Original Research Paper

Volume - 7 | Issue - 6 | June - 2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

Physical Education

PREVALENCE OF OBESITY AND HYPERTENSION IN SCHOOL ADOLESCENTS

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ABSTRACT A cross sectional study on 165 healthy consented adolescent girls was conducted to find the correlation of obesity with blood pressure. The cut off for blood pressure were taken according to height percentile, age and sex specified in the fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents (2004) and body mass index as prescribed by WHO expert consultation (2004). Mean systolic blood pressure of subjects was 124.29 and diastolic blood pressure was 80.36. Statically significant positive correlation of SBP with weight (0.264), body mass index (0.286) and DBP (0.506) at ($p<0.01$) and DBP with weight (0.359), body mass index (0.389) and SBP (0.506) at ($p<0.01$) was seen. 18% girls had isolated SBP hypertension and 21% had isolated DBP hypertension. Overall prevalence of malnutrition was 21.81%, Overweight and obese girls were 8.48% and 7.87% respectively. It was concluded on the basis of the results that stage screening of blood pressure is recommended to take necessary steps to eradicate or fight with the evil effects of hypertension especially in girls.

KEYWORDS : Adolescents; Blood Pressure; Obesity; Body Mass Index; Girls.

1. Introduction

Raised blood pressure, systolic or diastolic at any age, in either sex is a contributor for all forms of cardiovascular disease (Kannel WB, 1975) and have a strong, continuous, graded, consistent, independent, predictive and etiologically significant relationship (Indian guidelines on hypertension, 2014) according to JNC 7 report (2004) 180 million Indian were found pre-hypertensive and 89 million hypertensive While hypotension was also reported to be relatively higher in Asian Indians (M Paul Annand, 2004). Hypertension can be detected if looked specifically during childhood; (Agarwal et al, 1983; Sundar et al, 2013; Savitha et al, 2007) and more persistent in overweight and obese adolescents (Sundar et al, 2013; Sorof & Daniels, 2002; KD Monyeki et al, 2006), whereas babies born with low birth weight suffer cardiovascular and/or metabolic diseases in their later age (Hoet and Hanson 1999). David Barker in 1988 forwarded the hypothesis of adult diseases in which he suggested that nutrition to foetus permanently changes the metabolic and structural level, which increases many health related risks in adulthood (Barker and Osmond 1988) Bogdarina I et al, 2007 suggested a link between utero and development of hypertension in adulthood due to environmental and genetic factors, linear relationship between body mass index and blood pressure was detected as the roots of hypertension and obesity could be tracked down to early age (Ivana Vaneckova et al 2014; Kunesˇ J & Zicha J 2009) linear relationship appeared between body mass index and blood pressure in different populations (Hall- 2003), body mass index and blood pressure have direct relation at the age of 8-11years (Falaschetti et al 2010), obesity is studied as major factor of hypertension in general population (Kannel – 2000), obesity is the most significant determinant of hypertension (Julius et al 2000). Thus, the present study is done to find out the correlation of obesity with blood pressure and the prevalence of prehypertension and hypertension in school going adolescents. Obesity is also prevalent among the adolescents (boys) as reported by Banik and Sharma (2016).

2. Research Methods

Study Design

The cross sectional study was conducted on private school going girls adolescent aged 12- 15 years of urban areas of Delhi, India.

Informed consent

Permission from head of institutions, parents filling consent forms from all 165 participants was taken before the study. They all were oriented and procedure, objectives and importance of the study was told. Those who refused to participate due to health and personal problems were excluded from the study.

Anthropometric measurements

The trained medical staff took all the measurements. The calibrated digital weighing machine, stadiometer were used for weight and height. Participants were asked to come barefoot and lightest clothing on for the measurements. Each adolescent was classified as normal weight; overweight and obese categories for BMI (WHO expert consultation, 2004) and height percentile, age and gender specifications for Systolic blood pressure and diastolic blood pressure were taken (National High Blood Pressure Education Program, 2004)[] Automatic digital blood pressure instrument (Omron HEM757) used and Participant were instructed not to consume any eatables, drugs or caffeinated drink and avoid any exercise at least 30 minutes before and be relaxed while giving their blood pressure readings. The chair was adjusted as per the sitting height of the participants to make sure the cuff is parallel to the heart and it was wrapped in the left arm approximately one-half inch above the elbow. Mean of three blood pressure readings with the interval of 30 minutes was recorded for statistical analysis.

Statistical Analysis

The relationship between physical fitness and Systolic blood pressure and diastolic blood pressure of obese and non-obese adolescents was analysed by calculating Pearson's product-moment correlation (Yefremenko A. et al, 2016). Mean and Standard deviation were also analysed using SPSS 16.0 version.

