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Original Research Paper

Pharmacy

EVALUATION OF PREVALENCE AND RISK FACTORS OF HYPERTENSION IN SCHOOL CHILDREN

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ABSTRACT

Background: Hypertension in children is defined as elevating blood pressure of both systolic and diastolic equal to or greater than 95th percentile by age, gender, height and weight. According to ESH (European society of hypertension) and AAP (American academy of pediatrics) an increasing trend has been observed in the incidence, prevalence of hypertension in children, this study is expected to improve awareness in people regarding hypertension in children. **Aim:** This study was performed to evaluate the incidence, prevalence and risk factors of hypertension among school age children and to assess relationship between physical activity of children with their blood pressure **Materials and Methods:** The study was a cross sectional observational study carried out at different schools in Hanam Konda. All the data were collected from the children by interacting with them directly by using data collection form and physical activity questionnaire. **Results:** Among the total sample population, subjects with hypertension were found to be 27. Among which females were 11(41%) and males were 16(59%). subjects with sedentary lifestyle were found to be 14 (52%) and 5(19%) subjects were found to be obese out of 5 members 4 members are having sedentary lifestyle, and 5(19%) subjects were found to have concomitant disease conditions and 3(38%0 were found to be with family history. **Conclusion:** This study suggests that hypertension in children is a considerable public health challenge worldwide. Childhood hypertension is rare in children but the occurrence of hypertension in children was common now a days due to family history, obesity, sedentary lifestyle and other disease conditions. According to our study we concluded that changing dietary habits, increasing physical activity in children and creating awareness regarding childhood hypertension in children and their parents may reduce the prevalence rate in children.

KEYWORDS : Nephrotic syndrome, obesity, hypertension, sedentary lifestyle

Introduction

Definition: Two standard guidelines are used for hypertension in children include ESH (European society of hypertension) guideline introduced in 2016 and AAP (American academy of pediatrics) guideline introduced in 2017. [Table 1] According to these recommendations, childhood hypertension is characterized by elevated systolic blood pressure and diastolic blood pressure that are equivalent to or higher than the 95th percentile by age, gender, and height at three or more visits. These recommendations define normal blood pressure as falling within or below the 90th percentile for one's age, gender, height, and weight. (3)

Table .1

CATEGORY/CLASS	SBP/DBP PERCENTILE
Normal	Less than 90th percentile
Prehypertension	Greater than 90th – less than 95th percentile
Hypertension stage 1	95th – 99th percentile
Hypertension stage 2	Greater than 99th percentile

Table .2 Screening BP Levels Needing Further Analysis

Years of age	Boys	Girls
	SBP/DBP (mmHg)	SBP / DBP (mmHg)
10 years	110/70	110/70
11 years	110/75	115/75
12 years	120/75	120/70
> 13 years	120/80	120/80

Epidemiology: Previous studies showed prevalence of hypertension in children is 2-3% and 9.02% urban & 17.47% in rural. Hypertension prevalence in children with type 1 diabetes mellitus is 4-16%, type 2 diabetes mellitus is 12-31%, neuro fibromatosis is 6.1% and chronic renal disease is 20-70%. The prevalence of HTN is also based on race and their food habits (2)

Risk Factors: Obesity, Gender, Family history, Sedentary lifestyle, Race. (4)

Etiology: Primary hypertension occurs without any exact cause or does not occur due to other medical conditions which are caused by low birth weight, prematurity, unhealthy dietary habits like high salt and calorie intake, obesity, family history, gender, type-2 diabetes mellitus, high cholesterol levels, sedentary lifestyle

Secondary hypertension occurs due to exact cause and with other medical conditions include glomerulonephritis, renal vein thrombosis, hyperthyroidism, polycystic kidney disease, arterial venous fistula, William syndrome, thrombocytopenic purpurea, increased intracranial pressure, stroke, sleep disorders (obstructive sleep apnea), drugs include glucocorticoids, oral contraceptives, decongestants. (8)

Pathophysiology: Based on previous articles hypertension in children had different pathophysiological changes which include

i) **Nephrotic Syndrome:** It is a renal disorder characterized by edema and loss of protein from plasma into urine due to increased glomerular permeability. Several studies have reported that nephrotic syndrome causes increased hypertension.

