Effectiveness of Multi-Intervention on Blood Pressure among School Children

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Abstract: *An Experimental study to assess the effectiveness of Multi Intervention on Blood Pressure among School Children aged 10 - 12 years. According to the 4th report on Diagnosis, Evaluation & treatment of High BP in children & adolescents (2004) guidelines, 24 Children who had elevated BP were selected for the study by simple random sampling technique. A modified tool of "WHO STEPS Instrument" was used for the data collection. Multi – Intervention includes a structured teaching on hypertension with a practical session of 30 - 40 mts for 2 days with appropriate follow up for 3 months. The major findings of the study shows that the children with elevated BP had the family history of NCD and the multi –Intervention showed a statistically significant difference between experimental and control group at P= 0.01 level. The study findings concludes that the multi intervention is effective in reducing the elevated BP among children.*

Keywords: Multi Intervention, Blood Pressure, School Children, physical activity, NCD

1. Introduction

Hypertension is the most common, most potent universal contributor of morbidity and mortality in developed and developing countries affecting approximately one billion individuals worldwide. Cardiovascular diseases lead the non-communicable diseases epidemic contributing to nearly one third of global deaths: 17.3 million deaths a year (JNC-VII Report, 2003)[1].

With rapid economic development and changes of lifestyle in the past few decades, prevalence of hypertension has reached alarming proportions among Indian children in the recent years. Even though the prevalence is far lower in children and adolescents; the evidence indicates that hypertension begins to develop during the first two decades of life (Zinner, et al., 1985; Chadha, et al., 1999). Several studies (Higgins, et al., 1980; Kuller, et al., 1980; Lauer and Clarke, 1984; Shears, et al., 1986; Pruitt, 1996) have reported the tracking effect of blood pressure from childhood to adulthood.

There are preliminary evidences which predict that hypertensive processes begin in the childhood (DeSweit, et al., 1992), with co-relations between blood pressure levels from early to late childhood (Lauer and Clark, 1989) and from childhood to adulthood (Nelson, et al., 1992). These reports suggest the importance of tracking blood pressure in children to detect the early stages of hypertension. Studies on hypertension in childhood have the important advantage that they may help in the control and possibly prevention of high blood pressure before its harmful sequelae can occur (Singal, et al., 2008).

As the symptoms of childhood hypertension are largely nonspecific, most children with essential hypertension are likely to be asymptomatic which also makes the data on prevalence of pre-hypertension and sustained hypertension among school children scanty, in India.

A cross-sectional study was done by Dr. Reddy, et al., (2015)[2] to find the prevalence of sustained hypertension and pre-hypertension among school children aged 11-17 years. A total of 1085 apparently healthy students of northern India were studied. The mean BMI of the students was 17.5 ± 2.7 kg/m2, among which 5 (0.4%) were obese and 39 (3.5%) overweight. After two evaluations, hypertension was identified in 62 (5.9%) children and pre-hypertension in 130 (12.3%). Rates of elevated BP were significantly higher (46.5% *vs* 17%, *P<0.001*) among those with high BMI. In conclusion, nearly 20% of the school children had elevated blood pressure.

The need of the hour is to determine strategies to prevent the occurrence of both overweight as well as high Blood Pressure among children in order to enable them to grow into complete healthy individuals. This requires concentrating both at home and at school where children spend most of their time. Encouraging physical activity and healthy dietary habits, such as increasing fibre intake, reducing the consumption of junk foods and saturated fat, and increasing levels of physical activity starting in childhood, may have important effects on public health. As this also gains the benefits of 'Child to Child Programme' it helps us to build a healthy, disease free nation in the future.

With the overall objective of creating awareness and increasing knowledge and practice of the school children on diet, physical activity, yoga and adequate sleep, the present study was conducted among school children. The objectives of the study were assessing the prevalence of hypertension among school children, to find the effectiveness of Multi-Intervention on levels of elevated blood pressure and draw an association between the levels of elevated blood pressure with their demographic variables among school children aged between 10- 12 years in selected schools.

2. Objectives

1) To assess the prevalence of hypertension with overweight among school children aged between 10- 12 years in selected schools.
2) To find out the effectiveness of Multi-Intervention on levels of elevated blood pressureamong school children aged between 10- 12 years in selected schools.
3) To find out the association between levelof elevated blood pressure with their demographic variables among school children aged between 10- 12 years in selected schools.