Results

Table 1: Descriptive Characteristics of Subjects (Mean and Standard Deviation) n=165

Variables	Age (years) 12		Age (years) 13		Age (years) 14		Age (years) 15		Collectively all categories	
	Mean	S. D	Mean	S. D	Mean	S. D	Mean	S. D	Mean	S. D
Height (cm)	153.64	5.11	179	7.25	151	9.42	167	4.88	159.33	7.74
Weight (kg)	50.84	11.31	68	13.97	65	10.30	50	8.26	54.52	11.60
Body mass index (kg/m^2)	21.84	4.45	21.2	5.00	28.5	2.85	17.93	3.55	21.41	4.15
SBP (mmHg)	159	16.73	124	13.08	120	11.41	132	15.07	124.29	14.30
DBP (mmHg)	98	14.10	83	16.59	76	9.37	95	9.78	80.36	13.35

Table: 2 Number of Girls as per age n=165

	Age of the Girls	No. of Girls	Value in Percentage
8th std.	12 years	39	23.63%
9th std.	13 years	50	30.30%

10th std.	14 years	35	21.21%
11th std.	15 years	41	24.84%
		165	100%

Table: 3 Categorization of girls as per Body mass index n=165

Categorization of girls as per Body mass index	Number of girls	Value in percentage
Under weight	36	21.81%
Normal weight	102	61.81%
Overweight	14	8.48%
Obese	13	7.87%
Total	165	100%

Table: 4 Correlation of systolic blood pressure with height, weight and body mass index n=165

	Height	Weight	BMI	DBP
SBP	0.957	0.264**	0.286**	0.506**

**. Correlation is significant at the 0.01 level (2-tailed).

Table: 5 Correlation of diastolic blood pressure with height, weight and body mass index n=165

	Height	Weight	BMI	SBP
DBP	0.890	0.359**	0.387**	0.506**

**. Correlation is significant at the 0.01 level (2-tailed).

Table: 6 Hypertension of isolated systolic blood pressure as per Body mass index

Body mass index category	Girls having SBP	Systolic Blood Pressure	
	93 (56.36%) out of 165	Pre-hypertension	Hypertension
Under Weight	14 (15.05%)	10	04
Normal weight	61 (65.59%)	45	16
Overweight	06 (6.45)%	06	----
Obese	12 (12.90%)	06	06

Table: 7 Hypertension of isolated diastolic blood pressure as per Body mass index

Body mass index category	Girls having DBP	Diastolic Blood Pressure	
	72 (43.63%) out of 165	Pre-hypertension	Hypertension
Under weight	15 (20.83%)	07	08
Normal weight	37 (51.38%)	26	11
Overweight	08 (11.11%)	06	02
Obese	12 (16.66%)	06	06

Table: 8 Prevalence of hypertension based on Systolic blood pressure n=165

SBP	**Age (years) 12**	**Age (years) 13**	**Age (years) 14**	**Age (years) 15**	**SBP (Category wise)**
Normal (<90 percentile)	12 (30.76%)	21 (42%)	18 (51.42%)	18 (43.90%)	69
Pre hypertension (90th to 95th percentile)	18 (46.15%)	22 (44%)	13 (37.14%)	14 (34.14%)	67
Stage 1 hypertension (95th to 99th percentile)	08 (20.51%)	06 (12%)	04 (11.42%)	09 (21.95%)	27
Stage 2 hypertension (>99th	01 (2.56%)	01 (2%)	-----	----	2
Total	39	50	35	41	

Table: 9 Prevalence of hypertension based on Diastolic blood pressure n=165

DBP	Age (years) 12	Age (years) 13	Age (years) 14	Age (years) 15	DBP (Category wise)
Normal (<90 percentile)	16 (41.02%)	25 (50%)	24 (68.57%)	25	90
Pre hypertension (90<95)	09 (23.07%)	12 (24%)	11 (31.42%)	10 (24.39%)	42
Stage 1 hypertension (95+5)	11 (28.20%)	06 (12%)	----	05 (12.19%)	22
Stage 2 hypertension (99+5)	03 (7.69%)	09 (14%)	----	01 (2.43%)	13
Total	39	50	35	41	

Graphical representation of tables:

