



## Prevalence and risk factors for hypertension among school attending adolescents in Kancheepuram district

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#### Abstract:

**Background:** Hypertension among school going adolescents as an evolving public health concern in urban India is well recognized. In the present study, an attempt was made to find the prevalence of hypertension among school attending adolescents in 11-19 years age group and to study the socio-demographic, and life style habits prevalent in this study group contributing to hypertension in this study group. **Materials and Methods:** Descriptive, cross-sectional study was conducted during September 2012 to January 2013 in secondary and matriculation schools in sub-urban parts of Rathinamangalam, Kancheepuram District. A total of 1540 students were randomly selected from six schools in the study area and purposive sampling of adolescents is done for the operational feasibility. Blood pressure readings along with socio-demographic and life-style characteristics were recorded using a pre-tested questionnaire. **Results:** Among 1540 students, the prevalence of hypertension (>95 percentile distribution per age and gender) among male adolescents in this study is 1.9% and 1.72% among female adolescents. The prevalence of isolated systolic hypertension (>95 percentile distribution per age and gender) among males is 0.71% when compared with 0.28% in females. **Conclusion:** Prevalence of hypertension is found to be less but life style factors, which can have negative effect on blood pressure, are highly prevalent. Preventive efforts should target school attending adolescents to promote healthy life styles habits.

**Key words:** Anthropometry, Adolescent Hypertension, Body Mass Index, Obesity, School Attending Adolescents

#### Introduction

Hypertension among school going adolescents as an evolving public health concern in urban India is well recognized. Heart studies across

the world have shown that adults with hypertension reported high systolic or diastolic blood pressures (BP) during their childhood [1,2]. Elevated blood pressure in childhood is associated with early

markers of cardiovascular abnormalities such as left ventricular hypertrophy (LVH) and atherosclerosis. The long-term health risks for hypertensive children and adolescents can be substantial. Hence, there has been an increasing focus on the identification, prevention, and treatment of children and adolescents with sustained hypertension [3]. The assessment and management of hypertension in children differs from those in adults in several important ways. Hypertension in children and adolescents is defined by normative values for blood pressure according to gender, age and height, which are published in fourth report of National High Blood Pressure Education Program (NHBPEP). Hypertension is defined as average systolic or diastolic BP >95th percentile for gender, age and height measured on three separate occasions.

The Joint National Committee Seventh Report (JNC VII) introduced a new concept, pre-hypertension, and recommended health-promoting lifestyle modifications for these individuals. The JNC VII guidelines state that BP levels between 90th and 95th percentile are considered pre-hypertensive. 'Tracking' the tendency of individuals to maintain their blood pressure level compared with their peers is another important factor in determining the ultimate development of hypertension [4]. Developing countries are undergoing nutrition transition due to increased economic development and market globalization leading to rapid changes in lifestyle and dietary habits [5].

The life style related modifiable risk factors are identified as the main stay for prevention efforts to target for health education among this vulnerable age group. The dietary habits like eating sweets and bakery foods and eating behaviors like snacking and eating more fried food were significantly associated with high prevalence of overweight and obesity in school adolescents [5,6]. Promoting physical activity in childhood may increase physical activity in adulthood and help reduce the burden of chronic disease. Evidence from the Cardiovascular Risk in Young Finns study indicates that decreased physical activity levels in childhood and persistent inactivity are linked to obesity in adulthood [7]. Evidence-based research indicates that physical activity reduces adiposity in both overweight and normal children, improves musculo-skeletal and cardiovascular health and fitness, positively influences concentration and memory and thereby on intellectual performance [8,9]. Leisure-time habits

such as watching television, playing video games or computer games increase the likelihood of being overweight and obesity among adolescents and are identified as a widely present life-style factor among school adolescents [10].

The study was conducted to assess the prevalence of hypertension and risk factors among school attending adolescents in Kancheepuram district.

## Aims

To study

1. The prevalence of hypertension among school attending adolescents aged 11 to 19 years.
2. To identify the risk factors associated with high blood pressures among the adolescents.

