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PREVALENCE OF HYPERTENSION AND ITS RELATIONSHIP WITH BMI: A STUDY AMONG THE SUNNI MUSLIMS ADOLESCENTS OF LUCKNOW, UTTAR PRADESH, INDIA

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ABSTRACT

Hypertension is the leading cause of morbidity and mortality world widely. Onset of hypertension occurs mainly in the younger phase. The increasing trend of hypertension in children and adolescents in India may be due to the changes in the life styles, food habits, mental stress, playing video games in leisure time, television and lack of physical exercise. Keeping these in mind, the objectives of the present study was to evaluate the prevalence of hypertension in school going adolescents and its relationship with various BMI indices. This cross-sectional study was conducted among the 159 school going Sunni Muslims adolescents aged between 12 to 18 years residing at Aurangabad Jagir and Chillawava (sub urban areas), adjacent to the Lucknow City. Variables like Height, weight and Blood pressure level were measured following standard method. Statistical Analysis like mean, SD, t- test, ANOVA, correlation and regression were done using SPSS (V.20). The mean Height (cm) and Weight (kg) among the studied boys were 157.9 (12.1) and 44.0 (11.3) respectively whereas, among girls these were 148.4 (7.2) and 39.0 (7.7). These differences based on sex were statistically highly significant. The mean BMI among girls was slightly higher and this was not significant. The mean Systolic Blood Pressure (SBP) among boys was 119.1 (13.8) and among girls this was 113.7 (12.5) and the difference was statistically significant ($t = 2.46$; $p < 0.01$). The mean (SD) Diastolic Blood Pressure (DBP) in boys and girls were 75.9(10.6) and 74.5(10.3) respectively, which was not significant. Age changes had a great impact on all the anthropometric variables when considered as sex combined. SBP was correlated with severe thinness, whereas, DBP was correlated with Thinness. In this study we also observed that mean BMI was increases as the age increases and mean SBP and DBP was increases as BMI increases. The study revealed the fact that hypertension is prevalent among both the thin and severely thin (BMI group) adolescents.

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INTRODUCTION

Hypertension is one of the common non-communicable disease affecting both adolescents and adults. Recent global figure indicating that the prevalence of hypertension is not just a problem to the developed countries but the developing countries are facing by the same (WHO, 2013). Hypertension is the leading cause of morbidity and mortality world widely (WHO, 2008). Many people with hypertension are mostly unaware of their present condition and among those with hypertension, treatment is infrequent and inadequate. When selected major risk factor were assessed, the leading global risk for mortality in the world were found to be high blood pressure which accounted for 13% of the global deaths (WHO, 2011), Physical inactivity (6%), overweight and obesity (5%).

The global prevalence of hypertension has been increasing since 2000 (Barenon, 2002). It is projected to increase to 1.54 billion affected individuals and a prevalence rate of 29.4% in 2025 (Kearney *et al*., 2005). Hypertension is the common non communicable disease affecting mainly adolescents and adults (Juhasz *et al*., 2010). Onset of hypertension occurs mainly in the younger phase, if precaurtive measure is not taken properly then it can't be easily tackled (M C Niece *et al*, 2007). As the blood pressure increases with growth and the development of adolescents hypertension has been linked to obesity, which is the ultimate result of practicing sedentary behavior, insufficient physical activity and it is sometimes linked to familial history; and birth weight is also evident that children with elevated blood pressure tend to maintain that level of