3. Materials & Methods

A true experimental study design was adopted and totally 279 children for control group as well as 293 for experimental group were screened for the selection of samples. The children who met the inclusive criteria of having >90th Systolic/Diastolic Percentile as per the 4th report on Diagnosis, Evaluation & treatment of High BP in children &adolescents (2004) were selected as samples. There were 14 in control and 13 children in study group met the inclusion and exclusion Criteriaamong which 12 children were selected using lottery method for both the groups.

A semi- structured checklist, which is a modified tool of "WHO STEPS Instrument", was used for the data collection. It has socio -demographic data of the school children, dietary pattern, physical activity as well as Bio -Physiological measurements including Height, Weight, BP and Heart Rate. For Measuring Hypertension, the 4th report on Diagnosis, Evaluation &treatment of High BP in children & adolescents (2004) guidelines for blood pressure percentiles was used.

Initially, a formal written permission was obtained from Chief Educational officer and the Headmasters of the selected schools. The objectives and the intention of this study were explained to the parents and the school children. The consent of the parents and Assent from the study participants was obtained.

Heart Rate & Blood pressure (BP) measurements weredone during the leisure time of the children such as lunch break in a comfortable place assigned for that by using a mercury sphygmomanometer as per the recommendations of American Heart Association. Efforts were made to eliminate the factors which may affect the blood pressure, *e.g.* anxiety, crying, exercise, *etc.* The average of the three consecutive readings was taken as the blood pressure of the child to overcome the issue of "White Coat Hypertension".

The Multi – Intervention included a structured teaching on prevention and control of hypertension, overweight, dietary modification, physical activity, yoga and sleeping pattern was given through the power point presentation as well as practical sessions of 30 -40 mts for 2 days for the children

and the parents of the study group with the regular follow up for 3 months. As the social support is very much needed for the attitude change & sustained practice, the school teachers especially physical education teachers also were included for the teaching session to motivate the children on regular basis.Thestudy group and the teachers of the schools were also provided the study material on dietary modification, physical activity, yoga and pranayama for reference.Regular telephonic follow ups were made every week for three months. The post test was done after 3 months in both experimental and control group.TheControl group led their life under normal circumstances for the entire period of intervention & data collection. After the data collection, the control group was also given the Multi – Intervention as like study group.

4. Results & Discussion

According to the first objective of the study, the prevalenceof levels of elevated blood pressure with overweight among school children aged between 10 – 12 years was 4.72% at 95%confidence interval. Among 572 children screened, 27 of them had both elevated blood pressure and overweight. Patil RR and GargBS[3],conducted a study between 2010 – 2012 to assess the prevalence of hypertension and variation in blood pressure among 958 schoolchildren from 83 schools aged between 6-16 years in rural area of Wardha. The study concludes that the prevalence of hypertension and was found to be 3.0% and the proportion of hypertension among males was 2.8% against 3.2% in females.

Table 1: Prevalence of elevated blood pressureand overweight among School Children aged 10 - 12 years

Total number of children screened	Number of children with elevated BP and overweight	% of children with elevated BP and overweight and 95% Confidence interval
572	27	4.72 % (3.04 % - 6.93%)

Fig 1 shows the distribution of family history of Non – Communicable Diseases (NCD) among School Children aged between 10 -12 years. It shows that there were family members who had NCDs in both study & control group. Family history of hypertension was significant risk factor for hypertension as it is evident in many studies such as a study by NiravBuch et al[4],Verma M, Chhatwal J, George SM.,[5], and Gupta. R[6] who have also reported similar observations. The prevalence of hypertension was very high (42%) among children of hypertensive parents (either father or mother or both). This study strongly supports the fact that increase in prevalence of adolescent HT is highly significant among parents with hypertension. Similar relationship was found in Sharma et al. a study done among Delhi school students [7].
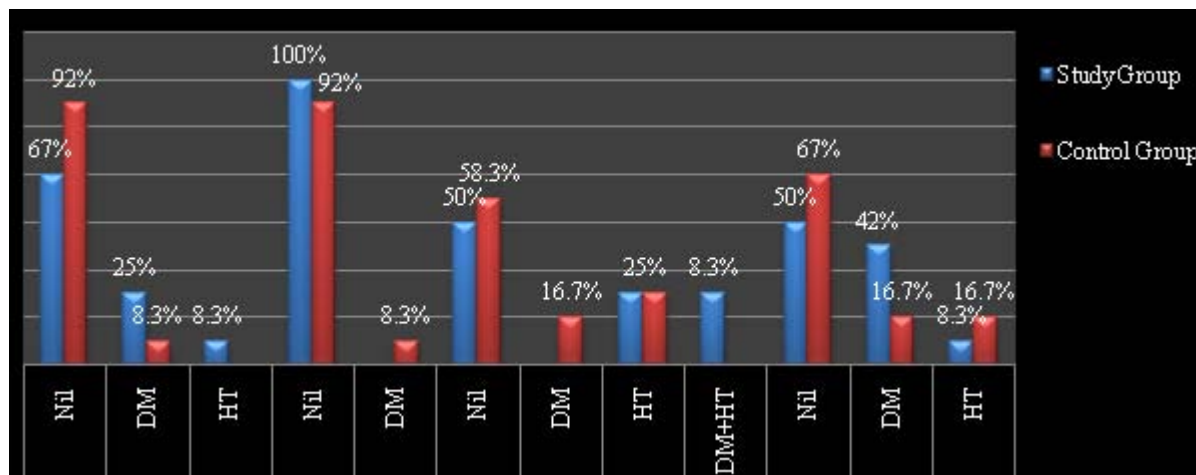
Figure 1: Distribution of Family History of Non –Communicable Diseasesamong School Children

