

# INFLUENCE OF STRESSOR ON BLOOD PRESSURE IN SCHOOL CHILDREN

Sudung O. Pardede\*, Partini P. Trihono\*, Irene Yuniar\*\*, Taralan Tambunan\*

## ABSTRAK

### **PENGARUH STRES PADA TEKANAN DARAH ANAK SEKOLAH**

Telah diketahui bahwa stres fisik dan psikis dapat meningkatkan tekanan darah pada anak. Kemarahan yang merupakan stres psikologis biasanya akan meningkatkan tekanan darah, sedangkan ketakutan dan kesedihan dapat menurunkan tekanan darah. Tujuan penelitian ini adalah untuk mengetahui pengaruh pemeriksaan fisik dan fungsi vena pada anak usia sekolah terhadap tekanan darah. Penelitian ini merupakan penelitian deskriptif, pre and post test study yang merupakan bagian dari suatu penelitian skrining yang dilakukan terhadap murid sekolah dasar di Cibubur, Jakarta Timur. Pengukuran tekanan darah dilakukan sebelum dan setelah pengambilan darah vena. Pada penelitian ini didapatkan 449 anak, tetapi 9 di antaranya dikeluarkan karena data yang tidak lengkap pada 7 anak dan 2 anak pingsan setelah pengambilan darah vena. Peningkatan tekanan darah sistolik didapatkan pada 121 (27,5%) anak, penurunan tekanan darah sistolik pada 42 (9,5%) anak, dan tidak ada perubahan tekanan darah sistolik didapatkan pada 277 (63%) anak. Peningkatan tekanan darah diastolik didapatkan pada 123 (28%) anak, penurunan tekanan darah diastolik pada 38 (8,6%) anak dan tidak ada perubahan tekanan darah diastolik pada 279 (63,4%) anak. Tekanan darah sistolik dan diastolik meningkat pada 61 (13,8%) anak, tekanan darah sistolik dan diastolik menurun pada 14 (3,2%) anak, dan tidak ada perubahan pada tekanan sistolik maupun diastolik didapatkan pada 195 (44,3%). Kesimpulan: pada sebagian besar (63%) anak usia sekolah, pungsi vena tidak menyebabkan perubahan tekanan darah.

## INTRODUCTION

Blood pressure in normal children varies with age, sex, height and weight. Following birth, the systolic and diastolic blood pressure increases gradually. Systolic blood pressure stabilizes during the first year of life, followed by its gradual increase during the remainder of childhood and adolescence. Diastolic blood pressure shows a gradual decline and then rises slowly during the first year of life, and remains stable relatively until the 5 years of age, and increases gradually

throughout childhood and adolescence. Heavier and or taller children generally have higher blood pressure than leaner and smaller children of the same age. In children and adolescents, systolic and diastolic blood pressure during sleep at night is approximately 10% lower than during the day time.<sup>1)</sup> Blood pressure increases during exercise and mental stress and is identified as an important predictor of subsequent blood pressure levels in adolescents and young children.<sup>1-2)</sup> Treiber et al reported the relation of hostility and increasing of blood pressure.<sup>3)</sup> Transient

\* Department of Child Health, Faculty of Medicine, University of Indonesia – Jakarta

\*\* Undergraduate Medical Student, Faculty of Medicine, University of Indonesia – Jakarta.

elevation of blood pressure especially during crying or in an apprehensive child is common.<sup>1)</sup> Children usually are in anxiety condition when they are facing a venipuncture procedure. Anxiety, a psychological or a mental stressor may increase blood pressure. Some literature reported the relationship between mental stress and blood pressure,<sup>1)</sup> but so far we couldn't find the literature about the relation of venipuncture procedure and increased of blood pressure in children.

The aim of this study is to evaluate the role of a venipuncture as a stressor in altering blood pressure in school children.

## SUBJECTS AND METHOD

This study is a descriptive, pre and post test design held in 4 elementary schools in Cibubur Subdistrict, East Jakarta, in August 1999, consisting of 3 governmental schools and 1 private school. This study is part of an integrated study aimed to look at baseline data of school children. Informed consent were requested from the parents before the study. The procedure of the study was explained to all students, consisting of anamnesis, physical examination including blood pressure measurement, and a venipuncture procedure for blood tests. Blood pressure was measured before and after a venipuncture by pediatricians and pediatric residents at the right arm after the child had been sitting quietly for a few minutes. The blood pressure cuffs covered at least two third of the upper arm, and with bladder encompassing most of the circumference of the arm without overlapping.

The criteria of normal blood pressure and hypertension was based on The Task Force on Blood Pressure Control in Children. It is recommended that systolic and diastolic blood pressure below the 90<sup>th</sup> percentile for age and sex be considered normal. Systolic and diastolic blood pressure readings in the range of the 90<sup>th</sup> to 95<sup>th</sup> percentile for age and sex be regarded as high normal. Hypertension is defined if systolic and diastolic blood pressure greater than the 95<sup>th</sup> percentile for age and sex.<sup>5</sup> In this study, the alteration between blood pressure measurements before and after a venipuncture was considered significant if it changed 10 mmHg or more.

