

Prevalence and Factors that Influence Hypertension in Adolescents in Central Jakarta

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Abstract Hypertension in adolescent has been often associated with other cardiovascular risk factors. Contributing factors of hypertension in adolescent are multifactorial. We aim to determine the prevalence of hypertension in adolescent and its potentially associated factors. A cross-sectional study involved 313 children aged 12-18 years, where were randomly selected from Junior High Schools in Central Jakarta. Information about family history, race/ethnic, birth weight, physical activity levels, smoking and consumption of alcohol was gathered by questionnaire. Body weight, height, and blood pressure were measured. Hypertension was defined according to the Fourth Report of National High Blood Pressure Education Programme Working Group on High Blood Pressure in Children and Adolescent. The study included 313 adolescents with mean age 13.97 ± 1.02 years. Prevalence of hypertension was 9.6%. Bivariate analysis showed that family history of hypertension (parental hypertension; $p = 0.012$; CI 95% = 1,20-6,02) and overweight/obesity ($p < 0.001$; CI 95% = 2,99-14,42) were significantly associated with hypertension. The multivariate analysis indicated that overweight/obese adolescents displayed six times more chance of having hypertension than adolescents with light/normal weight (OR = 6.5; CI 95% = 2.99-14.43). Gender, low birth weight, race/ethnic, physical activity, and smoking were not significantly associated with hypertension. The prevalence of hypertension in the sample studied was high. Overweight/obesity and family history of hypertension were significantly associated with hypertension. The prevention of overweight and obesity can decrease the prevalence of hypertension.

Keywords: hypertension, prevalence, adolescent

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1. Introduction

Hypertension is a common disease worldwide and is associated with increased risk of myocardial infarction, stroke, heart failure, retinopathy, and renal failure in adults. [1] Prevalence of hypertension is increasing with age. Around 15% occurs in young adult and 60% in people aged above 65-year-old. [2] Hypertension in adulthood may occur from childhood and adolescence. Hypertension in the adolescent can remain until adulthood period and it has higher morbidity and mortality. [3] Measurement of blood pressure in adolescents is needed to identify or to assure hypertension. The management of hypertension in adolescents can reduce the prevalence of hypertension in the adulthood.

Adolescence is a time of transition from childhood to young adulthood. At this time, great and rapid changes in the growth process of physical, cognitive, and psychosocial/behavioral and hormonal occurs. These changes lead to lifestyle, diet, relationships, eventually increasing the risk of health problems in adolescents including hypertension. [5]

The prevalence of hypertension in adolescents may vary. Studies in many developed countries observed the

prevalence between 1.3 and 21.6%. [6] McNiece et al, in a adolescents study with participants aged between 11-17 years in 2003-2005, found the prevalence of pre-hypertension and hypertension were 15.7% and 3.2% respectively. [7] In Indonesia, Wila Wirya et al (1988) in the study observed that prevalence of hypertension in school-aged children from 6-18 years was 3.11%. [8] Thaib et al (1993) in Medan reported the prevalence of hypertension were 4.5% in boys and 4.6% in girls aged 6-16 years. [9]

2. Materials and Methods

This is a cross-sectional analytic study investigating the prevalence and contributing factors of hypertension in junior high school students in Central Jakarta after obtaining ethical approval from the Research Ethics Committee of Medical Faculty of University of Indonesia. Participants were selected based on cluster random sampling with inclusion all adolescents in junior high school in Central Jakarta while those parents refusing to join would be excluded, absence on the day of the study, suffering from congenital abnormalities/syndromes/hormonal potentially causing hypertension and were taking antihypertensive medication during recruitment.