## Materials and Methods:

This is a cross-sectional study conducted during September 2012 to January 2013 in secondary and matriculation schools in sub-urban parts of Rathinamangalam, Kancheepuram District. A pre-tested, questionnaire was filled by the students after receiving approval from school authorities. Blood pressure and anthropometric measurements were recorded as per WHO guidelines. Hypertension was diagnosed when blood pressure exceeded two standard deviations (i.e.95th percentile) above the mean pressure for the population. Body Mass Index (BMI), and waist circumference were used as a measure of obesity. The statistical analysis is performed using Microsoft Excel and SPSS software version 19 and Chi Square test was used for test of significance.

Consent was taken from the concerned authorities of secondary and matriculation schools.

## Results:

Of the 1540 school going adolescents, 698 (45.32%) were girls and 842 were boys (54.68%). The socio-demographic profile of the participants is summarized in Table 1.

**Table 1: Socio-demographic profile of the participants**

Particulars		Male (n)	Female (n)	Total
1. Age (in years)	12	47	37	84
	13	161	146	307
	14	189	144	333
	15	187	136	323
	16	159	170	329
	17	72	57	129
	18	24	3	27
2. Religion	19	3	1	4
	Hindu	707	587	1294
	Christian	87	64	151
	Muslim	45	38	83
3. Type of Family	Jain	3	9	122
	Nuclear	661	547	1208
	Joint	162	132	294
4. Family Monthly Income in Rupees	Others	3	2	5
	<1000	14	6	20
	1001-5000	249	236	485
	5001-10000	214	181	395
	10001-20000	196	128	324
	>20001	291	157	134

The mean, standard deviation and age/gender specific percentiles of Systolic and Diastolic blood pressure are shown in Tables 2 and 3.

**Table 2: The mean, standard deviation and age/gender specific percentiles of Systolic blood pressure**

Age	Gender	Count	Mean	Standard Deviation	Mean $\pm$ Standard Deviation	Percentile				
						05	25	75	95	99
12	Female	37	106	11	106 $\pm$ 11	90	100	110	126	126
	Male	47	99	13	99 $\pm$ 13	72	90	110	120	120
13	Female	146	103	14	103 $\pm$ 14	80	90	110	128	140
	Male	161	102	13	102 $\pm$ 13	80	92	110	124	130
14	Female	144	102	12	102 $\pm$ 12	82	94	110	122	138
	Male	189	102	14	102 $\pm$ 14	80	90	110	126	142
15	Female	136	106	12	106 $\pm$ 12	88	98	114	128	132

	Male	187	109	14	$109 \pm 14$	90	100	118	132	142
16	Female	170	106	15	$106 \pm 15$	86	100	116	130	138
	Male	159	111	13	$111 \pm 13$	90	100	120	132	140
17	Female	57	106	12	$106 \pm 12$	90	98	112	128	136
	Male	72	112	10	$112 \pm 10$	90	104	120	128	130
18	Female	03	107	11	$107 \pm 11$	98	98	120	120	120
	Male	24	108	12	$108 \pm 12$	90	98	119	122	132
19	Female	01	120	0	$120 \pm$	120	120	120	120	120
	Male	03	109	15	$109 \pm 15$	92	92	120	120	120

**Table 3: The mean, standard deviation and age/gender specific percentiles of Diastolic blood pressure**

Age	Gender	Count	Mean	Standard Deviation	Mean $\pm$ Standard Deviation	Percentile				
						05	25	75	95	99
12	Female	37	67	8	$67 \pm 8$	54	60	70	80	80
	Male	47	66	10	$66 \pm 10$	50	60	72	82	90
13	Female	146	65	10	$65 \pm 10$	50	60	70	80	94
	Male	161	66	10	$66 \pm 10$	50	60	72	80	90
14	Female	144	67	10	$67 \pm 10$	50	60	74	84	92
	Male	189	64	10	$64 \pm 10$	50	58	70	80	88
15	Female	136	69	8	$69 \pm 8$	56	62	72	80	90
	Male	187	68	9	$68 \pm 9$	52	60	72	80	90
16	Female	170	68	9	$68 \pm 9$	56	60	74	80	90
	Male	159	68	10	$68 \pm 10$	50	60	74	84	90