Multiple mechanisms and comorbidities contribute to pathophysiology of hypertension in children with nephrotic syndrome include:

a) Renal factors include sodium retention, RAAS activation, albuminuria, fluid shift medication side effects due to calcineurin inhibitors like cyclosporine, tacrolimus, renal fibrosis, decreased GFR, progression of CKD
b) Extra renal factors include genetic predisposition, lifestyle changes, dietary habits, cardiovascular factors like hyperlipidemia, impaired glucose metabolism, increased arterial stiffness, left ventricular hypertrophy, and obesity. (9)

ii) **Obesity:** Based on previous articles hypertension in children with overweight and obesity mediated by several mechanisms include:

a) Sympathetic nervous system hyperactivity which causes cardiovascular manifestations such as increased blood pressure and heart rate.
b) Obese children reported to have increased blood pressure due to altered balance between sympathetic and parasympathetic nervous system activity.
c) According to some studies insulin resistance has also been indicated in pathophysiology of obesity related hypertension in children due to positive associations between fasting insulin levels and resting blood pressure in obese children. Insulin resistance with obesity prevents insulin induced glucose uptake but leaves sodium renal and causes renal sodium retention effects and results in chronic volume overload and BP elevation.

Iii) **Sedentary Lifestyle Or Low Physical Activity:** A sedentary lifestyle contributes to artery hardening and plaque buildup in the arteries. When your arteries are stiff and narrow, the heart must work hard to circulate the blood throughout the body. This leads to increased blood pressure

a) low physical activity also leads to increased weight and obesity which then leads to hypertension

Iv) **High Sodium Intake:** According to previous articles increased salt consumption may induce vascular resistance, anatomic remodeling and microvascular endothelial inflammation

a) High salt intake may also provoke water retention and leads to high flow in arterial vessels which causes increased blood pressure.
b) High sodium intake causes pressure natriuresis which leads to increased salt and water excretion which leads to elevation of blood pressure in renal arteries. (10)

Clinical Features: symptoms may also occur based on system/organ

i) Cardiovascular symptoms include chest pain, shortness of breath, irregular heartbeat, atherosclerosis, heart failure, heart palpitations, murmurs.
ii) Endocrine: hyperthyroidism.
iii) Neurological symptoms include seizures, encephalopathy, confusion, anxiety, tremors.
iv) Renal symptoms include renal failure and edema.
v) High blood pressure also affects retina including hemorrhage exudates, papilledema, narrowing of arteries, double vision/blurred vision, hypertensive retinopathy.
vi) Others: growth retardation, pallor, acne or hirsutism.

Diganostic Parameters: Sphygmomanometer, history and physical examination are the standard procedures. Blood tests include lipid profile, creatinine, serum electrolytes, thyroid profile, RFT and other tests include urinalysis, echocardiogram, renal ultrasound (7)

Complications: If the child hypertension was not treated and continuous into adulthood they are at risk of stroke, heart attack, kidney diseases, hypertensive encephalopathy, left ventricular hypertrophy, coronary artery disease (12)

Treatment Patterns

Some of the antihypertensive drugs include:

1) Sympatholytic Drugs: The primary mechanism by which central sympatholytic medications lower blood pressure is by activating central 2 adrenergic receptors in brainstem centers, which also decreases sympathetic nerve activity and norepinephrine release from neurons into the heart and peripheral circulation.

a. Centrally acting drugs (alpha receptor agonists): methyldopa, clonidine, Monoxide
b. Post ganglionic adrenergic neuron blockers: reserpine
c. Alpha blockers: prazosin, terazosin, doxazosin

2) Beta Blockers: The way that beta blocker's function is by obstructing the actions of the hormone epinephrine, also referred to as adrenaline. Beta blockers reduce blood pressure.

a. Nonselective: propranolol, timolol, labetalol, carvedilol, nadolol
b. Cardio selective: metoprolol, atenolol, acebutolol
c. Ganglionic blockers: hexamethonium, decamethonium, Trimethoprim, tetramethyl ammonium

3) Vasodilators: By using these drugs, the blood flows more easily through the vessels. They influence the muscles in the walls of the arteries and veins, preventing the muscles from tightening and the walls from narrowing.

a. Arterial: hydralazine HCl, minoxidil, diazoxide
b. Arteriovenous: sodium nitroprusside

4) Ace Inhibitors: It reduces blood pressure.

a. Captopril, ramipril, enalapril, lisinopril, quinapril, benazepril, perindopril

5) Angiotensin 2 Blockers: These medications ease blood vessel tension, reduce blood pressure, and facilitate the heart's ability to pump blood.

a. Losartan, valsartan, telmisartan, candesartan

6) Calcium Channel Blockers: These drugs limit intracellular calcium influx, which prevents calcium from entering the heart and arteries, causing the peripheral vessels to dilate and lowering blood pressure.

a. Dihydropyridines: amlodipine, nifedipine, clonidine, felodipine, nicardipine
b. Non dihydropyridines: verapamil, diltiazem

