertension in healthy school children aged 10 to 15 years in Kurnool, Study of The relation blood pressure with variables -sex, Weight, height, socioeconomic status and family history.

**Method-** Cross-sectional study

**Setting:** Kurnool urban area (school based study).

**Participants:** Apparently healthy school children 10- 15 yrs.

**Outcome Measures;** prevalence of Hypertension

**Results:** Out of 1000 (100%) children included in the study, 55.7% (557) are Males and 44.3 % (443) children are females. Most of the study subjects were aged 15 years followed by 14 and 13 years and least no. Were in 10, 12, 11 years in the ascending order. 87.6 % of children are in the normal range of blood pressure recordings, 6.8 % are pre-hypertensive and 5.6 % are hypertensive.

Spurt in blood pressures was observed between 12 – 14 years in the study. 5.74 % of males are Hypertensive and 5.40% of females are Hypertensive. This difference is statistically insignificant. Prevalence of Systolic Hypertension (3.10%) is more than diastolic hypertension (2.50%). The difference is not significant statistically. p value = 0.21 chi square = 1.54 23.80% of obese children are hypertensive whereas only 5.90% overweight children are hypertensive. The difference is statistically significant. P - Value 0.044 and chi square = 6.21.

41.86% of hypertensive children have a family history of hypertension and 15.78 % of normal children have a positive family history. The data is statistically significant. p value is <0.0001.

In the study population, 36.1% (20) of hypertensive children (56) belonged to lower socioeconomic class, 33.60% (19) belonged to middle socioeconomic class and 30.30% (17) belonged to upper class according to modified kuppaswamy scale but the difference is not statistically significant. P value is 0.60, chi square is 0.99.

**Conclusion:** Prevalence of hypertension is slightly higher in boys but the observation is statistically insignificant.

Anthropometric variables like height, weight, body mass index, presence of family history showed positive correlation with systolic as well as diastolic blood pressure. Socioeconomic status and parental education have no effect on paediatric hypertension in the current study.

### KEYWORDS

pre-hypertension, hypertension, obesity, Overweight, family history.

### Introduction:

The term „Blood Pressure“ refers to arterial blood pressure. Arterial blood pressure is defined as the lateral pressure exerted on the arterial walls by the flowing column of blood within it. Blood pressure is conventionally expressed in terms of millimetres of mercury.

The normal function of blood pressure is

1. To maintain a sufficient pressure head to keep the blood flowing.
2. To provide the force of filtration at the capillary bed Thus assuring nutrition to the tissue cells, urine and lymph formation and so on.

Hypertension is a common disease associated with mortality and morbidity. The disease is a silent threat to the health of people all over the world. Since most of the people are asymptomatic and the disease does immense harm to body in the form of “Target organ damage“. The World Health Organization named it as a “SILENT KILLER“. Due to epidemiological transition, Hypertension is also increasing in trend in paediatric population .BP tracking studies suggest that hypertension in adulthood often has its origin in childhood

Children with upper percentile of blood pressure levels, are more likely to become adult hypertensives. If the trend towards adult hypertension can be recognized in childhood, it may be possible to alter life style and prevent systemic hypertension as well as related complications

The prevalence of hypertension, and its associated complications have

reached such an enormous proportion, that WHO has recognized it and expressed its concern by observing the year 1978 with the *slogan* “Down with Blood Pressure”.

It is suggested that Hypertension has its origin in Childhood but goes undetected unless specifically looked for during this period. Accurate blood pressure measurements should be part of the routine annual physical examination of all children, 3 years or older.

The childhood hypertension is amenable to pharmacological and non pharmacological intervention at earliest possible point of time. Thus early detection of hypertension is important to prevent adult hypertension and its sequel like heart failure, stroke and renal failure. Obesity and family history were found to be important influencing factors in development of this hypertension

**Materials and methods:** A list of schools in the urban area of Kurnool was obtained. From the list of schools four schools were selected using lottery method of simple random sampling.

Initially questionnaires were issued to the students. After the questionnaire is filled up, students were asked to come to the investigator with their questionnaires in hand and then their weight and height were measured and BP was recorded one by one and was noted in their respective questionnaires with the help of teachers. After collection of data from all the four schools, the questionnaires were used for analysis.

**Methods adopted for statistical analysis:**

Data entry was done using Microsoft Excel software and analysed using Epi Info 7 version software.