After receiving permission from the school and arranged a class for subjects, researcher distributed questionnaires, information, and informed consent forms. Subjects were included if willing to follow study examination which measured weight, height, blood pressure, and physical examination. Weight was measured with a student wearing uniform using weight scales without shoes. Weight was measured using string scales which were rounded to the nearest 0.5 kg. Height was measured on stand-up position with students' back against to the wall, straight face facing forward, feet pressed together without shoes. Height was measured using a measuring instrument that has been calibrated to the nearest 0.1 cm. Blood pressure was measured using a digital blood pressure measurement device Omron HEM-7111 models. The measurement was taken in the sitting position with exposed outstretched right arm on the table, and examination performed three times with 5-minute interval. Hypertension criteria were established based on the Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescent (2004). [11]

Birth weight is the weight measured within an hour post-natal. Birth weight were grouped into low birth weight (LBW) if 1500-2499 grams, normal if 2500-3999 grams or high if ≥ 4000 gram. [12] Birth weight obtained based on the questionnaire. Nutritional status of the subjects was assessed by clinical examination and anthropometric body weight and height plotted on the NCHS/CDC 2000 curve and classified as obese, overweight, good nutrition, and malnutrition. Obesity, if body weight based on the subject of body height was above 120% and body mass index (BMI) on the age and gender measured above the 95th percentile. Overweight, if body weight based on the subject of body height is between 110-120% and the calculation of body mass index (BMI) according to age and gender percentile lies

between 85-95%. Good nutrition, if body weight based on the subject of body height is between 90-110%. Malnutrition, if body weight based on subject of body height 70-90%. [13]

Measurement of physical activity performed by the Global Physical Activity Questionnaire (GPAQ). This questionnaire was developed by WHO to conduct a survey on the relationship of the risk of chronic disease and physical activity in the population, especially in developing countries. This questionnaire has been tested for its validity and reliability in nine developing countries including Indonesia. [14] Criteria of physical activity based on the result GPAQ analysis. [15]

The collected data were processed and analyzed using the software package for the social studies statistic version 17.0 for Windows (SPSS Inc). The data were presented in the form of narrative, tables, and graphs. Statistical tests used to test the hypothesis were unpaired categorical variables using chi-square test and for data that did not meet chi-square test criteria, Fischer test was used. A p-value < 0.05 was considered statistically significant.

3. Results

This study was conducted in four junior high schools in Central Jakarta, consists of two public junior high schools and two private junior high schools were randomly selected from 36 public junior high schools and 65 private junior high school. Each school was taken one class from each grade (7,8, and 9). To all students in the class were distributed a questionnaire and consent form to be filled out and signed.

Most of the research subjects were females with the ratio of female to male ratio was 1.52: 1 and the average age of participants were 13.97 years (SD 1.02 years).