17	Female	57	69	9	$69 \pm 9$	50	62	74	84	88
	Male	72	70	8	$70 \pm 8$	56	64	75	80	84
18	Female	03	75	5	$75 \pm 5$	72	72	80	80	80
	Male	24	70	10	$70 \pm 10$	56	60	80	80	82
19	Female	01	70	0	$70 \pm$	70	70	70	70	70
	Male	03	66	7	$66 \pm 7$	58	58	70	70	70

The prevalence of hypertension in our study is 1.62 %. The prevalence of hypertension (>95 percentile distribution per age) among male adolescents in this study is 1.9% and 1.72% among female adolescents. The prevalence of isolated systolic hypertension (>95 percentile distribution per age) among males is 0.71% when compared with 0.28% in females. The prevalence of isolated diastolic hypertension (>95 percentile distribution per age) among males and females is 0.23% and 0.86% respectively.

**Table 4: Distribution of blood pressure as per JNC VII Classification**

Age	Stage								
	Male	Low (expect all other cases)		Normal (<120/80)		Pre-Hypertensive (120-139/80-89)		Stage 1 Hypertensive (140-159/90-99)	
		N	N	%	N	%	N	%	N
12	47	3	6.4%	44	93.6%	0	0.0%	0	0.0%
13	161	12	7.5%	148	91.9%	1	0.6%	0	0.0%
14	189	14	7.4%	171	90.5%	4	2.1%	0	0.0%
15	187	26	13.9%	155	82.9%	3	1.6%	3	1.6%
16	159	28	17.6%	126	79.2%	3	1.9%	2	1.3%
17	72	13	18.1%	59	81.9%	0	0.0%	0	0.0%
18	24	3	12.5%	21	87.5%	0	0.0%	0	0.0%
19	3	0	0.0%	3	100.0%	0	0.0%	0	0.0%

The distribution of blood pressure as per JNC V11 classification as per age and gender is shown in Tables 4 and 5.

**Table 5: The distribution of blood pressure as per JNC V11 classification as per age and gender**

M.Age	Stage								
	Female	Low (expect all other cases)		Normal (<120/80)		Pre-Hypertensive (120-139/80-89)		Stage 1 Hypertensive (140-159/90-99)	
		N	N	N%	N	N%	N	N%	N
12	37	3	8.1%	34	91.9%	0	0.0%	0	0.0%
13	146	10	6.8%	132	90.4%	3	2.1%	1	0.7%
14	144	15	10.4%	125	86.8%	3	2.1%	1	0.7%
15	136	19	14.0%	116	85.3%	1	0.7%	0	0.0%
16	170	20	11.8%	148	87.1%	2	1.2%	0	0.0%
17	57	5	8.8%	48	84.2%	4	7.0%	0	0.0%
18	3	0	0.0%	3	100.0%	0	0.0%	0	0.0%
19	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%
21	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%

The prevalence of pre-hypertension as per JNC VII classification is 1.30% and 1.86% in male and female adolescents (across the age groups) respectively. In this study, among hypertensive adolescents, positive family history for high blood pressures is 64.28% and for Type-2 Diabetes Mellitus is 53.57% i.e. either in parents or grand parents have been reported. This is found to be a non-significant association ( $p < 0.05$ ).

**Table 6: The distribution of BMI age and gender**

Variable				Mean	Percentile				
					05	25	75	95	99
Gender	Female	Age	12	17.77	13.70	15.63	19.04	26.90	26.94
			13	18.40	13.14	15.43	19.91	27.87	36.00
			14	18.78	13.42	16.00	20.37	24.65	33.70
			15	19.31	14.86	16.65	21.34	26.17	29.05
			16	19.80	15.04	17.12	22.48	26.91	29.76
			17	19.56	15.06	17.36	20.93	26.67	29.86
			18	20.65	16.66	16.66	26.24	26.24	26.24
			19	27.06	27.06	27.06	27.06	27.06	27.06
	Male	Age	12	17.89	13.20	15.23	19.90	23.34	31.24
			13	17.76	13.15	14.81	20.17	24.26	27.06
			14	17.84	13.15	14.98	19.84	25.39	27.51
			15	18.64	13.78	15.63	21.09	25.99	31.46
			16	19.99	14.71	16.73	22.68	27.97	40.97
			17	18.50	14.88	16.77	20.18	22.45	22.86
			18	21.66	15.24	17.47	21.28	43.83	55.47
			19	18.25	14.69	14.69	20.57	20.57	20.57

The prevalence of over weight and obesity among male students is 9.26% and 5.90% and 10.52% and 4.46% among female students.