blood pressure in adulthood (Anjana *et al*., 2005). Some adolescents appear hypertension that inherit from their parents, while others fall for maintaining poor lifestyle choices, which results in obesity and decreased cardiovascular fitness (Lewington *et al*., 2002). Pre hypertension has higher chances of developing hypertension within two to four years and cardiovascular complication when it is compared to normotensive (Huang *et al*., 2013). Detection and prevention of pre hypertension and hypertension in children and adolescents becomes important increasingly for reducing the global burden of disease due to hypertension. At the same time it also helps to prevent the long term effects (Rai *et al*., 2018). Indian Academy of Pediatrics recommended Annual Blood Pressure measurement of all children over three years of age in hospitals and clinics (Bagga *et al*., 2007). The symptoms of childhood hypertension are usually non specific, as most of the children are asymptomatic. Measuring and monitoring of blood pressure in children can also help to identify the actual underlying etiology, precaurtive measure and early management to avoid the catastrophic event (Das *et al*., 2017). The increasing trend of hypertension in children and adolescents in India may be due to the changes in the life styles, food habits, and consumptions of more food from outlets instead to nutrients and healthy food, mental stress, playing video games in leisure time, television and lack of physical exercise. It may also be stated that neighborhood cultural environment may have also influence on food habits. (Raj *et al*., 2007 and Afrifa-anane *et al*., 2015).

Most of the non communicable diseases are undiagnosed in most of the community because of their asymptomatic nature in the earlier phase of the diseases. Hypertension is one of the diseases which is diagnosed and treated in the 25% of the cases according to Rural Half (Park, 2009). Studies have documented that hypertension may begin in adolescents perhaps begin in childhood (De Man *et al*., 1991; Uhari *et al*.,1991; Yong *et al*.,1993). Prevalence of childhood hypertension is noted to be 5-10% in developing countries and 1-2% in developed countries (Luma and Spiotta, 2006). Prevalence of hypertension and pre hypertension in school children varies with region. Prevalence of HT in childhood is 4 to 15 % and that of pre HT is 5 to 25% worldwide (Ellenga *et al*., 2014). Previous studies from India have documented the prevalence of HT in children in urban area ranging from 2 to 6% and of pre HT as 12.3% and 10.8% respectively (Genovesi *et al*., 2011; Buch *et al*., 2011; Sharma *et al*., 2010; Verma and Singh, 2012).

Objectives: The objective of the present study was to evaluate the prevalence of hypertension in school going adolescents and its relationship with various BMI indices.

MATERIALS AND METHODS

Study area: This cross-sectional study was conducted in the two sub urbans areas of Lucknow city named Aurangabad Jagir and Chillawava. The samples were taken from the two schools named Suryabala Vidyalaya and M.C.D. Public School, located about 10 km. away from the Lucknow, Capital City of Uttar Pradesh, India.

Sample Size: This cross-sectional study was conducted among the 159 school going Sunni Muslims adolescents aged between 12 to 18 years residing at Aurangabad Jagir and Chillawava (sub urban areas), adjacent to the Lucknow City. In this study, the blood pressure and BMI were measured in 159 students among which 103 (64.8%) were boys and 56 (35.2%) were girls. According to age wise distribution 38 (23.9%) were aged 12 years, 24 (15.1%) were aged 13 years, 19 (11.9%) were aged 14 years, 16 (10.1%) were aged 15 years, 15 (9.4%) were aged 16 years, 16 (10.1%) were aged 17 years, 31 (19.5%) were aged 18 years. The samples were drawn with the help of school register. The ethnicity was checked and other than Sunni Muslim children were excluded.

Variables: Anthropometric variables like Height, Weight were measured following standard method (Lohman *et al*., 1988) and Blood pressure level was measured by using Sphygmomanometer.

Ethical consideration: Before taking the measurements consent was taken from the school authorities as well as also from the parents of the students.

Statistical analysis: Observation was expressed as percentage and mean (SD). Analysis was done using SPSS (V.20). The mean and standard deviation was found for age, BMI, Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP). Independent t - test was done for BMI Height, Weight, SBP and DBP to show sexual dimorphism. ANOVA was used to understand the effect of Age on Height, Weight, BMI, SBP and DBP. To test the correlation and regression analyses of BMI with SBP and DBP were done.