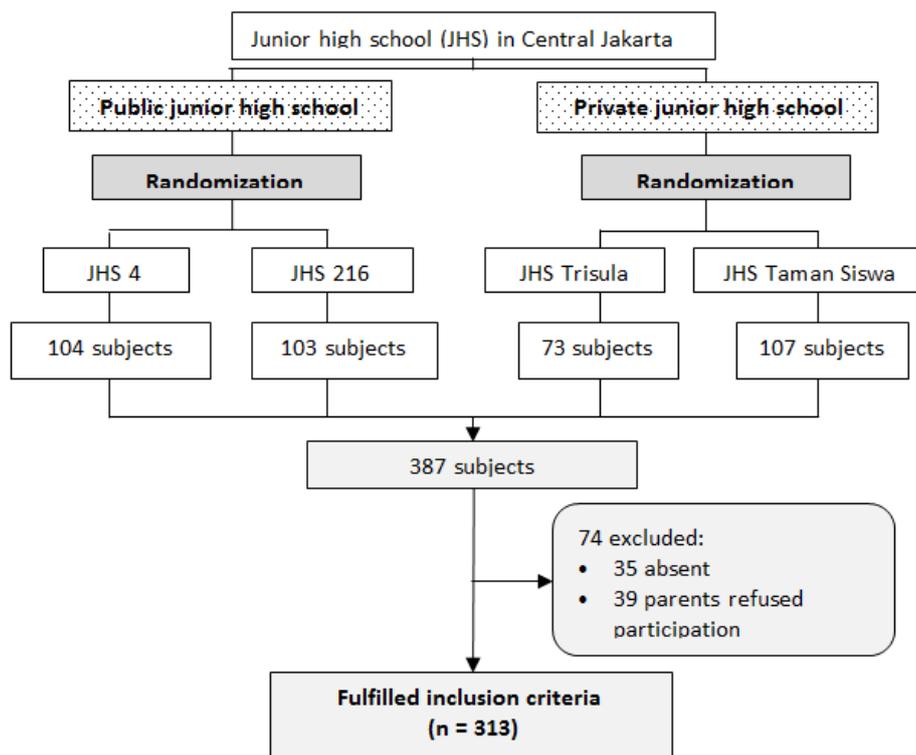


Figure 1. Study flow

Table 1. Subject characteristic

Characteristic	Category	N (%)
Age		Mean=13.97 ye ars (SD= 1.02)
Age group	Early adolescent (10-13 years)	112 (35.8)
	Mid adolescent (14-16 years)	198 (63.3)
	Late adolescent (17-18 years)	3 (1)
Gender	Male	124 (39.6)
	Female	189 (60.4)
Birth weighth	Small	14 (4.5)
	Normal	229 (73.2)
	Big	8 (2.6)
Nutritional status	Not remember	62 (19.8)
	Underweight	54 (17.3)
	Normoweight	195 (62.3)
Physical activity	Overweight	37 (11.8)
	Obese	27 (8.6)
	Low	196 (62.6)
Ethnic	Moderate	76 (24.3)
	High	41 (13.1)
	Java	158 (50.5)
Hypertensive father	Sundaness	58 (18.5)
	Betawi	45 (14.4)
	Minang	19 (6.1)
	Batak	8 (2.5)
	Palembang	4 (1.3)
	Others	21(6.7)
	Yes	61(19.5)
No	252 (80.5)	
Hypertensive mother	Yes	47 (15)
	No	266 (85)
Hypertensive parents (both)	Yes	19 (6.1)
	No	294 (93.9)
Total		313 (100)

Table 2 shows that 16.6% of the subjects had a smoking habit and most of the subjects had a father who had smoking habit (62%). The results showed that 15 of the subjects (4.8%) were at least ever tried to drink alcohol but only 2 subjects drink alcohol regularly with maximum intake of once in a month. They were not included in the criteria for risk factors of hypertension in this study.

Table 2. Smoking habit and alcohol consumption

Characteristic	Category	n (%)
Smoking subject	Yes	52 (16.6)
	No	261 (83.4)
Smoking father	Yes	194 (62)
	No	119 (38)
Smoking mother	Yes	19 (6.1)
	No	294 (93.9)
Both of parents	Yes	13 (4.2)
	No	300 (85.8)
Passive smoking	Yes	189 (60.4)
	No	124 (39.6)
Alcohol consumption	Yes	15 (4.8)
	No	298 (95.2)
Total		313 (100)

The results of this study indicate that the prevalence of hypertension in adolescent junior high school students in Central Jakarta is by 9.6% and pre-hypertension is 5.1%.

Table 3. Prevalence adolescence hypertension of junior high school students in Central Jakarta

	Hypertension N (%)	Pre-hypertension N (%)	Normotension N (%)
Male	16 (12.9)	12 (9.7)	96 (77.4)
Female	14 (7.4)	4 (2.1)	171 (90.5)
Total	30 (9.6)	16 (5.1)	(86.3)

Table 4 shows that there is a significant relationship between overweight / obesity and family history of hypertension to hypertension in adolescents.

Table 4. Bivariate analysis between gender, ethnicity / race, birth weight, nutritional status, physical activity, family history of hypertension, smoking and alcohol drinking with hypertension.