**Method of anthropometric measurements** – Instructions followed in measuring weight:

1. It was ensured that the reading in the digital weighing machine was zero before each measurement.
2. Removed shoes and bulky clothing from students.
3. Students were made to stand still with feet in center of platform of weighing machine and head straight to look forward Recorded to the nearest 0.1 kg.
4. Recorded to nearest 0.1 kg.

**Instructions followed in measuring height:**

1. Removed shoes and bulky clothing from students.
2. Undo hairstyles or accessories.
3. Located the crown of the head of the student.
4. Students were made to stand erect with hands at sides.
5. 4 contact points – head, upper back, buttocks and heels.
6. Students head was aligned in such a way that the Frankfurt plane is parallel to the headpiece of stadiometer. (Frankfurt plane is the imaginary line from lower margin of eye socket to the notch above the tragus of the ear). Subject was instructed to breathe in and recorded to the nearest 0.5 cm.
7. BMI was calculated using the formula

Centre for Disease Control - BMI growth charts developed by National Centre for Health Statistics were used to categorize children using BMI percentiles

**Table 11 - Categorization based on Body Mass Index Percentile**

Category	BMI Percentile
Normal	< 85 <sup>th</sup> percentile
Overweight	85 <sup>th</sup> – 95 <sup>th</sup> percentile
Obese	> 95 <sup>th</sup> percentile

**Blood pressure Measurement:**

- Blood pressure was recorded as per recommendations of fourth report by Task force on diagnosis, evaluation and treatment of high blood pressure in children and adolescents<sup>1</sup>.
- The standard device for BP measurements has been the mercury manometer.<sup>33</sup> Mercury column sphygmomanometer was used and cuffs having bladder width approximately 40% of arm circumference tied midway between the olecranon and acromion process.<sup>34,35</sup> For such a cuff to be optimal for an arm, the cuff bladder length should cover 80% of the circumference of the arm.
- Blood pressure was recorded in sitting position in right arm with arm resting on the table with the cubital fossa supported at the level of the heart. The lower edge of the cuff placed 1.2 to 2.5 cm above the inner side of the elbow joint.
- Efforts were made to eliminate factors which affect BP like anxiety, crying, exercise etc. Initially, radial pulse obliteration pressure was determined to estimate the systolic BP. The cuff was inflated 20–30 mmHg above the level and the cuff was deflated at a rate of about 2 mm Hg/sec after application of stethoscope over cubital fossa.
- Phase 1 and phase 5 of the Korotkoff sounds were taken as indicative of the systolic and diastolic pressures, respectively. Average of three consecutive readings taken at 2 minute interval was recorded.
- Hypertension was diagnosed if average systolic or diastolic blood pressure is  $\geq 95^{\text{th}}$  percentile for age, sex and height.

Pre-hypertension was diagnosed if average systolic or diastolic BP is  $\geq 90^{\text{th}}$  and  $< 95^{\text{th}}$  percentile for age, sex and height.

Children diagnosed as pre-hypertensive were advised lifestyle modifications and hypertensive were also advised lifestyle modifications, and complete urine examination, blood urea, serum creatinine ,U/S abdomen, baseline cardiac evaluation and regular follow up.

- Questionnaire included details regarding family history of hypertension.
- Details of parent education, employment status and income were asked to assess the socioeconomic status of the family. Socioeconomic status of child is analyzed based on Modified

Kuppuswamy Scale 2012 and categorized as upper, middle and lower classes.

**Inclusion criteria:**

Apparently healthy school children aged 10-15 years of Kurnool

**Exclusion criteria:**

- Children below 10 years and above 15 years.
- Children with chronic illness
- Children with congenital anomalies.
- Modified Kuppuswamy Scale 2012 and categorized as upper, middle and lower classes.