The life style factors related findings in this study group are summarized in Table 7.

**Table 7: The life style factors related findings in the study group**

SI No	Risk factor	n	%	
1	History of high blood pressure in the family	460	29.87%	
2	History of high blood sugar in the family	473	30.71%	
3	History of heart diseases in the family	158	10.25%	
4	Frequency of consuming in a week a. Fruits	Never	123	7.98%
		1-2 times	871	56.55%
		3-5 times	375	24.35%
		6 times and above	171	11.10%
5	b. Vegetables	Never	102	6.62%
		1-2 times	474	30.77%
		3-5 times	498	32.33%
		6 times and above	466	30.25%
6	Non-vegetarian food items	Never	204	13.24%
		1-2 times	979	63.57%
		3-5 times	249	16.16%
		6 times and above	108	7.01%
7	Bakery items (chips, cakes, puffs, burgers)	Never	95	6.16%
		1-2 times	996	64.67%
		3-5 times	321	20.84%
		6 times and above	128	8.31%
8	Cool drinks (Fanta, Coke, Pepsi)	Never	202	13.11%
		1-2 times	902	58.57%
		3-5 times	277	17.98%
		6 times and above	159	10.32%
9	Daily Physical exercise other than playing in the week	No	1042	67.66%
		1-2 times for half hour	273	17.72%
		3-5 times for half hour	113	7.33%
		6 times and above for half hour	85	5.51%
		Others	27	1.75%
10	Hours of sleep per day	<4	29	1.88%
		4.1-8.00	1065	69.15%
		8.1-12	443	28.76%
		>12	3	0.19%
11	Practice	Yoga	196	12.72%
		Meditation	187	12.14%



## Discussion

Adolescent hypertension is a major risk factor for premature morbidity and mortality in developing countries including India. School going adolescents (11-19 years) are the vulnerable group as they are exposed to life style factors, which lead to the development of high blood pressure at a young age. The traditional risk factors like family history when complemented with unhealthy life style factors like reduced physical activity, poor eating habits, compromised quality of sleep and absence of relaxation methods are leading to emergence of the hypertension epidemic among adolescents in India. Research indicates that blood pressure increases with age and tracking of blood pressure is identified as an important public health preventive strategy when adopted successfully.

The distribution of systolic and diastolic blood pressure among boys and girls at different ages is summarized in results section. It shows varied readings related to biological and psychosocial factors. The appearance of menarche associated with high levels of anxiety is shown as higher systolic blood pressure reading among girls aged 12 and 13 years. The prevalence of hypertension (>95 percentile distribution per age) among male adolescents in this study is 1.9% and 1.72% among female adolescents. The studies across India have mentioned prevalence of hypertension among school children as varying from 0.46% to 21.5% [11,12]. The studies conducted among low income group

adolescents mentioned prevalence of hypertension as ranging from 2.8% [13] to 3.8 % [14] though the prevalence of hypertension is slightly more among girls this is not found to be statistically significant. This difference based on gender among girls has been mentioned in a Finland study [15]. The prevalence of isolated systolic hypertension (>95 percentile distribution per age) among males is 0.71% when compared with 0.28% in females. In a New Delhi [16] study the prevalence of isolated systolic hypertension is stated as 2.7% and isolated diastolic hypertension as 2.0%. Earlier studies indicated that increased systolic blood pressure interacts with risk factors like obesity and diabetes and along with increased age amplifies the risk for age-related cardio-vascular events among males [17]. The prevalence of isolated diastolic hypertension (>95 percentile distribution per age) among males and females is 0.23% and 0.86% respectively. This difference among females is attributed to physiological changes associated with attainment of

puberty. Pre-hypertension as per JNC VII classification in this study is found to be 1.31% and 1.86% among male and female adolescents respectively. This is very less compared with study from Wardha [11], which mentioned pre-hypertension among rural school adolescents as 10.6%.