The second objective of the study was to find the effectiveness of Multi-Intervention on elevatedblood pressure among school children aged between 10- 12 years in selected schools.Table 2 shows the post-test level of elevated blood pressure score among experimental and control children after intervention. In experimental group, 67% of the children were having normal BP, 33% of the children were having pre- hypertension (HT) and none of the children had stage I HT. In control group, 100% of the children were having pre HT. Statistically there was a significant difference between experimental and control group at P=0.01 level. It shows that the multi intervention was effective in reducing the elevated blood pressure among children.So, the first null hypothesis of the study i.e. there is no significant difference in the levels of elevated blood pressure among experimental and control group after intervention was rejected.

The similar finding was observed by Brian Torrance, K Ashlee McGuire, Richard Lewanczuk, and Jonathan McGavock[8],who performed a review on overweight, physical activity and high blood pressure in children: a review of the literature in 2007. After reviewing a number of physical activity intervention studies performed in children, the authors concluded that 40 minutes of moderate to vigorous aerobic-based physical activity 3–5 days/week will improve vascular function and reduce blood pressure in obese children.

Table 2: Effectiveness of Multi - Intervention on elevated blood pressure of School Children

		Group				Mann – whitney U test
		Experiment		Control		
		N	%	N	%	
1	Normal	8	67	0	0	**Z=3.91 P=0.01 **S**
2	Pre HT	4	33	12	100	
3	Stage I	0	0	0	0	
	Total	12	100	12	100	

Not significant P >0.05, * significant at P≤0.05 , ** highly significant at P≤0.01 * very high significant at P≤0.001**

Thethird objective was to find out the association between levelsof elevated blood pressure with their demographic variables among school children aged between 10- 12 years in selected schools.

Table 3: Association between Post -test level of elevated BP and socio - demographic Variables(Experimental)

Socio - demographic Variables		n	Level of Hypertension				Chi square test
			Normal		PreHT		
			n	%	n	%	
Age (years)	10 -11	6	1	17	5	83	**χ2=11.07 P=0.01**S**
	11 -12	6	6	100	0	0	
Gender	Male	7	6	86	1	14	**χ2=5.18 P=0.02* S**
	Female	5	1	20	4	80	
Religion	Hindu	7	4	57	3	43	χ2=0.83 P=0.65 NS
	Christian	4	2	50	2	50	
	Muslim	1	1	100			
Level of education	5th std	4	3	75	1	25	χ2=0.68 P=0.70NS
	6th std	4	2	50	2	50	
	7th std	4	2	50	2	50	
Birth Order	First	6	5	83	1	17	χ2=4.45 P=0.10NS
	Second	4	2	50	2	50	
	Third	2	2	100	2	100	
No. of Siblings	One	8	6	75	2	25	χ2=2.74 P11111=0.10 NS
	Two	4	1	25	3	75	
No. of Persons in the family	Four	6	5	83	1	17	χ2=3.42 P=0.18NS
	Five	4	1	25	3	75	
	Six	2	1	50	1	50	
Monthly income of the family (Rs.)	<5000	2	2	100			χ2=2.54 P=0.11 NS
	5001 -10000	10	5	50	5	50	
Mother's Education	Primary	1	1	100			χ2=4.28 P=0.11 NS
	HSc	3	3	100			
	Degree	8	3	37	5	63	
Father's Education	Primary	3	3	100			χ2=2.33 P=0.50 NS
	High school	1			1	100	
	HSc	1	1	100			
	Degree	7	3	43	4	57	
Father's work status	Government	1			1	100	χ2=5.98 P=0.11 NS
	Private	7	4	57	3	43	
	Self employed	4	3	75	1	25	
Mother's work status	Home maker	7	4	57	3	43	χ2=0.01 P=0.92 NS
	Private	5	3	60	2	40	
Residence	Rural	1	1	100			χ2=4.28 P=0.11 NS
	Semi urban	3	3	100			
	Urban	8	3	38	5	62	
Type of family	Nuclear family	7	4	57	3	43	χ2=0.46 P=0.79 NS
	Joint family	1	1	100			
	Extended family	4	2	50	2	50	