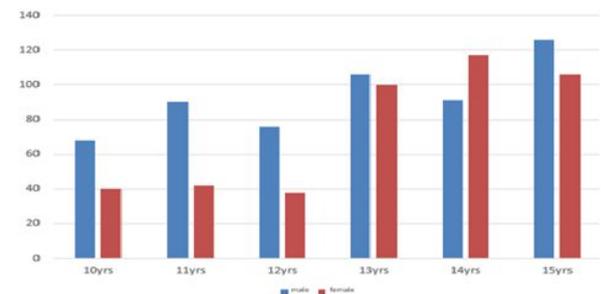
**Table 13- Age and sex wise distribution of the study sample**

Age (years)	Total	Male	Female
10	108 ( 10.8 % )	68 ( 12.2 % )	40 ( 9.0 % )
11	132 ( 13.2 % )	90 ( 16.1 % )	42 ( 9.4 % )
12	114 ( 11.4 % )	76 ( 13.6 % )	38 ( 8.5 % )
13	206 ( 20.6 % )	106 ( 19.0 % )	100 ( 22.5 % )
14	208 ( 20.8 % )	91 ( 16.3 % )	117 ( 26.4 % )
15	232 ( 23.2 % )	126 ( 23.9 % )	106 ( 23.9 % )
<b>Total</b>	<b>1000</b>	<b>557 ( 55.7 % )</b>	<b>443 ( 44.3 % )</b>

**FIGURE 1 - Age and sex wise distribution of the study sample**

Most of the study subjects were aged 15 years followed by 14 and 13 years and least number were in 10 , 12 , 11 years age group in the ascending order.

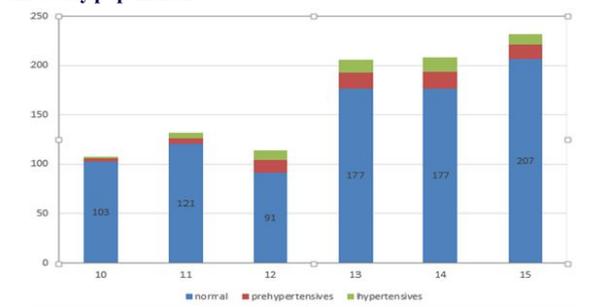
The above table shows that out of 1000 (100%) children included in the study, 55.70% (557) children are males and 44.30% (443) children are females.



**Table 15 - Distribution of hypertension and pre-hypertension in the study population**

Group	Number
Normal	876 ( 87.6 % )
Pre-hypertension	68 ( 6.8 % )
Hypertension	56 ( 5.6 % )
<b>Total</b>	<b>1000 ( 100 % )</b>

**FIGURE 3 - Distribution of hypertension and pre-hypertension in the study population**



**FIGURE 4- Age wise distribution of prevalence of hypertension and pre-hypertension in the study population**

Age (years)	Normal	Prehypertension	Hypertension	Total
10	103(95.4%)	3(2.7 %)	2( 1.85 % )	108
11	121(91.68%)	5(3.78 %)	6(4.55 %)	132

12	91(79.8%)	13(1.4 %)	10( 8.77 %)	114
13	177(85.9 %)	16(7.76 %)	13( 6.31 %)	206
14	177(85.1%)	17(8.17 %)	14( 6.7 %)	208
15	207(89.2%)	14(6.03 %)	11 ( 4.74 %)	232
<b>Total</b>	<b>876( 87.6%)</b>	<b>68(6.8 %)</b>	<b>56 ( 5.6 %)</b>	<b>1000(100%)</b>

The above table shows that 87.6 % of children are in the normal range of blood pressure recordings, 6.8 % are pre-hypertensive and 5.60% are hypertensive.

Spurt in blood pressures was observed between 12 – 14 years in the study.

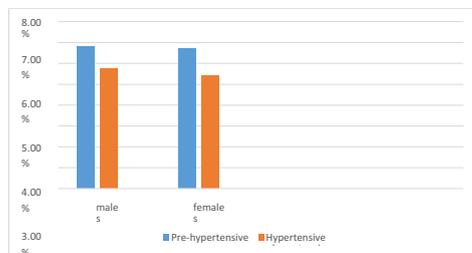
**Table 17 - Gender wise distribution of prevalence of pre-hypertension and hypertension in the study population**

Gender	Normal	Pre-hypertensive	Hypertensive	Total
Males	487(87.4%)	38 ( 6.82 %)	32 ( 5.74 %)	557(55.7%)
Females	389(87.9%)	30 ( 6.7 %)	24 ( 5.4 %)	443(44.3%)
<b>Total</b>	<b>876(87.6%)</b>	<b>68 ( 6.8 %)</b>	<b>56 ( 5.6 %)</b>	<b>1000(100 %)</b>

p- Value = 0.97 and chi square = 0.052

The table shows that 5.74% of males are Hypertensive and 5.40% of females are Hypertensive. This difference is statistically insignificant