Family history for hypertension, cardiovascular disease and Type - 2 Diabetes Mellitus is identified as a strong determinant for predicting high blood pressure among adolescents. In this study, among 64.28% and 53.57% of hypertensive adolescents, positive history for high blood pressures and Type-2 Diabetes Mellitus in the family members i.e. either parents or grand parents have been reported. This is similar to the findings from studies [13,18], as the single most cause identified for high blood pressure among hypertensives' and lacks any associations with obesity or physical inactivity in this study.

Obesity is also recognized as a major risk factor for the development of hypertension [19]. Risk factors such as physical inactivity and unhealthy eating habits, which result in obesity, are found to be common among school adolescents in India. The distribution of BMI between 85 to 95 percentile for age and gender is considered over weight and above 95 percentile is obesity. The overall prevalence of over weight and obesity among male adolescents is 9.26% and 5.90% and 10.52% and 4.46% among female adolescents. The prevalence of over weight and obesity among male hypertensives' in this study is 37.5% and 12.5% compared with 33.33% and 16.66% among female hypertensives'. This association is found to be non-significant. This is comparable with rates of obesity reported in studies [5,12,16,19,20,23,24] across India.

Unhealthy dietary habits have been found to have a strong relation with increased rates of obesity in India [21,22]. In this study we attempted to document the dietary behaviors of adolescents as self-reported by them. This is qualitative information provided by the students and hence lacks any validation at this point but we believe this information will be useful to understand the dietary behaviors among school attending adolescents. The frequency of consumption of fruits in a week is 1-2 times among 56.55%, 3-5 times among 24.35% and 6 times and above in 11.10% of study participants. The frequency of consumption of vegetables in a week is 1-2 times among 30.77%, 3-5 times among 32.33% and 6 times and above in 30.25% of study participants. This low rate of consumption of



protective food items is also mentioned in similar study conducted by Puri et al [26]. Majority of the study participants i.e 63.57% stated they consume non-vegetarian food items 1-2 times a week, about 3-5 times in a week-16.16% and more than 6 times in a week-7.01%. Interestingly, 64.67% mentioned consuming bakery items 1-2 times per week, 3-5 times in a week-20.84%, and more than 6 times in a week-8.31%. Studies have identified similar rates of intake of junk food items as more favored than regular meals by adolescents [26-28] and their consumption is associated with increased rates of obesity among school adolescents [10, 26- 28].

Also a matter of concern is, 58.57% subjects mentioning 1-2 times intake of artificial sweetened beverages in a week, 3-5 times in a week-17.98% and more than 6 times in a week-10.32%. Globally there have been increasing trends of consumption of sweetened sugar beverages (SSB) among children and adolescents as is similarly reflected in our study subjects [29]. Physical inactivity is quoted as a factor contributing to increased rates of over weight and obesity among adolescents. In our study, 67.66% participants mentioned that other than physical education classes as part of curriculum they are not involved in any physical activity promoting schedules. Moderate rates of physical activity among adolescents are reported from rural Bengal [30] similar to our findings. Leisure time activities such as watching television is common among adolescents and 54.15% study subjects were watching TV for two hours during weekdays and 37.27% during weekends. Children watching more than two hours of television on weekdays had a statistically significant risk for obesity [25].

Adolescence is identified as a period of acute stress encountered in the process of growing. This might trigger high blood pressures in this vulnerable age group when associated with poor quality and less duration of sleep and lack of coping skills to overcome stress. In our study, 69.15% participants reported getting on an average 4-8 hours of sleep, and 28.76% as sleeping for 8-12 hours during weekdays nights. Studies reported that children who slept less than 8 hours at weekends are at high risk for development of obesity [25]. Only 12.72% study participants reported practicing yoga and 12.14% doing meditation regularly. Studies [31,32] reported that Yoga (NG IV) for 30 to 45 minutes/day, five days/week and transcendental meditation resulted in decreased blood pressures among hypertensive adolescents. This can be recommended to school authorities to be implemented in school curriculum.

## Conclusions:

Prevalence of hypertension is found to be less but life style factors, which can have negative effect on blood pressure, are highly prevalent. Preventive efforts should target school attending adolescents to promote healthy life styles habits. Imparting health education to students and also parents especially mothers will be an ideal strategy to improve health living among school attending adolescents as they grow into young adults.

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