Variable	Hypertension		OR (CI 95%)	p value
	Yes n(%)	No n (%)		
Gender				
Male	16 (53.3)	108 (38.2)	0.54	0.119
Female	14 (46.7)	17 (61.8)	(0.25-1.15)	
Birth weight				
< 2500 gram	2 (7.7)	12 (5.3)	0.64	0.644
≥ 2500 gram	24 (92.3)	213 (94.7)	(0.14-3.20)	
Ethnicity				
Other than Jawa-Bali	5 (16.7)	47 (16.6)	1.00	1.000
Jawa-Bali	25 (83.3)	236 (83.4)	(0.37-2.76)	
Activity				
Low	20 (66.7)	176 (62.2)	1.216	0.777
Moderate-high	10 (33.3)	107 (37.8)	(0.54-2.39)	
Nutritional status				
Overweight/obesity	17 (56.7)	47 (16.6)	6.57	< 0.001
No	13 (43.3)	236 (83.4)	(2.99-14.42)	
Hypertensive father				
Present	11 (36.7)	50 (17.7)	2.69	0.012
Absent	19 (63.3)	233 (82.3)	(1.20-6.02)	
Hypertensive mother				
Present	6 (20)	41 (14.5)	1.48	0.422*
Absent	24 (80)	242 (85.5)	(0.57-3.83)	
Hypertensive parents (both)				
Present	3 (10)	16 (5.7)	1.85	0.409*
Absent	27 (90)	267 (94.3)	(0.51-6.77)	
Smoking subject				
Yes	7 (23.3)	45 (15.9)	1.61	0.298
No	23 (76.7)	238 (84.1)	(0.65-3.97)	
Smoking father				
Yes	21 (70)	173 (61.1)	1.48	0.341
No	9 (30)	110 (38.9)	(0.65-3.36)	
Smoking mother				
Yes	2 (6,7)	17 (6)	1.12	0.701*
No	28 (93,3)	266 (94)	(0.24-5.09)	
Both of parent				
Yes	1(3.3)	12 (4.2)	0.78	1.000
No	29 (96.7)	271 (95.8)	(0.09-6.20)	
Passive smoking				
Yes	22 (73.3)	167 (59)	1.91	0.127
No	8 (26.7)	116 (41)	(0.82-4.44)	
Alcohol				
Yes	0 (0.0)	0 (0.0)	TD	TD
No	30 (100)	283 (100.0)		

4. Discussion

This research is reporting the prevalence and factors affecting hypertension in adolescent of junior high school students. However, this study had several limitations, namely the measurement of the level of physical activity carried out using a questionnaire based on subjective criteria. The evaluation of smoking risk factor and alcohol consumption also based on subjective criteria by using questionnaire and this was used by mentioning the identity so that collected data did not describe the true condition. Recall bias for some research questions, such as birth weight because some parents do not recall their children's birth weight.

The final results of this study found that the prevalence of adolescent hypertension was 9.6% with a systolic blood pressure and/or diastolic blood pressure greater than or equal to the 95th percentile for age, sex and height. This prevalence was higher than the prevalence of hypertension aged 15-24 years based on Riskesdas 2013 in the amount of 8.7%. [16] The results of this study is higher if compared to Savitha dkk [17] research in India at the age of 10-16 years at 6.61% and research of da Silva dkk [18] in adolescents aged 14-17 years in Brazil by 7.4% but lower than a similar study by Jago dkk [19] and Sundar dkk [20] the prevalence of hypertension in adolescents was 23.9% and 21.5%. Study of Wila Wirya et al (1988) in Jakarta in children aged 6-18 years reported a prevalence of hypertension was 3.11% and Thaib et al (1993) in Medan in children aged 6-16 years reported a 4.5% prevalence of hypertension in boys and 4.6% in girls. [8,9] The reason for the difference between the prevalence of hypertension in this study and those in the previous studies may be related to different age-groups of participants.

In this study, the percentage of boys suffering from hypertension was higher than the girls, 12.9% and 7.4%, respectively. Bivariate analysis showed there was no significant relationship between gender and the prevalence of hypertension ($p = 0.119$). The results of da Silva study, boys are more likely develop hypertension than girls significantly. [18] Research conducted by Sundar et al in India in adolescents aged 13-17 years also demonstrated the boy had higher prevalence of hypertension than the girls significantly. [20] This study also found that the prevalence of hypertension of boys are higher than girls not significant. It may be due to the different proportion of male and female students in this study compared to by Da Silvas and Sundar. Prevalence of hypertension in boys in the study of da Silva and Sundar showed higher than observed in girls.

Family history of hypertension was present in 46.7% of hypertensive vs 26.5% of non-hypertensive, which was statistically significant. In this study, there was a significant association between high blood pressure with a family history of hypertension. This is consistent with several previous studies. Research in Lagos, Nigeria showed that adolescents with a family history of hypertension had systolic and diastolic blood pressure were significantly different from adolescents without family history of hypertension. [21] Okoh et al study in children aged 6-12 years showed that family history of hypertension associated with higher prevalence of

childhood hypertension than was seen children without a family history of hypertension. [22] In addition, research Mijinyawa et al noted that adolescents with hypertension in Kano, Nigeria had family history of hypertension is twice as large compared to adolescent who have family normotensive. [23] Children who have family history of hypertension should be targeted in primary prevention by monitoring blood pressure and diabetes management and lifestyle modification.