7) Diuretics: Increasing sodium and water losses from the urine and lowering salt reabsorption at different nephron locations. resulting in a drop in blood pressure.

a. Thiazides: hydrochlorothiazide, chlorothiazide, hydro flumethiazide, indapamide
b. Loop diuretics: furosemide, bumetanide, ethacrynic acid
c. Potassium sparing diuretics: spironolactone, amiloride
d. Carbonic anhydrase inhibitors: acetazolamide
e. Osmotic diuretics: mannitol, glycerol

8) In children with nephrotic syndrome treatment options include synthetic steroids

e.g.: prednisolone, prednisone, methylprednisolone

a) These steroids have salt retaining activity via mineralocorticoid receptors properties, but the exact mechanism is not known fluid shift from interstitial to intravascular compartment and increases the plasma renin activity which increased sympathetic nerve activity and enhanced vascular smooth muscle responsiveness to catecholamines and angiotensin 2 which impaired

vasodilation and nitric oxide synthesis (11)

Aims and Objectives

Aim Of Study: A cross sectional observational study to evaluate the incidence, prevalence and risk factors of hypertension among school age children. To assess the physical activity relationship with the blood pressure of children

Objectives Of Study: Evaluate prevalence of hypertension. Evaluate risk factors and causes of hypertension. Evaluate relationship between physical activity of children with their blood pressure. To prevent further complications of hypertension in children. Evaluate the relationship between body mass index of the children with their blood pressure. As the hypertension is asymptomatic and symptoms developed in children can't identify by them so, this study is aimed to improve the children and their parent's knowledge regarding symptoms of hypertension to create awareness in people about hypertension in children

MATERIALS AND METHODS

The study was conducted at government and private schools in Hanam Konda, Warangal. This study is a cross sectional observational study, and the design enabled us to evaluate the incidence, prevalence, risk factors of hypertension. The total study population comprised 623 of which 27 children were found to be hypertensive.

Inclusion criteria include children of either gender (male and female) between the ages of 10 and 15, underweight, healthy weight and overweight children, physically active and in active children.

Exclusion criteria include children with known cases of hypertension.

All the information was collected from children directly by interacting with them by using data collection form and physical activity questionnaire. Data collection forms include children's age, gender, height, weight, body mass index, blood pressure at three separate visits, family history. Physical activity questionnaire which is a self-administer and seven days recall instrument. It is of two types based on age and class oof children which includes PAQ-C and PAQ-A. PAQ-C (physical activity questionnaire for older children) which was used to assess the physical activity levels in elementary school children in grades 4-8 and approximately 8-14 years of age .PAQ-A (physical activity questionnaire for adolescents) which was used to assess the physical activity levels in high school children in grades 9-12 and approximately 14-19 years of age (13).

Results

1. Gender Distribution

GENDER DISTRIBUTION	MALE	FEMALE
NO. OF PATIENTS	307	316

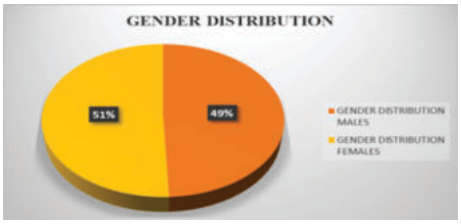


Fig 1 Gender Distribution: Among the 623 children, 307 (51%) people were males, and 316 (49%) people were females.

2. Family History Distribution

DISTRIBUTION OF FAMILY HISTORY	WITH FAMILY HISTORY	WITHOUT FAMILY HISTORY
NO OF PATIENTS	320	303

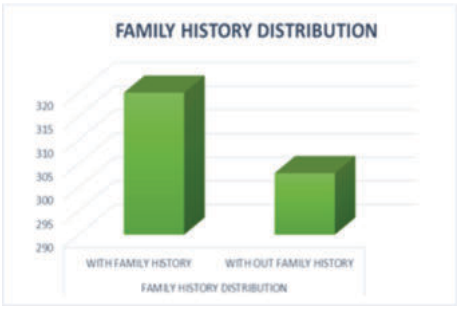


Fig 2 Family History Distribution: Among the total children,320 (50%) people with family history and 303 (49%) people without family history

3. Weight Distribution

WEIGHT DISTRIBUTION	UNDER-WEIGHT	HEALTHY WEIGHT	OVERWEIGHT
NO. OF PATIENTS	97	473	53

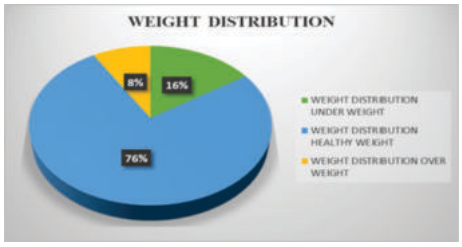


Fig 3 Weight Distribution: Among all cases of 623 people. 97(16%) people were under weight, 473(76%) people were healthy weight, 53(8%) people were overweight.

