Can Tho Journal of Medicine and Pharmacy 6(2) (2020)

BLOOD PRESSURE PERCENTILES AND HYPERTENSION ASSOCIATED FACTORS AMONG CHILDREN AGED 6-15 YEARS IN SOUTHERN VIETNAM

Truong Ngoc Phuoc[1,2], Tran Thi Nhu Le[1,3*], Bui Quang Nghia [1,2], Lieu Khanh Truong[4]

[1]Can Tho University of Medicine and Pharmacy
[2]Can Tho Children's Hospitsal
[3]Can Tho University of Medicine and Pharmacy Hospital
[4]Can Tho Central General Hosptial
**Corresponding author: ttnle@ctump.edu.vn*

ABSTRACT

***Objectives**: To determine blood pressure percentiles and hypertension associated factors including gender, and obesity in children 6-15 years old in southern Vietnam. **Methods**: Blood pressure was measured in a random sample of 1080 students aged 6-15 years who are studying at primary and secondary high schools in My Tho City, Vietnam. A descriptive cross-sectional study was conducted from November 2017 to June 2018. To diagnose children with hypertension, the blood pressure must be above the 95th percentile. Data were analyzed using IBM SPSS statistics software version 18.0. The relationship between hypertension and child demographic characteristics (gender, obesity) was analyzed using Chi-squared test. **Results**: the 95th percentiles of systolic and diastolic blood pressure of the children was 110/70 mmHg in the 6-year-old group, 120/75 mmHg in the 7-to-12-year-old group and 125/80 mmHg in the 13-to-15-year-old group respectively. The rate of hypertension in children was 10%. Male children had a 1.2 -time higher risk of hypertension than female children (p>0.05). Obese children had an 8.6 -time higher risk of hypertension than non-obese children (p<0.001). **Conclusions:** This study reported for the first time the blood pressure percentile chart of school children aged 6-15 years in Vietnam. The results supported useful information in early diagnosis and timely treatment of hypertension in children.*

***Keywords:** Blood pressure; Children; Hypertension; Percentile chart; Vietnam.*

I. INTRODUCTION

Hypertension can occur at any age [1]. However, hypertension in children was often neglected during the diagnosis. In a study from 1999 to 2006 of 14187 children ages 3 to 18 in Cleveland-United State, 507 of the children (3.6 %) had hypertension but only a quarter was diagnosed [2]. The report showed that lacking information of hypertension in children leads to the directly injurious effects in the diagnosis and treatment [3]. In fact, the standard blood pressure tables are essential to provide recommendations for diagnosis, evaluation, and treatment of hypertension [1]. The National Health and Nutrition Examination Survey 1999–2000 (NHANES) presented blood pressure tables including the 50th, 90th, 95th, and 99th percentiles by sex, age, and height [4]. A study in India [5] in 1999 (n = 10215 children) reported children aged 5-9 years had systolic blood pressure (SBP) ranged from 70-140 mmHg, diastolic blood pressure (DBP) ranged from 36 - 100 mmHg, while those of 10-14 years old children were 72 - 160 mmHg and 46 - 120 mmHg, respectively. This study also provided the rates of hypertension which were 11.9% for males and 11.4% for females. Meanwhile, Vietnam has not yet had a typical blood pressure table for children. The blood pressure tables for foreign children have been used so far in the diagnosis and treatment of

hypertension for children in Vietnam leading to errors due to a great difference in the weight and height between Vietnamese and foreign children. Up to now, the Vietnam National Association of Cardiology has not yet reported the status of hypertension in children. In present study determined "blood pressure percentiles and hypertension associated factors including gender, and obesity in 6-15-year-old children in southern Vietnam" with the following objectives purpose of the current study was to determine blood pressure percentiles and hypertension associated factors including gender, and obesity in children 6-15 years old in southern Vietnam.

II. METHODS

2.1. Ethics statement

The study was approved by Can Tho University of Medicine Research Ethics Committee. A descriptive cross-sectional study was conducted from November 2017 to June 2018. To diagnose children with hypertension, the blood pressure must be above the 95th percentile. Data were analyzed using IBM SPSS statistics software version 18.0. The relationship between hypertension and child demographic characteristics (gender, obesity) was analyzed using Chi-squared test.