Some studies comparing blood pressure between African – American children and Caucasian showed that the blood pressure of African American children is higher than Caucasian children. [2] Brady et al study showed more than 13 years of age, the blood pressure of African American children were significantly higher than for non-African American. The causes of this discrepancy are due to differences in diet, vascular reactivity, and environment. [24] Riskesdas data 2013 showed that the prevalence of hypertension in Indonesia at the age above 18 years outside of Java and Bali is higher than Java and Bali. The highest prevalence was in the Bangka Belitung (30.9%), followed by South Kalimantan (30.8%), East Kalimantan (29.6%) and West Java (29.4%). [16] Previously, there was no studies investigating relationship between hypertension and race/ethnicity in Indonesia. This study showed no significant relationship between the race in the Java-Bali and race outside Java-Bali.

Less optimal nutrient in uterine will restrict fetal growth and result in LBW, so LBW clinical clues from the environment in the uterine is less than optimal and the risk factors for chronic diseases later in life. Several studies suggest an inverse relationship between LBW and blood pressure in adolescents, yet not proven in this study. [25] In this study, 4.5% of the subjects had LBW and 14.2% of LBW suffering from hypertension. Bivariate analysis concluded that there was no significant association between birth weight and hypertension. Law et al found the increasing of blood pressure in children in China, Guatemala, and Chile having correlation to low birth weight. [26] This might be due to there are 19.8% of the subjects who did not fill birth weight data because parents do not recall the birth weight of the subject.

Several previous studies showed that blood pressure was higher in obese children than non-obese children significantly. [27,28] Eisenmenn et al reported more nutrition and obesity had correlation with high blood pressure significantly. [29] This study showed that there was a correlation significantly between more nutrient and obesity to hypertension case.

The correlation between obesity and hypertension had long been known but the exact mechanism of how the occurrence of obesity-induced hypertension has not been clear until now. Most research focuses on the pathophysiology of the three main things that is the autonomic system disorders, insulin resistance and abnormalities of structure and function of vessels. [27] Prevalence of insulin resistance in obese adolescents in Jakarta reported that the prevalence of hypertension in obese children was 34.8%. [30] It showed that there is correlation among obesity, insulin resistance, and hypertension.

Most of the subjects in this study had a low physical activity but bivariate analysis concluded there was no

significant relationship between physical activity and incidence of hypertension in this study. This finding is consistent with the observational study conducted by Klesges [31] and Brage [32] also found no association between physical activity and blood pressure in pre-pubertal children. This study showed different result with Leary [33] and Gidding [34] which stated that the more active children had lower systolic blood pressure. This difference can be caused by the amount of subjects was much greater in the two studies above (5505 and 964 subjects, respectively) compared to our study.

In this study the risk factors of smoking has no significant relationship with the incidence of hypertension, either smoking father, smoking mother, both of parents smoke, smoking subject and exposure to secondhand smoke. These results are in accordance with several other studies that stated there was no any correlation between smoking and hypertension. [18,35] Unlike the case with studies in the adult population suggest a link between cigarettes with hypertension and cardiovascular morbidity. [36] This may be caused by several things such as smoking not common in this population, most of subject just tried to smoke, and information given in the questionnaire could affect the results of this research.

The relationship between alcohol consumption and high blood pressure have been reported in some reports. Prevalence of systolic hypertension is more common in moderate and heavy drinkers than non-drinkers. [37] Alcohol consumption was considered was a risk factor in this research that caused the hypertension is the subject who consumed alcohol at least once in a week or minimum one glass in a week. In this study, there was no subject who met the criteria of alcohol consumption as risk factor for hypertension as the cause of the 15 subjects ever consumed alcohol, 13 subjects just tried to drink a glass and never drunk anymore, and the others (2 subjects) drunk maximum once a month.