**FIGURE 5 - Gender wise distribution of prevalence of pre-hypertension and Hypertension in study population**



**Table 18 - Distribution of Systolic and Diastolic hypertension among study population**

Gender	Systolic hypertension	Diastolic hypertension	Hypertension
Males	20 ( 2.0 %)	12 ( 1.2 %)	32 ( 3.2 %)
Females	11 ( 1.1 %)	13 ( 1.3 %)	24 ( 2.4 %)
<b>Total</b>	<b>31 ( 3.1 %)</b>	<b>25 ( 2.5 %)</b>	<b>56 ( 5.6 %)</b>

p value = 0.21 chi square = 1.54

The above table shows the prevalence of Systolic Hypertension (3.10%) is more than diastolic hypertension (2.50%). The difference is not significant statistically.

**Table 19 -Distribution of overweight and obese in the study population**

Group	Number
Normal	910 ( 91 %)
Overweight	52 ( 5.2 %)
Obese	38 ( 3.8 %)
<b>Total</b>	<b>1000 ( 100 %)</b>

**Table 20 -Distribution of prehypertension and hypertension in overweight and obese children**

	Normal	Prehypertensives	Hypertensives	Total
Overweight	42 ( 80.7 %)	7 ( 13.4 %)	3 ( 5.9 %)	52 ( 100 %)
Obese	24 ( 63.1 %)	5 ( 13.1 %)	9 ( 23.8 %)	38 ( 100 %)

p- Value 0.044 and chi square = 6.21.

The above table shows that 23.80% of obese children are hypertensive whereas only 5.90% of overweight children are hypertensive. The difference is statistically significant.

**Table 21- Prevalence of Hypertension in children with a positive family history**

Family History	Normal BP	Hypertensives	Total
Positive	149 ( 15.78 %)	23 ( 41.86 %)	828 ( 100 %)

Negative	795 ( 84.22 %)	33 ( 58.14 %)	172 ( 100 %)
<b>Total</b>	<b>944 ( 100 %)</b>	<b>56 ( 100 %)</b>	<b>1000 ( 100 %)</b>

p value is < 0.0001 and chi square is 23.73.

The above table shows that 41.86% of hypertensive children have a family history of hypertension and 15.78% of normal children have a positive family history. The data is statistically significant.

**Table 22-Influence of socioeconomic status on blood pressure in study population**

Socioeconomic status	Non-Hypertensives	Hypertensives	Total
Upper class	313 ( 33.1 %)	17(30.3%)	330(33%)
Middle class	353 ( 37.3 %)	19(33.6%)	372(37.2%)
Lower class	278 ( 29.4 %)	20(36.1%)	298(29.8%)
<b>Total</b>	<b>944 ( 100 %)</b>	<b>56(100%)</b>	<b>1000(100%)</b>

p value is 0.60 chi square is 0.99

The above table shows that in the study population, 36.1% (20) of hypertensive children (56) belonged to lower socioeconomic class, 33.6% (19) belonged to middle socioeconomic class and 30.30%(17) belonged to upper class.

Traditionally, hypertension has been considered an uncommon problem among children and adolescents. In normal children blood pressure varies not only with age, but also with sex, height and weight. Essential hypertension is a major risk factor for cardiovascular disease in all age groups and both sexes.

Tracking studies and have identified elevated blood pressure in childhood as an important precursor of hypertension in adults. Early identification of hypertension helps in translation into early intervention and thus modification of the natural course of it to decrease the mortality and morbidity.

**Age and gender wise distribution of hypertension among study population**

The present study was carried out among 1000 apparently healthy school children aged 10 -15 years. The proportion of males is 55.70% (557) and that of females is 44.3% (443).

Most of the study subjects were aged 15 years followed by 14 and 13 years. A study by Larioia et al has shown that there will be spurts in blood pressure levels among 11-13 year boys and 12-14 year girls. In the current study spurt in blood pressures was observed between 12 – 14 years.

Similar observations have been made by Anand N.K. and Lalit Tandon et al

The spurt may be possible due to certain hormonal and physical changes occurring in the body at adolescence.

According to these recommendations as per the 4<sup>th</sup> report prevalence of hypertension (average systolic or diastolic BP is ≥95th percentile for age, Sex and height) was evaluated.