## RESULT

This study was performed in 449 children, consisting of 217 boys and 232 girls. Nine children were excluded because of incomplete data in 7 and 2 children had syncope after venipuncture procedures. None of the children in this study had hypertension. After physical examination and the venipuncture were done, increased systolic blood pressure was found in 121 children (27.5%), and decreased of systolic blood pressure was found in 42 children (9.5%), while unchanged systolic blood pressure was found in 277 children (63%). Increased diastolic blood pressure was found in 123 children (28.0%), decreased diastolic blood pressure was found in 38 children (8.6%), unchanged diastolic blood pressure was observed in 279 children (63.4%). Increased of systolic and diastolic blood pressure were found in 61 children (13.8%), increased of systolic blood pressure and unchanged of diastolic blood

pressure were found in 58 children (13.2%), increase of systolic blood pressure and decrease of diastolic blood pressure were found in 2 children (0.5%). Decreased of systolic blood pressure and unchanged of diastolic blood pressure were found in 26 children (5.9%). Systolic blood pressure decreased and diastolic blood pressure increased in 2 children (0.5%), systolic and diastolic blood pressure decreased in 14 children (3.2%). Unchanged systolic blood pressure

accompanied with increased diastolic blood pressure were found in 60 (13.6%) children. Unchanged systolic and diastolic blood pressure were found in 195 (44.3%) children, and unchanged systolic blood pressure and decreased of diastolic blood pressure were found in 22 (5.0%) children. Although systolic and diastolic blood pressure increased in 121 (27.5%) and 123 (28.0%) children, there were no children with hypertension before and after venipuncture procedure.

**Table 1. The alteration of blood pressure in the children after a venipuncture procedure.**

No.	Systolic	Diastolic	No. of cases	%
1.	Increased	Increased	61	13.8
2.	Increased	Unchanged	58	13.2
3.	Increased	Decreased	2	0.5
4.	Decreased	Increased	2	0.5
5.	Decreased	Unchanged	26	5.9
6.	Decreased	Decreased	14	3.2
7.	Unchanged	Increased	60	13.6
8.	Unchanged	Unchanged	195	44.3
9.	Unchanged	Decreased	22	5.0
<b>TOTAL</b>			<b>440</b>	<b>100</b>

## DISCUSSION

The prevalence of hypertension in childhood is not clearly defined and depends on the definition of hypertension chosen. The prevalence of hypertension in children is probably between 10%-3%.<sup>6)</sup> Fixler et al reported that the frequency of increase of systolic and diastolic blood pressure in school children were 1,2% and 0,3%.<sup>7)</sup> Rames et al reported that prevalence of hypertension in school children was <1%.<sup>8)</sup> In this study, there was no hypertension in 440 children, and this was probably caused by the small sample size.

Many factors play a role in blood pressure increase. In children, physiological stress could increase blood pressure<sup>1,4,7,9)</sup> but the role of physical activity in regulating of blood pressure is uncertain.<sup>4,10)</sup> Klesges et al reported that physical activity is not related to blood pressure in cardiovascular benefit to accrue.<sup>11)</sup> The relation of activity and cardiovascular risk depends on age, and this do not occur in children because inability of children to do aerobic activity.<sup>12)</sup> Blood pressure is labile in infancy and blood pressure rises during feeding, upright position, and sucking.<sup>9)</sup>

Psychological or mental stress increase blood pressure by the influence of the sympathetic system. Hyperactivity of the sympathetic system plays a significant role in the pathogenesis of elevation of blood pressure in children in different ways.<sup>1-2,4,13)</sup> Blood volume is shifted from peripheral to central area, cardiac output increases, total peripheral resistance remains unchanged, and blood pressure rises. With regard to acute environmental stress, hormonal system are activated. Sympathetic system activates the renin aldosteron system, and the pituitary is stimulated to increase its release of ACTH and vasopressin. Lesser degrees of excitement including mental arithmetic and playing electronic games, can increase blood pressure.<sup>4)</sup>

Physical activity and psychological stress generate increased blood pressure. Evaluating the influences of the stressor on increase of blood pressure is comparing the blood pressure before and after influence by a stressor. The explanation of study procedures, physical examination including blood pressure measurement, and venipuncture procedure are believed as a psychological or mental stressors for the children. After the study procedures were finished, it was hoped that the children were in quiet condition and so the blood pressure would turn to normal condition or lower than the first blood pressure examination.

Although we did not perform intra and interobservers evaluation, we believe that the result of blood pressure examination were valid because the examiners were pediatricians and pediatric residents. We measured blood pressure before and after venipuncture procedures.

By measuring the blood pressure before and after the venipuncture procedure, we assume that the alteration of blood pressure detected was due to such procedure as a stressor. Unfortunately, there was no data of children's blood pressure before the study procedures, so we were not able to find out the influence of such stressor on blood pressure.

Stressor in children may produce excitement, anger, fear, and grief. These stressors will control heart rate via sympathetic and parasympathetic nerve to heart and baroreceptor-mediated reflexes changes in heart. Excitement and anger will increase heart rate and produce increase systolic blood pressure, while increase in peripheral vascular resistance cause increase diastolic blood pressure. Fear and grief will decrease heart rate and produce bradycardia and hypotension.<sup>13)</sup> In this study, most of the children showed no changes either systolic blood pressure (277 children or 63%) nor diastolic blood pressure (279 children or 63.4%). This was probably caused by the fact that psychological stressor itself was not sufficient to alter blood pressure or the effect of psychological stressor has disappeared. Systolic blood pressure increased in 121 (27.5%) children and diastolic blood pressure in 123 (28%) children. This may be caused by influences of psychological stressor effect such as emotion and anger, and this effect will disappear in a few minutes but it is uncertain how long the psychological stressor effect will disappear. The variation of blood pressure alteration that was observed in this study, reflected the variation of individual response to stressor stimuli. Some children responded well to the stressor given while the others showed

the stressor given while the others showed no response at all. In this study, two children were excluded because of syncope due to hypotension.

In conclusion, in 63% of school children, psychological stressor do not alter blood pressure, either systolic or diastolic. In 44,3% school children, systolic and diastolic blood pressure was stable after the influence of stressor.

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