2.2. Study population

A cross-sectional study was conducted in 6 schools in My Tho city, Southern Vietnam. My Tho has a population of 165074 in which the urban population accounts for 74.76%. The Kinh, the most predominant ethnic, accounts for 98% of the population of My Tho, followed by the Hoa ethnic group accounting for 1.89% and the remaining ones are Khmer and Indian ethnic groups. Regarding education, My Tho has 19 primary schools with 393 classes and a total number of 13880 students. On average, there were between 30 and 35 students per class There were also 7 secondary high schools with 229 classes and a total number of 9911 students, which were 40-45 students per class on average. These schools are located in 10 wards belonging to 4 communities. In terms of healthcare, there has not been a published study on hypertension in children as well as in adults. In this study, 1080 children of 10 age groups (the average age was 10.5 ± 2.87) distributing from grade 1 to grade 9 were enrolled. Each grade has 108 participants, except 9th grade with 216 children divided equally into two groups of ages including 14 and 15 years old. On average, each age group accounts for 10% of the total number of children enrolled in the study. Blood pressure in children was measured according to four steps.

Steps 1: Chose randomly 3 primary schools and 3 secondary high schools from 26 schools

Steps 2: Select all grade classes from the six randomly chosen schools

Steps 3: At each grade in any school, select randomly 36 children matching eligibility criteria

Steps 4: Collect statistics of all children that match the following selection criteria

The inclusion criteria of patients for the study were as follows: (1) 6-15-year-old male and female students are living and studying at primary and secondary schools in My Tho City during the study period. (2) Objects and families accepted to participate in the study. The blood pressure evaluation included a sphygmomanometer technique (seated, 3 times repeated) measurement of systolic and SBP; DBP [6]. Anthropometric measurements included body weight, height.

Exclusion criteria of patients for the study were as follows (1) Children with hand deformities whose blood pressure cannot be measured; (2) Children who drank coffee 1 hour before measuring; (3) Children who eat, drink, use alcohol or any other stimulant 30 minutes before measuring; (4) Children leave their bodies cold; (5) Children use tobacco, anti-edema drugs such as ephedrine, phenyl-propanolanin, dilated pupils …

2.3. Data analysis

Collecting research data was based on the use of survey questionnaires, blood pressure, height, and weight measurements on each patient. SPSS version 18 software was used to process the collected data. The relationship between hypertension and child demographic characteristics (gender, obesity) was analyzed using Chi-squared test.

III. RESULTS

3.1. Study population

In this study, 1080 children fit the criteria for disease selection. The information of the children was as follows: male students accounted for 48.8 and female students accounted for 51.2%; The average height of the children was 138.5 ± 15.7 centimeters (min 101, max 177.5); The average weight of the child was 34.7 ± 11.4kilograms (min 13.5, max 75); Average BMI was 17.6 ± 3.1 (min 10.5, max 42.3), average SBP was 101.9 ± 11.3 mmHg (min 60, max 145); average DBP was 63.2 ± 8.8 mmHg (min 38, max 100). When the average SBP increased to 1 mmHg, the average DBP would increase by 0.6 mmHg. SBP explained 59.6% of the variation of the average in the research sample (DBP= 2.45 + 0.6 *SBP; F = 1587.8, p <0.001, 95% confidence interval 35.61 - 41.88). The child's blood pressure index increased with age, the difference in systolic and DBP between ages was statistically significant (p<0.001). However, when comparing each age group separately, the 6-year-old children have the lowest systolic and DBP, children aged 7-12 years have lower SBP than children aged 13-15 years, all of these differences are statistically significant for each group (p<0.05); The difference in systolic and DBP in children aged 7-12 years and 13-15 years was not statistically significant (p> 0.05). (See Table 1)

Table 1. Describe the distribution of SBP and DBP by age.