Out of 1000 study population, 56 (5.6%) apparently healthy school children are hypertensive and 68 (6.8%) are pre-hypertensive in the current study. Studies have come out with prevalence of hypertension varying widely in different Indian studies from 0.46% (Anand N K and LalithTandon et al study conducted among 5000 children aged 5 – 17 years in Amritsar) to 11.90% ( Gupta R et al). There could be a higher prevalence of HTN in southern India probably because of influential factors like genetic inheritance, dietary habits, and lifestyle factors.

No.	Author (s)	Age group	Sample Size	Location	HTN prevalence
1.	Present tudy	10 – 15 yrs	1000	Kurnool	5.6 %
2.	Patel.U.et al	11 – 18 yrs	1006	Bhopal	5.36 %
3.	Avinash Sharma et al	11 – 17 yrs	1085	Shimla	5.9 %
4.	Anuradha et al	12 – 16 yrs	2258	Tirupathi	9.5 %
5.	Anand N.K. and LalitTandon	5 – 17 yrs	5000	Amritsar	0.46 %

Results of current study are also comparable with study done by Sharma Avinash, et al a cross sectional school based study conducted in Shimla among children of age group 11 - 17 years. The prevalence of hypertension was 5.90%.

### Gender wise prevalence of hypertension

Study is comparable with study of Patel.U. et al in which the prevalence of hypertension among males was 5.37% and among females was 5.36% and the difference was not significant statistically. Chadha et al also reported statistically insignificant difference in prevalence of hypertension was reported among boys and girls (11.9% in boys and 11.4% in girls), it was found that boys are slightly taller and heavier than girls. These findings are in favour of the argument that body weight and height are the strongest determinants of blood pressure and not the gender.

Prevalence of systolic and diastolic hypertension among study population

In the current study, systolic hypertension is more than diastolic hypertension among boys (2% versus 1.20%) and diastolic hypertension is more than systolic among girls (1.1% versus 1.3%) but the difference was not significant statistically. Results are comparable with the study conducted by Patel U et al

S. No.	Author (s)	Boys		Girls	
		Systolic Hypertension	Diastolic Hypertension	Systolic Hypertension	Diastolic Hypertension
1.	Present Study	2 %	1.2 %	1.1 %	1.3 %
2.	Patel U et al	3.38 %	1.99 %	2.38 %	2.97 %

### Prevalence of hypertension among obese children

Prevalence of obesity in study population is 5.2% (52). Out of 52(100%) obese children, 23.8% (9) are hypertensive and 13.1% (5) are pre-hypertensive. Out of 38 (100%) overweight children in the study population 5.9% (3) are hypertensive and 13.4% (7) are pre-hypertensive.

Patel U et al has reported prevalence of hypertension among obese children was 24.07 % which is comparable with the current study (23.8%)

Prevalence of hypertension among obese children was 13.7% and 22% in the study done by Verma et al and Anjankumar V S et al respectively. Palti et al observed that children maintaining their percentile rank for weight or BMI showed a higher correlation for blood pressure tracking studies.

Verma et al found that the prevalence of hypertension was 34 times in obese children as compared to non-obese and the correlation was statistically significant.

S. No.	Author (s)	HTN among obese children
1.	Present study	23.8 %
2.	Patel . U. et al	24.07 %
3.	Verma.et al	13.7 %
4.	Anjan Kumar V.S.et al	22 %
5.	Kuruville John et al	29.41 %

These findings strongly favour the argument that anthropometric variables like height, weight and body mass index show positive correlation with systolic as well as diastolic blood pressure. Hence, obese children of who were taller and heavier showed higher prevalence of hypertension.

Hypertension in obese children may occur due to:

1. Increased cardiac output
2. Increased blood volume
3. Excessive sodium intake
4. Increased steroid production
5. Alteration in receptors for various pressor substances.

### Prevalence of Hypertension among children with a positive family history

Family history of hypertension is an important risk factor for hypertension among apparently healthy children. In the study population, an association between family history of hypertension and hypertension in children has also been found by various studies.

In the current study, 41.86% of hypertensive children have a family history of hypertension and 15.78% of normal children have a positive family history and the data is statistically significant. Results are comparable with study conducted by Yuvraj et al 17.2% of hypertensive children had a family history. Study conducted by Verma et al

Results in present study are comparable with study done by Jasmine S Sundar et al in which the prevalence of hypertension was very high (41%) among children of hypertensive parents.