Family history of overwt/ obese	No	9	4	44	5	56	χ2=2.40 P=0.12 NS
	Yes	3	3	100			

Table 3shows the association betweenPost -test level of elevated BP and socio - demographic variables of experimental group. Statistical significance was found with the age and gender of the children. The similar pattern was observed in the study conducted by Dr Reddy et al[2],(2015) among 501 residential school children (266 boys and 235 girls) to evaluate relationship of blood pressurewith variables like age, sex, height, weight and body mass index (BMI) and to find out the prevalence of hypertensionin children and its correlation with BMI. The above study concluded that the mean SBP and mean DBP showed a positive correlation with age, gender, height and weight of school children.
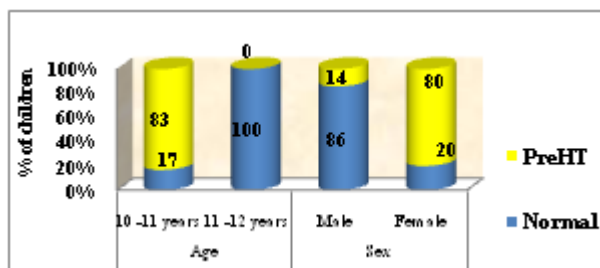

Figure 2: Association betweenPost -test level of elevated BP and socio - demographic Variables (Experimental)

Table 4: Association between the Dietary Habitsof Experimental and Control group children (Post-test)

		Group				Chi square test
		Experimental		Control		
		n	%	n	%	
Rice & Wheat products	< once/ week	2	17	2	17	χ2=1.97 P=0.37 NS
	2-4 times	5	41	8	66	
	5-6 times	5	42	2	17	
Green Leafy Vegetables	< once/ wk	1	8	2	17	χ2=6.12 P=0.05*S
	2-4 times	2	17	7	58	
	5-6 times	9	75	3	25	
Other vegetables	< once/ wk	1	8	3	25	χ2=6.60 P=0.03 *S
	2-4 times	6	50	9	75	
	5-6 times	5	42			
Fruits	< once/ wk	4	33	4	33	χ2=0.00 P=1.00 NS
	2-4 times	7	59	7	59	
	5-6 times	1	8	1	8	
Milk & Dairy Products	2-4 times	4	33	6	50	χ2=0.68 P=0.41 NS
	5-6 times	8	67	6	50	
Eggs	< once/ wk	3	25	5	42	χ2=1.50 P=0.47 NS
	2-4 times	6	50	6	50	
	5-6 times	3	25	1	8	
Legumes	< once/ wk	2	17	2	17	χ2=1.97 P=0.37 NS
	2-4 times	8	67	5	42	
	5-6 times	2	17	5	41	
Meat &Meat Products	< once/ wk	1	8	2	17	χ2=0.42 P=0.80 NS
	2-4 times	6	50	5	42	
	5-6 times	5	42	5	41	
Fish	< once/ wk	4	33	9	75	χ2=4.20 P=0.12 NS
	2-4 times	5	42	2	17	
	5-6 times	3	25	1	8	
Fast foods incl. any form	< once/ wk	11	92	7	58	χ2=3.55 P=0.06 NS
	2-4 times	1	8	5	42	
Bread &	< once/ wk	3	25	1	8	χ2=2.36
Bakery Products	2-4 times	7	25	6	50	P=0.31 NS
	5-6 times	2	33	5	42	
Sweet and Candy	< once/ wk	5	33	7	58	χ2=4.59 P=0.10 NS
	2-4 times	3	25	4	33	
	5-6 times	4	33	1	8	
ice creams /cakes/cookies/biscuits	< once/ wk	9	75	7	58	χ2=0.75 P=0.38 NS
	2-4 times	3	25	5	42	
Noodles	< once/ wk	8	67	5	42	χ2=2.80 P=0.24 NS
	2-4 times	4	33	5	41	
	5-6 times	0	0	2	17	
Puffs, samosa ,chat items	< once/ wk	9	75	4	42	χ2=6.92 P=0.03 *S
	2-4 times	3	25	5	33	
	5-6 times	0	0	3	25	
Carbonated Soft Drinks	< once/ wk	2	17	3	25	χ2=0.31 P=0.85 NS
	2-4 times	5	42	4	33	
	5-6 times	5	42	5	41	
Packed foods	< once/ wk	9	75	8	67	χ2=0.20 P=0.65 NS
	2-4 times	3	25	4	33	
	5-6 times	0	0	0	0	