Fig 1: Number of Girls as per age n=165

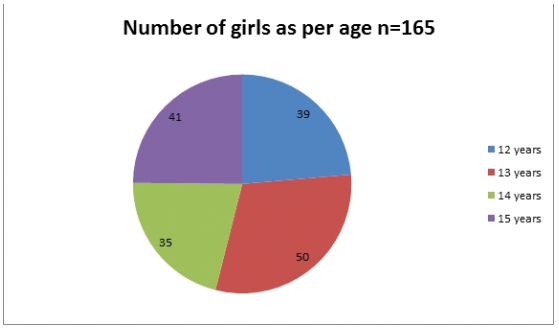


Fig 2: Categorization of girls as per Body mass index n=165

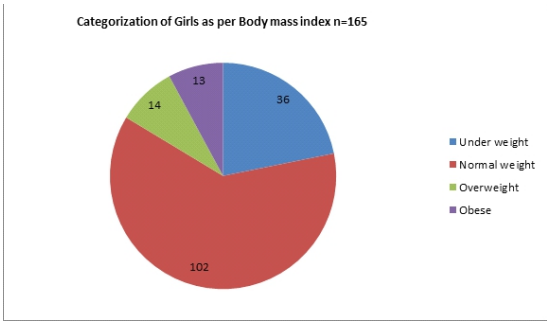


Fig 3: Hypertension of isolated systolic blood pressure as per Body mass index

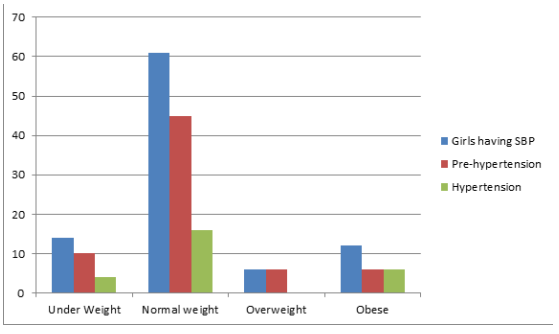


Fig 4: Hypertension of isolated diastolic blood pressure as per Body mass index

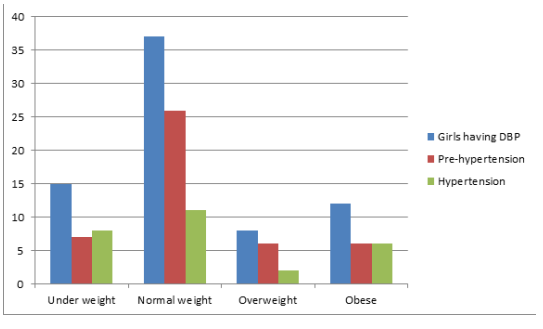


Fig 5: Prevalence of hypertension based on Systolic blood pressure n=165

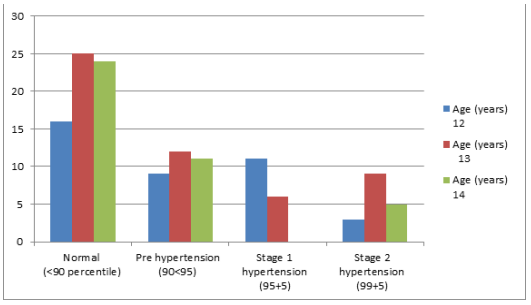
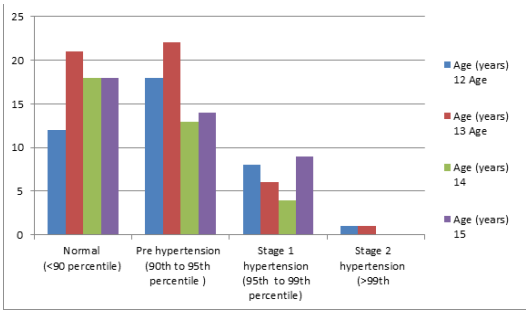


Fig 6 (Table 9)