4. Physical Activity Distribution

PHYSICAL ACTIVITY DISTRIBUTION	SEDENTARY	NON-SEDENTARY
NO. OF PATIENTS	298	325

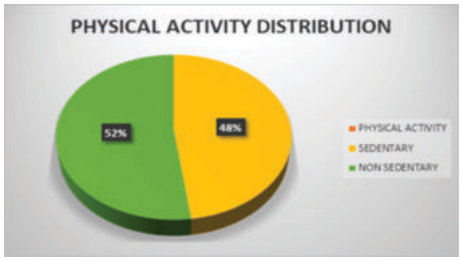
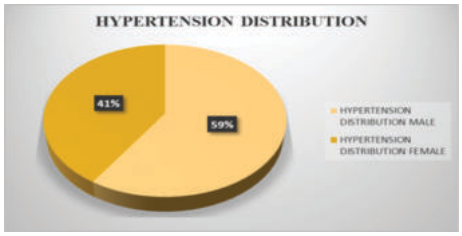


Fig 4 Physical Activity Distribution: In 623 children ,298(48%) children were sedentary, and 325(52%) children were non sedentary.

5. Hypertension Distribution

HYPERTENSION DISTRIBUTION	NORMAL B.P	HIGH B.P
NO. OF PATIENTS	596	27



HYPERTENSION DIVISION	MALE	FEMALE	SEDENTARY	OBESITY
NO. OF PATIENTS	16	11	14	5

HYPERTENSION DIVISION	DISEASE CONDITION	FAMILY HISTORY
NO. OF PATIENTS	5	3

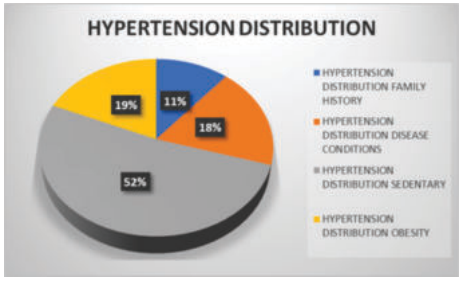


Fig 5,6,7 Hypertension Division: From a total population of 623 children 596 people had normal blood pressure and 27 people had high blood pressure.

Out of 27 children 16(35%) members of male, 11(24%) members of female,14(30%) are sedentary,5(11%) are obesity ,5 (62%) are disease conditions, 3 (38%) members are with family history of Hypertension.

8. Disease Conditions

DISEASE CONDITIONS	NEPHROTIC SYNDROME	CONGENITAL	OTHERS
NO. OF PATIENTS	2	2	1

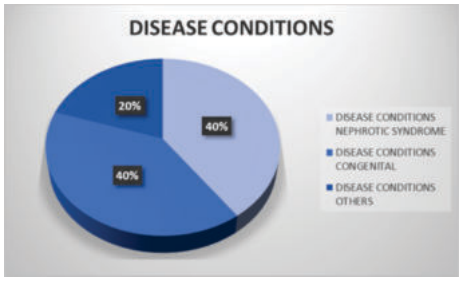


Fig 8 Disease Conditions: Among 27 children ,2 (40%) children with nephrotic syndrome and 2 (40%) with congenital and 1 (20%) are others

9. Dietary Distribution

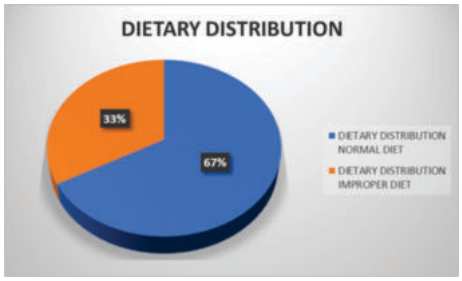


Fig 9 Dietary Habit Distribution: A total of 623 children, 417(67%) children are in normal diet and 206(33%) are in improper diet.

10. Age Distribution

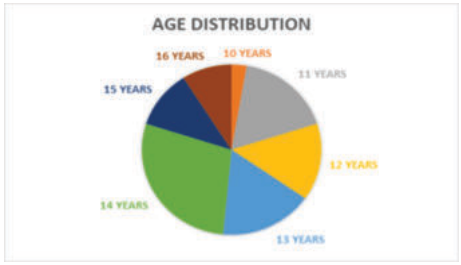


Fig 10 Age Distribution: Out of 623 children, subjects of age 10 years age were found to be 17(3%).11 years age were 108(17%), 12 years age were 91(15%), 13 years age were 105(17%), 14 years age were 177(28%), 15 years age were 69(11%),16 years age were 56(9%).