Table 4 shows the post-test dietary habits of school children aged between 10- 12 years in selected schools. The habit of eating green leafy vegetables, other vegetables&the frequency of eating Puffs, samosa,and chat itemshave significantassociation which shows that the following a balanced diet will help to control the elevated BP.

Table 5: Association between the Dietary Habits of Experimental and Control group Children (Post-test)

		Group				Chi square test
		Experiment		Control		
		n	%	n	%	
What type of oil or fat is most often used for meal preparation in your household	None in particular	5	42	6	50	χ2=2.18 P=0.53 NS
	Coconut Oil			1	8	
	Butter or ghee	1	8			
	Vegetable oil	6	50	5	42	
Do you eat fried items as Snacks in between your meal	Yes	5	42	10	83	χ2=4.44 P=0.03 *S
	No	7	58	2	17	
Do you eat Street foods more than 2 times a week?	Yes	5	42	7	58	χ2=0.66 P=0.41 NS
	No	7	58	5	42	

Table 5 shows the association between the dietary habits of school children of experimental and control group in the Post-test.The habit of eating fried items as Snacks in between meals showed a statistically significant difference between experimental and control group in the post test which shows consumption of the junk & fried foods in between meals has significant influence on level of elevated BP.

Myers VHand Champagne CM[9],have done a systematic review on nutritional effects on blood pressure which concludes that several studies on dietary fiber indicate that the strongest evidence for blood pressure lowering effects is in hypertensive participants. Vegetarians seem to have lower levels of hypertension and cardiovascular disease risk which has a coincidence with the findingsof the present study.

Table 6: Association between the Physical Activity of Experimental and Control group Children (Post-test)

		Group				Chi square Test
		Experiment		Control		
		n	%	n	%	
Do you go for regular sports activity?	No	6	50	11	92	χ2=5.04 P=0.03*S
	Yes	6	50	1	8	
In a typical week, do you play outdoor games/ vigorous activities,more than 2 hours /day?	No	6	50	11	92	χ2=5.04 P=0.03*S
	Yes	6	50	1	8	
Do you play during physical education period?	No	10	83	10	83	χ2=0.00 P=1.00 NS
	Yes	2	17	2	17	
How much time do you spend walking or bicycling for travel on a typical day?	No	2	17	2	17	χ2=2.57 P=0.46 NS
	1	4	33	5	43	
	2	4	33	3	25	
	3	2	17	2	17	
Do you do any vigorous-intensity sports, fitness or recreational	No	4	33	11	92	χ2=8.71 P=0.01**S
	Yes	8	67	1	8	
Do you usually spend more than 2 hours sitting or reclining to watch T.V. on a typical day?	No	8	67	5	42	χ2=1.5 P=0.22 NS
	Yes	4	33	7	58	
Do you use computer / play video games more than a hour per day	No	7	58	9	75	χ2=0.75 P=0.38 NS
	Yes	5	42	3	25	

Table 6 shows theassociation between the physical activity of experimental and control group children in the Post-test. The frequency of doing regular sports activity, playing outdoor games/ vigorous activities, more than 2 hours /day&doing any vigorous-intensity sports, fitness or recreational activity had a statistically significant difference between experimental and control which concludes that the regular physical activity has a positive influence on elevated levels of BP.

The study has limitations such as smaller sample size, dependence of physical education teachers and parents on monitoring the adherence of multi intervention, and telephonic follow up. This study also did not include other bio physiological measurements such as blood cholesterol and these areas are open for further research.

5. Conclusion

The results of this study substantiate the findings of earlier studies carried out in Western countries on significant high prevalence of childhood hypertension and emphasize that regular physical exercise, doing household activities, regulated television viewing, and healthy eating behaviors could contribute significantly to control BP.

School based programs should be conducted to control this syndrome in order to prevent future risk and any management plan for elevated BP should include 3 major components: diets, exercise, and family-based behavior and they should not be placed on restrictive diets because adequate calories are needed for proper growth.

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