Multivariate analysis was used to assess which variables had the strongest influence on the dependent variable. This study only revealed risk factor that has a significant relationship to the occurrence of hypertension. Overweight or obesity is the most powerful predictor of hypertension as a risk factor with OR 6.566 (95% CI 2.989 to 14.426). Similar results were also reported by Nur et al in the multivariate analysis investigating the risk factors of hypertension. It suggested body mass index gain is strong predictor of hypertension. [33]

5. Conclusions

Prevalence of hypertension in junior high school students in Central Jakarta was 9.6%. There was a significant association between family history of hypertension and overweight/obesity with hypertension. Prevention of overweight or obesity is expected to reduce the prevalence of hypertension in adolescents.

6. Suggestion

Frequent measurement of blood pressure of such cases, especially students with overweight and obesity, could be

an effective preventive method for the early detection of hypertension and its complications. Effective therapy and continuous health education concerning healthy lifestyle are also essential in adolescents.

References

- [1] McCrindle BW. Assesment and management of hypertension in children and adolescent. *Nat Rev Cardiol*.2010; 7: 155-63.
- [2] Barnstein D. Systemic hypertension. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF, editor. *Nelson Textbook of Pediatrics*. 18th Ed. Philadelphia: Elsevier Inc; 2007. p.1988-95.
- [3] Saing JH. Hipertensi pada remaja. *Sari Pediatri*. 2005; 6: 159-65.
- [4] Trihono PP. Tata laksana hipertensi pada anak. In: Prawitasari T, Kuswandani N, editor. *Manajemen penyakit pediatri di poliklinik*. Jakarta, IDAI; 2008. p.1-13.
- [5] Pardede N. Masa remaja. In: Narendra MB, Sularyo TS, Soetjningsih, Suyitno H, Ranu IGN, Wiradisuria S, editor. *Tumbuh kembang anak dan remaja*. Jakarta: Balai Penerbit IDAI; 2002. p.138-67.
- [6] Ejike C, Ugwu CE, Ezeanyika L. Variations in the prevalence of point (pre) hypertension in a Nigerian school-going adolescent population living in a semi-urban and an urban area. *BMC Pediatrics*. 2010; 10: 1-7.
- [7] McNiece KL, Poffenbarger TS, Turner JL, Franca KD, Sorof JM, Portman RJ. Prevalence of hypertension and pre-hypertension among adolescent. *J Pediatr*. 2007; 150: 640-4.
- [8] Wila Wirya IGN, Alatas H, Tambunan T, Harmanses S, Widiastuti E. Studies of blood pressure and prevalence of hypertension in schoolchildren in Jakarta. *Pediatr Indones*. 1988; 28: 183-9.
- [9] Thaib TM, Alam AM, Lubis AM, Ramayati R, Rusdidjas. Blood pressure values in school age children in Medan. *Pediatr Indones*. 1993; 34: 154-63.
- [10] Luma GB, Spiotta RT. Hypertension in children and adolescent. *Am Fam Physician*. 2006; 9: 1558-66.
- [11] National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics*. 2004; 114: 555-76.
- [12] Damanik SM. Klasifikasi bayi menurut berat lahir dan masa gestasi. In: Kosim MS, Yunanto A, Dewi R, Sarosa GI, Usman A, penyunting. *Neonatologi*. 1st Ed. Jakarta: Ikatan Dokter Anak Indonesia; 2008. p.11-30.
- [13] Syarif DR. Prinsip asuhan nutrisi pada anak. In: Syarif DR, Lestari ED, Mexitalia M, Nasar SS, editor. *Nutrisi pediatrik dan penyakit metabolik*. Jakarta: Balai penerbit IDAI; 2011. p.36-48.
- [14] Craig CL, Marshal AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, . International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc*. 2009; 35: 1381-95.
- [15] Surveillance and Population-Based Prevention. Department of chronic disease and health promotion, WHO. *Global physical activity questionnaire analysis guide*. Download: www.who.int/chp/steps. Accessed: February 27, 2014.
- [16] Badan penelitian dan pengembangan kesehatan kementerian kesehatan RI. *Riset Kesehatan Dasar 2013*. Download: <http://www.litbang.depkes.go.id>. Accessed : April 29, 2014.
- [17] Savitha MRK, Fathepur SSR, Kumar Y, Khan MA. Essential hypertension in early and mid-adolescence. *Indian J Pediatr*. 2007; 74: 1007-11.
- [18] Da Silva KS, de Farias JC. Risk factors associated with high blood pressure in adolescents. *Rev Bras Med Esporte*. 2007; 4: 213e-6e.
- [19] Jago R, Harrel JS, McMurray RG, Edelstein S, El Ghormlil L, Basin S. Prevalence of abnormal lipid and blood pressure values among an ethnically diverse population of eight-grade adolescents and screening implications. *Pediatrics*. 2006; 117: 2065-73.
- [20] Sundar JS, Andaikalam JM, Parameswari, Valamarthi, Kalpana, Shantaram. Prevalence and determinants of hypertension among urban school children in the age groups of 13-17 years in Chennai, Tamilnadu. *Epidemiol*. 2013; 3: 1-5.
- [21] Amadi C, Mbakwem A, Oke A, Ajuluchukwu J . Left ventricular mass of normotensive adolescent progeny of Nigeria hypertensives. *Internet J Cardiol*. 2011. Download: <http://ispub.com/IJC/10/1/9899>. Accessed: March 16, 2014.

