Prevalence of Hypertension in Primary School Children in Some Rural Areas at Sharqia Governorate

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ABSTRACT

Background: Increased carotid intima-media thickness and ventricular hypertrophy are two examples of the target organ damage that can occur in children with hypertension, which also raises the chance of developing cardiovascular disease later in life.

Objective: To determine prevalence of high blood pressure (HTN) among primary school children in the City of Dyarb Negm, Sharqia Governorate and determining the causes of high blood pressure in kids.

Subjects and methods: This is a cross-sectional study that we carried out from September 2018 to March 2019. The sample was calculated to be (817) students. All children were subjected to questionnaire filled by parents asking about: Personal data and family medical history. Measurements taken for each student were weight, height, and blood pressure.

Results: HTN were (37 cases) 4.5% (3.2% stage 1 and 1.3% stage 2) and pre HTN (76 cases) 9.2%, and normal were 86.4%. Pre hypertension and HTN cases were significantly associated with high social class and HTN was significantly associated with low social class. HTN and Pre HTN cases were significantly associated with obesity and overweight. Diabetes mellitus (DM), HTN and obesity positive family history were significantly associated with HTN then Pre HTN.

Conclusion: HTN among studied group was found in 37 cases (4.5%; 3.2% 1st grade and 1.3% 2nd grade). This study provides important evidence of the association between obesity, based on BMI and high blood pressure. HTN was significantly associated with high salt intake, higher number of meal and high caloric diet. Family history of HTN and obesity were significantly associated with HTN then Pre HTN.

Keywords: Hypertension, Children, Primary School Children, Prevalence.

INTRODUCTION

Target organ damage, such as increased carotid intima-media thickness or ventricular hypertrophy, can occur in children with hypertension, and this raises the chance of developing cardio vascular disorders later in adulthood. According to one study, kids whose systolic blood pressure (SBP) is over the 90th percentile tend to stay there [1]. Thus, identifying and altering risk factors can reduce the occurrence of the condition, while early identification and care in children can limit the disease, minimize complications, and reduce morbidity and mortality from cardiovascular diseases in adulthood [2]. The rate of childhood hypertension is rising[3]. The previously reported prevalence of hypertension in children was between 1% and 2%; recent estimates place it between 4% and 5% worldwide[4].

In children, there is a complex interaction between genetics and environment that contributes to the development of hypertension (primary). Studies have shown a strong positive family history among siblings with primary hypertension, suggesting a role for genetics in the development of the disease[5].

Furthermore, obesity is connected to the start of hypertension in children, and the increased prevalence of juvenile obesity is largely to blame for this alarming increase. Primary hypertension in children has also been linked to socioeconomic disadvantage and low birth weight in firstborns[6].

We aimed at this work to determine prevalence of high blood pressure (BP) among primary school children in the City of Dyarb Negm, Sharqia Governorate and determining the causes of high blood pressure in kids.

PATIENTS AND METHODS

This is a cross-sectional study that we carried out from September 2018 to March 2019. The sample was calculated to be (817) students. Written consents were obtained from all parents of enrolled subjects in the study.

Students aged 6 to 12 years from three different elementary schools in three different districts in a rural area near the Dyarb Negm Center in the Sharqia Governorate were recruited using a multi-stage sample technique, from 17 centers in Sharqia we chose Dyrab Negm Center as a cluster which is mainly a rural center and between 7 main villages in Dyarb we chose Gemiza village which is the biggest also as a cluster, all the three public primary schools were chosen, then children from 1st to 6th grade were chosen randomly.

The sample was calculated to be (817) students (317 boys and 500 girls) as the total number of students at the three primary schools is about (1920), prevalence of hypertension among primary school children was 6.48%, power of study was 80%, and with CI 95% (Epi info version 6).

Inclusion Criteria: Children in three primary school children (6 to 12) years old from both sexes; male and female.

Exclusion Criteria: Children families who were unwilling to participate in the study.

All children were subjected to questionnaire filled by parents asking about:

- Personal data (name- age- sex-parental occupation and education), medical history of student such as hypertension, diabetes mellitus and drug intake).

- Risk factors for hypertension include a lack of physical activity and an unhealthy diet, as well as a family history of high blood pressure, diabetes, or obesity. If a first-degree relative of the child also had the ailment, then the child was considered to have a positive family history.
- Students' weights, heights, and blood pressures were taken.

The subject's weight (to the nearest 0.5 kg) was determined by having them stand still on a weighing scale, with their feet spaced 15 cm apart. Subjects' heights (to the nearest 0.5 cm) were measured as they stood erect against a portable stadiometer's vertical scale, with their heads held in a position in which the superior margin of the bony orbit was parallel to the top of the external auditory meatus.