RESULTS

Table 1. Sexual dimorphism for Height, Weight, BMI, SBP and DBP

Parameters	Gender	N	Mean(SD)	t
Height	Boys	103	157.9(12.1)	5.39**
	Girls	56	148.4(7.2)	
Weight	Boys	103	44.0(11.3)	2.96**
	Girls	56	39.0(7.7)	
BMI	Boys	103	17.4(3.1)	0.49
	Girls	56	17.7(3.2)	n.s.
SBP	Boys	103	119.1(13.8)	2.46**
	Girls	56	113.7(12.5)	
DBP	Boys	103	75.9(10.6)	0.81
	Girls	56	74.5(10.3)	n.s

** = $p<0.01$; n.s. = not significant

Mean (SD) and sexual dimorphism were represented through the Table 1. The mean Height (cm) and Weight (kg) among the studied boys were 157.9 (12.1) and 44.0 (11.3) respectively whereas, among girls these were 148.4 (7.2) and 39.0 (7.7) respectively. These differences based on sex were statistically highly significant. In case of height it was ($t = 5.93$; $p<0.01$) and in case of weight it was ($t = 2.96$; $p<0.01$). The mean BMI (kg / m^2) among boys and girls were 17.4 (3.1) and 17.7 (3.2) respectively. The mean BMI in girls is slightly higher and the sex difference in mean BMI was not statistically significant. The mean SBP among boys was 119.1 (13.8) and among girls this was 113.7 (12.5). The mean difference in this regard depending on sex was also statistically significant ($t = 2.46$; $p< 0.01$). The mean (SD) DBP in boys and girls were 75.9(10.6) and 74.5(10.3) respectively, which was also not statistically significant considering the sexual differences. Mean (SD) of SBP and DBP were increases as the BMI increases and the data was statistically significant ($p<0.01$) in case of SBP ($F=3.24$, $p<0.01$) but not in DBP ($F=0.49$).

Table 2. Age trends in anthropometric variables and indices

Variables	Sex	Age(in years)							
Mean (SD)		12	13	14	15	16	17	18	*F*
Height	Boys	141.6	150.4	156.6	162.2	167.8	165.7	167.3	32.5***
		(5.7)	(8.0)	(7.1)	(7.1)	(7.6)	(9.1)	(6.9)	
	Girls	143.3	148.7	152.6	147.0	150.7	154.0	151.1	3.5**
		(7.5)	(5.9)	(5.1)	(6.4)	(5.8)	(4.6)	(6.4)	
	Overall	142.4	149.7	155.6	158.4	162.1	160.6	163.6	24.8***
		(6.6)	(7.1)	(6.7)	(9.6)	(10.8)	(9.4)	(9.5)	
Weight	Boys	33.1	37.6	40.1	47.3	51.7	52.0	51.1	12.4***
		(6.1)	(4.7)	(6.1)	(11.9)	(7.8)	(12.5)	(10.5)	
	Girls	31.5	39.3	40.4	43.5	43.8	44.4	45.3	8.8***
		(5.3)	(6.3)	(5.9)	(1.9)	(5.6)	(5.7)	(6.6)	
	Overall	32.3	38.3	40.2	46.4	49.1	48.7	49.8	20.0***
		(5.8)	(5.3)	(5.9)	(10.3)	(7.7)	(10.5)	(10.0)	
BMI	Boys	16.4	16.7	16.3	17.9	18.3	18.9	18.2	1.6
		(2.6)	(2.7)	(1.7)	(4.2)	(2.2)	(3.7)	(3.5)	n.s.
	Girls	15.4	17.7	17.3	20.3	19.5	18.8	20.1	4.1**
		(2.3)	(2.2)	(1.7)	(1.6)	(3.1)	(3.2)	(4.5)	
	Overall	15.9	17.1	16.6	18.5	18.7	18.8	18.7	4.2***
		(2.5)	(2.5)	(1.7)	(3.8)	(2.5)	(3.4)	(3.7)	
SBP	Boys	114.3	116.9	115.1	118.6	123.1	122.6	124.0	1.5
		(12.8)	(11.1)	(10.3)	(19.6)	(14.6)	(11.7)	(13.9)	n.s.
	Girls	109.3	115.6	115.4	109.0	131.2	109.7	114.9	2.7*
		(13.1)	(5.7)	(16.6)	(6.6)	(13.9)	(10.0)	(10.8)	
	Overall	111.9	116.3	115.2	116.2	125.8	117.0	122.0	2.9*
		(13.0)	(9.1)	(11.8)	(17.6)	(14.2)	(12.5)	(13.6)	
DBP	Boys	72.3	75.3	71.3	76.0	82.9	78.4	78.2	1.9
		(9.9)	(10.2)	(9.0)	(8.9)	(10.7)	(10.8)	(11.5)	n.s.
	Girls	68.9	73.7	79.8	75.3	82.6	75.4	79.1	2.1
		(12.9)	(8.6)	(5.6)	(10.2)	(10.9)	(5.7)	(3.9)	n.s.
	Overall	70.7	74.6	73.5	75.8	82.8	77.1	78.4	3.4*
		(11.4)	(9.4)	(9.0)	(8.9)	(10.4)	(8.8)	(10.2)	