Result and Analysis

Table 1 shows the mean age of 8th std. girl's ± 12 years, height (153.64cm), weight (50.84kgs), body mass index (21.84 kg/m^2), systolic blood pressure (159mmHg) and diastolic blood pressure (98mmHg). Standard deviation of height (5.11cm), weight (11.31kgs), body mass index (4.45kg/m^2), systolic blood pressure (16.73mmHg) and diastolic blood pressure (14.10mmHg). The mean age of 9th std. girl's ± 13 years, height (179cm), weight (68kgs), body mass index (21.22kg/m^2), systolic blood pressure (124mmHg) and diastolic blood pressure (83mmHg), standard deviation of height (7.25cm), weight (13.97kgs), body mass index (5.00kg/m^2), systolic blood pressure (13.08mmHg) and diastolic blood pressure (16.59mmHg). The mean age of 10th std. girls ± 14 years, height (151cm), weight (65kgs), body mass index (28.5kg/m^2), systolic blood pressure (120mmHg) and diastolic blood pressure (76mmHg), standard deviation of height (9.42cm), weight (10.30kgs), body mass index (2.85kg/m^2), systolic blood pressure (11.41mmHg) and diastolic blood pressure (9.37mmHg). The mean age of 8th std. girls ± 15 years, height (167cm), weight (50kgs), body mass index (17.93 kg/m^2), systolic blood pressure (132mmHg) and diastolic blood pressure (95mmHg), standard deviation of height (4.88cm), weight (8.26kgs), body mass index (3.55kg/m^2), systolic blood pressure (15.07mmHg) and diastolic blood pressure (9.78mmHg). Table 2 shows total number of girls as per their age and value in percentage. The 8th std. girl's mean ± age 12 years were 39 (23.63%), while the girls of 9th std. mean ± age 13 years were 50 (30.30%), whereas participants of 10th and 11th std. mean ± age 14 years 35 (21.21%) and 41 (24.84%) respectively. Table 3 displays the girls according to their body mass index category as per the recommendations of WHO, where 36 (21.81%) girls were underweight, 102 (61.81%) normal weight, 14 (8.48%) overweight and 13 (7.87%) obese. Table 4 illustrates the Pearson's product moment correlation of systolic blood pressure with height (r=0.957), weight (r=0.264), body mass index (r= 0.286) and diastolic blood pressure (0.506). Systolic blood pressure is significantly correlated with weight, body mass index and diastolic blood pressure at ($p<0.01$). Table 5 shows the Pearson's product moment correlation of diastolic blood pressure with height (r=0.890), weight (r=0.359), body mass index (r= 0.387) and systolic blood pressure (0.506). Diastolic blood pressure is significantly correlated with weight, body mass index and systolic blood pressure at ($p<0.01$). Table 6 explains the prehypertension and hypertension of 93 out 165 girls who had isolated systolic blood pressure as per the body mass index category. Total 14 (15.05%) girls came in the underweight category and out of which 10 were pre-hypertensive and 04 hypertensive, in normal weight category out of 61 (65.59%) 45 were found to have pre-hypertension and 16 had hypertension, in overweight category only 06 (6.45%) girls had prehypertension and none was suffering with hypertension were as in obese category 12 (12.90%) 06 were pre-hypertensive and similarly 06 were hypertensive. Table 7 illustrates the prehypertension and hypertension of 72 girls out of 165 who had isolated diastolic blood pressure as per the body mass index category. Total 15 (20.83%) girls came in the underweight category and out of which 07 were pre-hypertensive and 08 hypertensive, in normal weight category out of 37 (51.38%) 26 were found to have pre-hypertension and 11 had hypertension, in overweight category 08 (11.11%) girls had prehypertension and 02 were suffering with hypertension were in obese category 12 (16.66%) 06 were pre-hypertensive and similarly 06 were hypertensive. As shown in table 8 (fig – 5), the isolated systolic blood pressure in all age category 69 girls had normal SBP, 67 girls found to have prehypertension 27 girls were going through stage 1 hypertension and 02 had stage 2 hypertension. In table 9 (fig – 6), the isolated diastolic blood pressure in all age category 90 girls had normal DBP, 42 girls found to have prehypertension 22 girls were going through stage 1 hypertension and 13 had stage 2 hypertension.

India being a developing country is at the high risk of health problems with increased body weight and facing lot of challenges in health sector due to nutrition instability, less outdoor activities, tech savvy youth and burdened studies. Thus the present study has been done mainly to find out the presence of hypertension and obesity in school going girls' adolescents. According to results isolated systolic blood pressure was there in 93 out of 165 girls collectively in all normal weight categories, and 72 girls had isolated diastolic blood pressure in all normal weight category was found higher as compared to other weight categories. Interestingly the isolated diastolic blood pressure was found higher as compared to isolated systolic blood pressure in all the age groups and the mean body mass index of 11th std. girls came under weight category, may be at this age girls are more conscious about their weight due to psychosocial reasons and deliberately practice mal-nutritious or less food intake to look much more slimmer than others. Prevalence of malnutrition was 21.81% which is lower when compared to the study done on Delhi school going adolescents in 2014 (Annand T et al, 2014) and Prevalence of obesity in overweight and obese girls was 8.48% and 7.87% respectively which is found again lower as compared to study done on Delhi school going adolescents in 2015 (Bahl D et al, 2015) but found higher in females (3.3%) when compared to survey done in 2006 taking 2352 people from the age groups 15 to 64 years (J Mufunda et al, 2006)

Conclusions

In the present study, statistically significant positive correlation was observed between weight, height and body mass index with SBP and DBP which is similar to the findings have been reported by other authors (Bahl D et al, 2015). There are numerous studies that show enough evidence which emphasizes on screening for identification of adolescents with hypertension at early age (Sundar JS et al, 2013, Annand T et al, 2014; Banker CA et al, 2013; Kaur S et al, 2013). Thus, the health check-ups camps can be set up regularly in which simple and easy bodily measurements by trained personnel such as blood pressure, height and weight measurements for hypertension and obesity can be taken, so that education programmes related to healthy diet and importance of physical activities, obesity management courses, parents awareness programme can be organised and risks related to hypertension and obesity can be explained.

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