Years	SBP				DBP			
	Median blood pressure (mmHg)	Standard deviation (mmHg)	Min (mm Hg)	Max (mm Hg)	Median blood pressure (mmHg)	Standard deviation (mmHg)	Min (mm Hg)	Max (mmHg)
6	93	9.03	80	120	55	7.69	38	70
7	99	9.58	80	130	60	7.55	45	80
8	99	9.12	80	120	62	7.58	43	80
9	101	9.27	80	130	63	7.27	45	80
10	99	9.71	78	130	62	7.22	48	80
11	101	10.31	80	140	63	7.48	50	90
12	103	12.78	80	142	63	8.53	50	100
13	109	9.56	90	130	70	8.32	42	90
14	106	10.63	80	130	67	7.34	50	80
15	109	12.39	80	145	68	8.24	50	88

3.2. Blood pressure percentiles of children

The 95th percentiles of systolic and diastolic blood pressure of children in the group of 6 years were 110/70mmHg, the group of 7 to 12 years was 120/75mmHg and the group of 13 to 15 years was 125/80 mmHg (see Table 2).

Table 2. Percentile blood pressure by age group.

Years	Number	Blood presure	Boys		Girls	
			(mmHg)			
6	108		90^{th}	95^{th}	90^{th}	95^{th}
		SBP	107	112	104	108
		DBP	67	72	63	68
7-12	648	SBP	112	122	109	117
		DBP	72	77	69	74
3-15	324	SBP	122	127	118	123
		DBP	81	80	80	79

3.3. The rate of hypertension in children

The rate of hypertension in children was 108(10%), this rate was concentrated mainly in secondary school children or students. The difference in the threshold rate and actually between ages was statistically significant (p<0.001). The hypertension rate for secondary school students was 2.6- time higher than primary school student, this difference was statistically significant (p<0.001). (See Table 3)

Table 3. Comparison of hypertension between middle and primary school students.

	Hypertension		Normal blood presure		OR (Cl 95%)	χ^2 p
	Number	Percentage	Number	Percentage		
Secondary school	76	14.1	464	85.9	2.6 (1.69 – 4.00)	19.91 p< 0.001
Primary school	32	5.9	508	94.1		

3.4. Risk factors for hypertension in children

Male children had a 1.2- time higher risk of hypertension, which is not statistically significant (p> 0.05); Obese children had an 8.6 -time higher risk of hypertension than non-obese children, this difference was statistically significant (p<0.001). (See Table 4)

Table 4. The relationship between the prevalence of hypertension and sex, obese.

		Hypertension		Normal blood pressure		OR (Cl 95%)	χ^2 p
		Number	Percentage	Number	Percentage		
Sex	Male	20	3.8	507	96.2	1.2 (0.65 - 2.44)	0.42 0.515
	Female	17	3.1	536	96.9		
Obese	Yes	23	12.1	167	87.9	8.6 (4.3 –17.1)	52.5 <0.001
	No	14	1.6	876	98.4		

IV. DISCUSSION

The SBP of male children was 2.6 mmHg higher than that of female children, this difference was statistically significant (p<0.001). This result was also consistent with the study of 6 countries in Europe (4, 7) (1991) with 28043 children the SBP of male children was 6 mmHg higher than that of female children. The average DBP of male and female children was not statistically significant (p> 0.05). The average difference in DBP among boys and girls were 0.27mmHg.

The 90th, 95th percentile SBP and DBP percentile in children aged 6-15 years in the study sample was lower than that of the blood pressure percentile classification of International Blood Pressure [1]. At the same time, the grouping of blood pressure was also different. However, the survey results of the blood pressure classification table of Children were indices from foreign children. The cause of this difference may be due to differences in race, habitat, organ between Vietnamese children and foreign children. Therefore, it was necessary to build a blood pressure index for children in Vietnam. There were 108 children with 10% hypertension and when compared with the results of Fonseca-Reyess' study [6] (2018) (10.4%) were similar. Diagnostic criteria for hypertension in children was very important because it affected the decisions of doctors [8]. Therefore, creating the classification of suitable blood pressure index for Vietnamese children's organs in diagnosis and treatment was very necessary.