*** = p<0.001; ** = p<0.01; * = p<0.05 ; n.s. = not significant

Table 3. Sex wise Distribution of Combined Hypertensive Situation (SBP and DBP both)

Status	Boys	Girls	Sex combined
Hypertensive	29 (18.2)	11 (6.9)	40 (25.1)
Pre-hypertensive	6 (3.8)	6 (3.8)	12 (7.6)
Normotensive	39 (24.5)	12 (7.5)	51 (32.0)

Percentages are given in the parentheses

Table 4. Sex wise Distribution of Isolated High Systolic and Diastolic Blood Pressure

		Boys	Girls	t	Sex combined
Hypertensive	SBP	40 (25.2)	16 (10.1)	2.18 ns	56 (35.3)
	DBP	41(25.8)	21(13.2)	1.52 ns	62 (39.0)
Pre hypertensive	SBP	8 (5.0)	14 (8.8)	3.81*	22 (13.8)
	DBP	13 (8.2)	13 (8.2)	2.06*	26 (16.4)
Normotensive	SBP	55 (34.6)	24 (15.1)	2.16*	79 (49.7)
	DBP	49 (30.8)	21 (13.2)	0.04 ns	70 (44.0)

Percentages are given in the parentheses * = p<0.05; n.s. = not significant

Age trends among boys, girls and sex combined in anthropometric variables was tested by ANOVA (Table 2). Age changes had a great impact on all the anthropometric variables when considered as sex combined. Considering the height (Boys : F= 32.5,p < 0.001; Girls : F = 3.5, p< 0.01) and weight (Boys : F= 12.4,p < 0.001; Girls : F = 8.8, p< 0.001), both the variables had highly significant association with age changes in sex specific as well as sex combined (Height : F = 24.8; Weight : F =20.0; p < 0.0001). Age changes had no significant impact on BMI, SBP and DBP among boys while girls showed significant impact of age changes on BMI and SBP but not on DBP. Only sex combined had significant influence of age changes on SBP and DBP. Whereas, BMI showed significant association with age changes among the girls as well as in case of sex combined. Table 3 focused on the sex wise distribution of blood pressure status (systolic and diastolic blood pressure) and this table only considers those people who were belonging to the same category on both the higher level of systolic and diastolic blood pressure. The prevalence of both systolic and diastolic hypertension among boys was 18.2% whereas, among girls it was 6.9%. The prevalence of pre-hypertension and normotension among boys were 3.8% and 24.5% respectively and among girls these were 3.8% and 7.5% respectively. The overall sex combined prevalence of normotension (32.0%) was very high among the studied children which were followed by the hypertension (25.1%) and then pre hypertension (7.6%). Table 4. Represented sex wise total distribution of those individuals who were fall within either category of SBP or DBP. Out of the total samples, the prevalence of systolic hypertension among boys was 25.2% and among the girls it was 10.1%. Systolic pre hypertension and normotension in boys were 5.0% and 34.6% respectively and in girls were 8.8% and 15.1% respectively. The prevalence (Sex combined) of systolic hypertension (35.3 %) was more common than systolic pre-