11. Categorizaion Based On Clinical Features

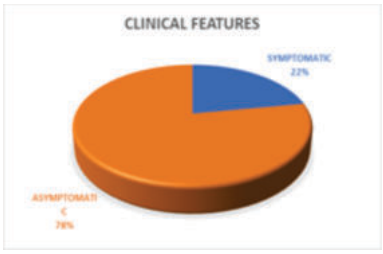


Fig 11 Categorization Based On Clinical Features: In the whole 623 subjects, symptomatic and asymptomatic were found to be 6(22%) and 21(78%).

12. Awareness Reagrding In Children

Figure 12awareness In Children: A total of 623 people was included in the sample, of which 202(32%) & 421(68%) were aware and unaware.

DISCUSSION

In the current study we recruited a total of 623 people based on the inclusion criteria. Among the total number of subjects male were found to be 307 (49%) whereas female was found to be 316 (51%).

Among the total sample the subjects were segregated based on family history. subjects with family history were found to be 320 (51%) and without family history were found to be 303 (49%)

Among all cases of 623 people.97(16%) people were under weight,473(76%) people were healthy weight,53(8%) people were overweight along with this physical activity of the subjects was assessed. Among which 298 (48%) were having sedentary lifestyle and 325 (52%) were found to have a non-sedentary lifestyle. According to some studies family history is the major factor for the development of hypertension.

In our present study, subjects were segregated based on association with other disease conditions. Subjects with nephrotic syndrome were assessed to be 2 (40%) and subjects with congenital conditions were found to be 2 (40%) and subjects with other disease conditions were assessed to be 1 (20%)

In this study, subjects were also categorized based on their dietary habits. The subjects with proper / normal diet were found to be 417 (67%) and those with improper diet were found to be 206 (33%). Improper intake of diet may also affect hypertension.

In our study we have categorized subjects based on age groups and the subjects of age 10 years were found to be 17 (3%) and subjects of age 11 years were found to be 108 (17%) and subjects of age 12 years were found to be 91 (15%) and subjects of age 13 years were found to be 105 (17%) and

subjects of age 14 years were found to be 177 (28%) and subjects of age 15 years were found to be 69 (11%) and subjects of age 16 years were found to be 56 (9%).

In the whole 623 subjects symptomatic and asymptomatic were found to be 6 (22%) and 21 (78%)

According to our study, there were 202(32%) who were aware of hypertension symptoms and 421(68%) who were unaware of hypertension symptoms.

Among the total sample population, subjects with hypertension were found to be 27. Among which females were 11(41%) and males were 16(59%). subjects with sedentary lifestyle were found to be 14 (52%) and 5(19%) subjects were found to be obese, and 5(18%) subjects were found to have concomitant disease conditions, and 3(11%) were found to be with family history.

Many studies showed that elevated blood pressure in children is a growing health problem that is often overlooked and recommended to measure BP in children at least once a year

According to some studies physical activity improves physical fitness, glucose and insulin resistance, bone health, reduces adiposity, cardiometabolic health and other health benefits

Based on some studies prevalence of hypertension in children as increasing recent years due to increasing sedentary lifestyle, low physical activity, unhealthy diet and unawareness of hypertension (5)

To increase the physical activity and to avoid sedentary lifestyle in children, schools to educate and encourage the children by conducting sports activities Gymnastics, Games and other extracurricular activities. Children should be educated and proper nutrition at home and schools to avoid the overweight and obesity and to prevent the hypertension (4)

According to our study most of the children have low physical activity scores and increased BMI and unhealthy dietary habits. So, based on these results children with sedentary lifestyle are overweight, obese, family history and children with other disease condition are the causes for development of hypertension in children.

We have advised the parents of the diagnosed children to take a doctor consultation to prevent sudden complications.

CONCLUSION

This study suggests that hypertension in children is a considerable public health challenge worldwide. Childhood hypertension is rare in children but the occurrence of hypertension in children was common now a days due to family history, obesity, sedentary lifestyle and other disease conditions. According to our study we concluded that changing dietary habits, increasing physical activity in children and creating awareness regarding childhood hypertension in children and their parents may reduce the prevalence rate in children. Longterm study needed to know about complete information of childhood hypertension.

Conflict Of Interest: The author declares no conflict of interest

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