Male children with hypertension accounted for 3.8%, girls with hypertension accounted for 3.1%, boys had a high risk of hypertension 1.2 times more than female children, however, this difference was not statistically significant (p > 0.05). Thus, in this study, the sex of the child didn't affect the hypertension of the child. This was also consistent with the epidemiological study of HA of 5 – 14-year-olds in New Delhi in India [5] (1999): the prevalence of hypertension in boys was 11.9%, in females was 11.4%. The difference was not statistically significant (p > 0.05).

The proportion of obese children with hypertension in this study was similar to the increase in hypertension in obese children in the study of Zhu. W [9], Leung, L. C. [10]. This difference may be due to the fact that the diet for children in each region affects their weight, which indirectly affects the SBP status in children. However, all three studies confirmed that obesity was a risk factor for hypertension in children.

V. CONCLUSION

The 95th percentiles of systolic and diastolic blood pressure of children in the group of 6 years was 110/70mmHg, the group of 7 to 12 years were 120/75mmHg and the group of 13 to 15 years was 125/80 mmHg. The rate of hypertension in children was 10%. Male children had a 1.2 -time higher risk of hypertension than female children (p>0.05). Obese children had an 8.6-time higher risk of hypertension than non-obese children (p<0.001).

The limitations of the study were the study only focused on the implementation of My Tho City with small sample size, so the blood pressure of Vietnamese children was not fully covered. Future orientation: (1) 108 children with hypertension in the study sample need to have a regular health check-up in order to take necessary tests to find the cause of hypertension; (2) Investigation on the situation of hypertension of children in the whole country; (3) Conduct further case studies on obesity association with hypertension in children for the purpose of recommendation and prevention

Acknowledgements: The authours are grateful to the members of Medicine department of Can Tho University of Medicine and Pharmacy in Vietnam.

Conflict of Interest: The authors declare that they have no conflict of interest.

REFERENCES

1. Xi B, Zong X, Kelishadi R, Hong YM, Khadilkar A, Steffen LM, et al (2016), "Establishing International Blood Pressure References Among Nonoverweight Children and Adolescents Aged 6 to 17 Years", *Circulation*, 133(4), pp. 398-408.
2. Hansen ML, Gunn PW, Kaelber DC (2007), "Underdiagnosis of hypertension in children and adolescents", *Jama*, 298(8), pp. 874-9.
3. Riley M, Dobson M, Sen A, Green L (2013), "Recognizing elevated BP in children and adolescents: how are we doing?", *The Journal of family practice,* 62(6), pp. 294-9.
4. National High Blood Pressure Education Program Working Group on High Blood Pressure in C, Adolescents (2004), "The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents", *Pediatrics,* 114(2 Suppl 4th Report), pp. 555-76.
5. Chadha SL, Vasan RS, Sarma PS, Shekhawat S, Tandon R, Gopinath N (1999) "Age- and height-specific reference limits of blood pressure of Indian children", *The National medical journal of India*, 12(4), pp. 150-6.
6. Fonseca-Reyes S, Romero-Velarde E, Torres-Gudino E, Illescas-Zarate D, Forsyth-MacQuarrie AM (2018) "Comparison of auscultatory and oscillometric BP measurements in children with obesity and their effect on the diagnosis of arterial hypertension" *Archivos de cardiologia de Mexico,* 88(1), pp. 16-24.
7. Falkner B, Daniels SR (2004) "Summary of the Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. Hypertension" 44(4), pp. 387-8.
8. Kavey RE, Daniels SR, Lauer RM, Atkins DL, Hayman LL, Taubert K, et al (2003) "American Heart Association guidelines for primary prevention of atherosclerotic cardiovascular disease beginning in childhood", *The Journal of pediatrics,* 142(4), pp. 368-72.
9. Zhu W, Huang X, He J, Li M, Neubauer H (2005) "Arterial intima-media thickening and endothelial dysfunction in obese Chinese children", *European journal of pediatrics,* 164(6), pp. 337-44.
10. Leung LC, Ng DK, Lau MW, Chan CH, Kwok KL, Chow PY, et al (2006), "Twenty-four-hour ambulatory BP in snoring children with obstructive sleep apnea syndrome", *Chest*, 130(4), pp. 1009-17.

(Received: 20/10/2019 - Accepted:26/12/2019)