hypertension (13.8%) and boys (25.2%) were more hypertensive (systolic) than girls (10.1%). This table also showed sex wise distribution of diastolic blood pressure. Out of 150, the prevalence of diastolic hypertension, pre-hypertension and normotension among boys were 25.8%, 8.2%, 30.8% respectively and among girls, prevalence of hypertension, pre-hypertension and normotension were 13.2%, 8.2%, 13.2% respectively. The prevalence (Sex combined) of diastolic hypertensive individuals (39.0%) were more than the diastolic pre-hypertensives (16.4%). In case of isolated diastolic hypertension, boys (25.8%) were more hypertensive than girls (13.2%). The mean difference depending on sex was not significant in systolic hypertension ($t=2.18$, $p>0.05$) and diastolic hypertension ($t=1.52$,$p>0.05$). While calculating the mean difference by considering sex, systolic ($t=3.81$, $p<0.05$) and diastolic pre-hypertension($t=2.06$, $p<0.05$) were found statistically significant and in case of normotension on the basis of mean we found significant sex difference in systolic normotension but not in diastolic normotension.

Table 5. Distribution of Hypertensive individuals with BMI Indices

Status	Severe Thinness	Thinness	Normal	Overweight	Obese
Hypertension (SBP)	21(13.2)	21(13.2)	6 (3.8)	7(4.4)	1(0.6)
Hypertension (DBP)	21(13.2)	25(15.7)	8(5.0)	7(4.4)	1(0.6)

Percentages are given in the parentheses

Table 5 showed the prevalence of systolic and diastolic hypertension in BMI indices. Prevalence of systolic and diastolic hypertensive individuals in severe thinness were 13.2%. The prevalence of diastolic hypertension was more (15.7%) amongst those who lie in the thinness group, when it is compared with the prevalence of systolic hypertension (13.2%). Prevalence of systolic blood pressure were very less (3.8%) among those individuals who had normal BMI but the prevalence of diastolic blood pressure was slightly higher (5.0%). The prevalence of systolic and diastolic hypertension in overweight and obese were (4.4%) and (0.6%) respectively. Both SBP and DBP (SBP=$p<0.01$and DBP = $p<0.05$) revealed significant correlation with BMI (sex combined). Among the boys as a whole, the correlation coefficients (r) of BMI with systolic and diastolic blood pressure were 0.388 ($p<0.01$) and 0.184 respectively. Amongst girls, the BMI was significantly correlated with SBP ($p<0.01$) but no correlation was established with DBP.

Table 6. Correlation of BMI indices with SBP and DBP

BMI Index	SBP	DBP
	r	r
Severe thinness	0.353**	0.195
Thinness	0.266	0.388**
Normal	0.189	-0.069
Overweight	0.935	-0.041
Obese	0.223	1.000**

** = $p < 0.01$

On further analysis on 159 samples, the data revealed that severe thinness group was positively correlated with SBP ($p < 0.01$) but no correlation was found in DBP (Table 6). Thinness groups showed no statistical significant correlation with SBP whereas in case of DBP we found strong statistical correlation ($p < 0.01$). Normal, overweight and obese group didn't show any significant correlation with SBP. While, normal and overweight group showed inverse relationship with DBP and it was not statistically significant. Obese group was significantly correlated with DBP ($p < 0.01$). Regression analysis considering SBP level as dependent variable on BMI as predictor resulted statistically significant ($p<0.001$) relationship. Similarly in case of DBP, linear regression analysis established the fact that BMI accounted for predictor over DBP significantly ($p<0.001$).