- [22] Okoh BAN, Alikor EAD. Childhood hypertension and family history of hypertension in primary school children in Port Harcourt. *Niger J Paed.* 2013; 40: 184-8.
- [23] Mijinyawa MS, Iliyasu Z, Borodo MM. Prevalence of hypertension among teenage students in Kano, Nigeria. *Niger J Med.* 2008; 17: 173-8.
- [24] Brady TM, Fivush B, Parekh RS, Flynn JT. Racial differences among children with primary hypertension. *Pediatrics.* 2010; 126: 931-7.
- [25] Falkner B, Hulman S, Kushner H. Effect of birth weight on blood pressure and body size in early adolescence. *Hypertension.* 2004; 43: 203-7.
- [26] Law CM, Egger P, Dada O, Delgado H, Kylberg E, Lvin P dkk. Body size at birth and blood pressure among children in developing countries. *Intern J Epidemiol.* 2000; 29: 52-9.
- [27] Behjati M, Barkhordari K, Lookzadeh MH. The relation between blood pressure and body mass index in Iranian School age children. *Iran J Med Sci.* 2006; 31: 33-6.
- [28] Sorof J, Daniels S. Obesity hypertension in children. *Hypertension.* 2002; 40:441-7.
- [29] Eisenmann JC, Wrede J, Heelan KA. Association between adiposity, family history of CHD and blood pressure in 3-8 year-old children. *J Hum Hypertens.* 2005; 19: 675-81.
- [30] Pulungan AB, Puspitadewi A, Sekartini R. Prevalence of insulin resistance in obese adolescents. *Pediatr Indones.* 2013; 3: 168-72.
- [31] Klesges RC, Haddock CK. A multimethod approach to the measurement of childhood physical activity and its relationship to blood pressure and body weight. *J Pediatr* 1990; 116: 888-93.
- [32] Brage S, Wedderkop N, Ekelund U, Franks PW, Wareham NJ, Andersen LB, et al. Features of the metabolic syndrome are associated with objectively measured physical activity and fitness in Danish children: European Youth Heart Study. *Diabetes Care.* 2004; 27: 2141-8.
- [33] Leary SD, Ness AR, Smith GD, Mattocks C, Deere K, Blair SN. Physical activity and blood pressure in childhood. Findings from a population-based study. *Hypertension.* 2008; 51: 92-8.
- [34] Gidding SS, Barton BA, Dorgan JA, Kimm SYS, Kwiterovich PO, Lasser NL. Higher self-reported physical activity is associated with lower systolic blood pressure: the Dietary Intervention Study in Childhood (DISC). *Pediatrics.* 2006; 118(6): 2388-93.
- [35] Nur N, Çetinkaya S, Yılmaz A, Ayvaz A, Bulut MO, Sümer H. Prevalence of hypertension among high school students in a Middle Anatolian Province of Turkey. *J Health Popul Nutr.* 2008; 26: 88-94.
- [36] Mitchell BE, Sobel HL, Alexander MH. The adverse health effects of tobacco and tobacco-related product. *Primary Care: Clinics in Office Practice.* 1999; 26: 463-98.
- [37] Jerez SJ, Coviello A. Alcohol drinking and blood pressure among adolescents. *Alcohol.* 1998; 16: 1-5.