It is therefore recommended that children of hypertensive parents must be screened to detect asymptomatic hypertension.

No.	Author (s)	Positive family history among hypertensive children
1.	Present study	41.86 %
2.	Yuvraj et al	17.2 %
3.	Jasmine Sundar et al	41 %
4.	Verma et al	85.7 %

The reason for familial aggregation may be genetic or environmental or both.

In study population, 36.1% (20) of hypertensive children (56) belonged to lower socioeconomic class, 33.6% (19) belonged to middle socioeconomic class and 30.3% (17) belonged to lower class but the difference is not statistically significant.

The result is also comparable with the study done by V.Coto et al which showed lack of association between socioeconomic status and hypertension in children.

Hypertension in children is influenced by various risk factors, both modifiable and non modifiable. The hypertension in these asymptomatic children is, usually essential hypertension which is probably aggravated due to obesity and a positive family history. It is therefore recommended that children of hypertensive parents must be screened to detect asymptomatic hypertension. Influencing factors like obesity should be checked and prevented by advising proper diet and regular exercise at home and schools. Parents should also be advised to take these measures.

Hypertension is not a rare phenomenon in the paediatric age group. Children may not present with the signs and symptoms of hypertension but detecting high blood pressure measurements at a young age and taking precautionary measures can go a long way in postponing the onset or even preventing the onset of hypertension at a later age.

### CONCLUSIONS

- In the present study, prevalence of hypertension is 5.6% among apparently healthy school children aged 10-15 years in Kurnool.
- Prevalence of hypertension is slightly higher in boys but the observation is statistically insignificant.
- Anthropometric variables like height, weight, body mass index, presence of family history showed positive correlation with systolic as well as diastolic blood pressure. Socioeconomic status and parental education have no effect on paediatric hypertension in the current study.
- Hypertensive children are at a higher risk of "childhood onset of adult diseases". Thus, timely recognition and intervention will result in decreased adulthood morbidity and mortality.
- Screening and tracking BP from childhood is of crucial importance. It is necessary to use national standards for BP percentiles and design and implement targeted interventions based on research findings for various age groups
- Regular monitoring of blood pressure of children having risk factors is basic step by which we can detect asymptomatic hypertensive children in very early age.

### 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 114 (2 Suppl 4th Report):562, 2004
2. Gupta AK, Ahmed AJ. Childhood obesity of hypertension. Indian Pediatr 1990; 27: 333-337.
3. Verma M, Chhatwal J, George SM. Obesity and hypertension in children. Indian Pediatric 1994; 31: 1065 -69. 1.
4. Chadha SL, Tandon R, Shekhawat S and Gopinath N, 1999, "An epidemiological study

- of blood pressure in school children (5-14 years) in Delhi, Indian Heart Journal, 51, 178-182.
5. Nelson textbook of pediatrics, part 20, section 8, 439, Systemic hypertension; Measurement of BP in children.
  6. Patel U, Patel NP, Jain S, Ratre BK, Shrivastava S .High blood pressure in school going adolescents: prevalence and risk factors 2014.
  7. Avinash Sharma, NeelamGrover,Shayam Kaushik Rajiv Bharadwaj and Naveen Sankhyan Prevalence of hypertension among school children in R.K.
  8. N.K. Anand and Lalit Tandon: "Prevalence of Hypertension in school going children", Indian Pediatrics, May 1996, Volume 33, Page 377 – 381.
  9. Park's Text book of preventive and social medicine: 22nd edition. Chapter 6 - Epidemiology of chronic non communicable diseases and conditions; page 344 and 345 - Hypertension.
  10. Williams CL, Hayman LL, Daniels SR, Robinson TN, Steinberger J, Paridon S, et al. Cardiovascular health in childhood: A statement for health professionals from the Committee on Atherosclerosis, Hypertension, and Obesity in the Young (AHOY) of the Council on Cardiovascular Disease in the Young, American Heart Association. Circulation 2002; 106:143–60. PR
  11. Nelson textbook of pediatrics, part 20, section 8, 439, Systemic hypertension; etiology and pathophysiology; Table 439-1
  12. Nelson textbook of pediatrics, part 20, section 8, 439, Systemic hypertension; diagnosis; table 439-4,47.
  13. National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000)
  14. Gupta R et al .Trends in Hypertension Epidemiology in India Journal of Human Hypertension 2004 : 18 : 73 – 8