DISCUSSION

The present study indicates that elevated blood pressure is more prevalent amongst the severe thinness and thinness BMI group. Our findings is inconsistent with the previous study done by Hosseini *et al*., found that elevated BP is more prevalent among the overweight and obese individuals (Hosseini *et al*., 2010). They also found that BMI and BP were significantly higher in boys than girls (Hosseini *et al*., 2010). Our data revealed that all the anthropometric variables were significantly higher in boys except BMI. It should be mentioned that DBP was higher amongst boys, still was not statistically significant. BMI was higher among girls and not statistically significant. Mohan and others (2004) found that there was a significant increase in the prevalence of hypertension as BMI increases, the same result was found in the present study (Mohan *et al*., 2004). In a study done by Bharati DR, Deshmukh PR and Garg BS, the prevalence of overweight and obesity was found to be 3.1% and 1.2% respectively, which was much lesser compared to our study (Bharati *et al*.,2008). In the present study, 56 (35.3%) and 22 (13.8%) subjects out of 159 samples were found to have hypertension and pre-hypertension (SBP) respectively; the prevalence of diastolic hypertension and pre-hypertension were found to have 62 (39.0%) and 26 (16.4%) respectively. Study done by Narayanappa and others (2012) among apparently healthy school children showed that overall prevalence of pre-hypertension and hypertension were 2.8% and 2.4% respectively, which was very much lower compared to our study, probably due to the difference in lifestyle and eating habits in southern states of India (Narayanappa and Rajani,2012).

The prevalence of isolated diastolic hypertension (39.0%) was higher than isolated systolic hypertension (35.3%) and isolated diastolic hypertension was more common than SDH (25.1%). Our result is contrasted by the findings of Jangid and others(2015), who reported that the prevalence of systolic hypertension was quite higher than diastolic hypertension and ISH was more common than SDH (Jangid *et al*., 2015). In the present study, Distribution of Hypertensive individuals in BMI Indices were studied. Out of 56 SBP hypertensives, only 42 (26.4%) were in under nutrition category and 14(8.8%) were over nutrition. Out of 62 DBP hypertensives, 46 (28.9%) belonged to under nourished group and 16 (10.1%) were from over nourished group. A study done by Verma and others (1994) found that, the prevalence of hypertension was much higher in obese as compared to non obese children which is inconsistent with our findings (Verma *et al*., 1994). In our study, isolated systolic hypertension, isolated diastolic hypertension and SDH were higher in males, this is supported by the study of Srinivas *et al*., who found that, hypertension in male was 6.6% and in female was 1.2%. Our findings are inconsistent with the study of Van den Ban and others (1989) who observed the prevalence of ISH was 6.3% and 3.0% among men and women respectively (Van den Ban *et al*.,

1989). The tendency of blood pressure to rise with age is supported by the findings from the Turkish study among the age group 13to 18 years (Irgil *et al*., 1998) and a study on Zambian school children (7 to16 years). In the present study, both mean SBP and DBP rose with age (Ng'andu, 1992). The overall prevalence of systolic hypertension and diastolic hypertension were 56(35.3%) and 62 (39.0) respectively while 22 (13.8) and 26 (16.4%) adolescents were in systolic pre-hypertensive and diastolic pre-hypertensive range, which is supported by the study of Das and others (2017)**,** who found the overall prevalence of hypertension was 19.7% while 13.4% children were in pre-hypertensive range (Das *et al*., 2017). The prevalence of hypertension (10.5%) was found to be higher than its pre-hypertension (6.9%) counterpart (Merhi *et al*., 2011).

On further analysis our study also found that systolic hypertension (Boys: 25.2% Girls: 10.1%) and diastolic hypertension (Boys: 25.8% Girls: 10.1%) were higher in boys than girls. Study from urban Maharashtra, among 6 to 16 years old school children, overall prevalence of hypertension was 13.3% and pre-hypertension was 5.8%. The prevalence of hypertension was higher in boys compared to girls (20.8% versus 17.1% respectively) (Mohammed *et al*., 2015). A nationwide study in Pakistan involving children 5-14 years, the overall prevalence of hypertension was reported as 12.2% with higher prevalence among boys (15.8%) than girls (8.7%) (Jafar *et al*., 2005)**.** The hypertension was more common amongst the boys than girls; this argument was supported by the findings of Dubey and others (2002) (Dubey *et al*., 2002). Dubey and others (2002) demonstrated the role of testosterone in high blood pressure observed in males compared to age matched non menopausal women which may explain why in their study boys consistently had higher blood pressure than girls (Dubey *et al*., 2002). Studies have shown that estrogen and estrogen receptor stimulation are protective of the cardiovascular system thus decreasing the incidence of CVDs (Palmieri *et al*., 2014; Kolovou *et al*., 2011). According to our findings, (Table 1) the mean systolic and diastolic blood pressure was found to be higher in boys when compared to girls. Jaddou *et al*. and Soudarssanane *et al*. have reported similar findings that both mean SBP and DBP were higher among boys than girls (Jaddou *et al*., 2001; Soudarssanane *et al*., 2006). While some other studies found that mean SBP was higher amongst boys and mean DBP was higher amongst girls (Durrani and Waseem, 2011; Danasekaran and Vinoth, 2015). But the mean BMI was slightly higher in girls than boys. The prevalence of hypertension and obesity was low in the present study when compared to other studies, but mean BMI increases as age increases. The major reason for the increasing trends of BMI and BP is the changes in the diet (lack of nutrition, lack of diet) (Raj *et al*., 2007; Afrifa-anane *et al*., 2015).

There is a significant correlation between the systolic BP ($p<0.01$), diastolic BP ($P<0.05$) and BMI as seen in Table 8. Our study documented that hypertension was more prevalent in subjects who are underweight when compared to the overweight subjects. The result is similar to the study of Genovesi and others (2011) (Genovesi *et al*., 2011). In the present study BMI correlated positively with SBP in both boys and girls but not with DBP. The results of our study are similar to the studies done earlier in which more males were found to be hypertensive and BMI correlated positively with blood pressure (Manchukonda and Srivastava,2015; Das *et al*.,2013; Waseem and Bano, 2017). It was interesting to note that a sizable proportion undernourished adolescents had hypertension. This finding suggests for systematic nationwide documentation of the prevalence of hypertension and its relationship with the risk factors, to identify suitable preventive measure. Also it mandates blood pressure checkup for children and adolescents during routine pediatric clinical practice and school health checkup.

Conclusion

The prevalence of diastolic hypertension was higher than the systolic and SDH. The hypertension was more common amongst the boys than girls. In this study we also observed that mean BMI was increases as the age increases and mean SBP and DBP was increases as BMI increases. It should be mentioned that most of the students of the studied population were belonging to the Underweight category and only few number of students were belong to over nutrition category. The study establishes the fact that hypertension is prevalent among both the thin and severely thin (BMI group) adolescents Sunni Muslims students who live in semi urban areas of Lucknow City. And there is a need for school based screening programme for primary and secondary preventions of these problems among adolescents' school students. The prevalence of isolated systolic hypertension and isolated diastolic hypertension were high among the underweight students when compared to other studies. It may be said that, the major reason for that is the changes in the diet (lack of nutrition and lack of exercise). There is a significant correlation between the systolic blood pressure ($p<0.01$), diastolic blood pressure ($p<0.05$) and BMI. In the present study BMI correlated significantly with SBP in both boys ($p <0.01$) and girls ($p<0.05$).

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