According to the guidelines of the NHBPEP, a mercury sphygmomanometer was used to measure BP. The onset of the "tapping" Korotkoff-1 sound was used to calculate the systolic blood pressure, and its disappearance was used to calculate the diastolic pressure (Korotkoff-5). The measurements were obtained while the subject was sitting quietly with one arm supported by a table. Cuffs should be the right size for the wearer's age, with the bladder of the cuff wrapping around the upper arm and covering the area between the acromion and the olecranon (75 percent) of the arm. The stethoscope's bell was positioned above the patient's brachial pulse in the proximal medial anti-cubital fossa. Anxiety, crying, exercise, and other potential blood pressure-altering causes were all avoided. The diagnosis of hypertension in children was confirmed by taking a second and third reading at least two weeks apart. The kid's BP was calculated as the mean of three consecutive readings.

When the average of three readings was greater than the 95th percentile for gender, age, and height, it was considered hypertension. U.S. national standards for BP charting were established by the Working Group on High Blood Pressure in Children and Adolescents within the National High Blood Pressure Education Program [7].

Three consecutive readings of blood pressure (BP) higher than the 90th percentile but lower than the 95th percentile constituted a diagnosis of prehypertension.

Obesity was quantified using the body mass index (BMI), which is calculated by dividing a person's weight in kilogrammes by their height in metres squared. Underweight was defined as a body mass index (BMI) between the 5th and 85th percentile and overweight as a BMI between the 95th and 99th percentile of age- and sex-specific norms.

Children found to be hypertensive after three separate measurements was submitted to: (A) Full targeted history stressing on (risk factors - causes – symptoms – family history) of hypertension. (B) Full clinical examination. (C) Laboratory investigation for cases suspected to have secondary causes include (Urine analysis, serum creatinine, blood urea nitrogen, electrolytes, lipid profile, pelviabdominal ultrasound, echocardiography). Children diagnosed as prehypertensive or hypertensive had their parents counselled and were referred to the Central Hospital's Pediatric Clinic for specialized care.

Ethical approval:
The Zagazig Medical Ethics Committee of the Zagazig Faculty of Medicine gave its approval to this study. All the caregivers of the participants gave written consent after receiving all information. The Helsinki Declaration was followed throughout the study's conduct.

Statistical analysis
SPSS version 16 was used to tabulate and analyse the data. The Kolmogorov-Smirnov test was used to check if the quantitative data were normally distributed. Quantitative data were presented as mean, standard deviation, median, and range and were compared by one-way ANOVA test. Categorical data were presented as frequency and percentage and were compared by the Chi-square test (X^2). In this study, a probability of less than 0.05 was considered significant.

RESULTS
Mean±standard deviation of age was 8.84±1.64, females were majority, and moderate social class was the most common one (Table 1).

Table (1): Demographic characters distribution among studied group

		N	%
Age / Year	**6-7**	**186**	**22.4**
	8-9	**320**	**38.5**
	10-11	**324**	**39.0**
	Mean ±SD **Median (Range)**	**8.84±1.64** **9.0 (6-11)**	
Sex	**Female**	**502**	**60.5**
	Male	**328**	**39.5**
Social class	**low**	**52**	**6.3**
	Moderate	**736**	**88.7**
	High	**42**	**5.1**
	Total	**830**	**100.0**

Table 2 shows the anthropometric parameters of the studied children. Regarding obesity, most of them were normal.

Table (2): Anthropometric parameters and prevalence of obesity distribution among studied group

Height	Mean± SD	1.36±0.11	
	Median (Range)	1.37 (1.05-1.72)	
Weight	Mean± SD	31.18±9.7	
	Median (Range)	30.0 (11-75)	
BMI	Mean± SD	16.27±3.33	
	Median (Range)	15.44 (9.2-33.7)	
		N	**%**
Classification	Obese (≥95th percentile)	88	10.6
	Overweight (≥85th percentile)	53	6.4
	Underweight (<5th percentile)	115	13.9
	Normal	575	69.3
	Total	830	100.0

HTN was found in 37 cases; 27 in stage 1 and 10 in stage 2 (Table 3).

Table (3): Prevalence of hypertension distribution among studied group

			N	**%**
BP grade	Normal		717	86.4
	PRE HTN		76	9.2
	HTN	Stage 1	27	3.2
		Stage 2	10	1.3
	Total		830	100.0

Prehypertension and HTN cases were significantly associated with high social class and HTN was significantly associated with low social class (Table 4).

Table (4): Relation between HTN and personal characters

			BP grade			**F/X²**	**P**
			Normal	**PRE HTN**	**HTN**		
Age	Mean ±SD		8.66±1.63	9.23±1.6	8.65±1.6	2.099	0.108
Sex	Female	N	426	53	23		
		%	59.4%	69.7%	62.2%	3.1	0.21
	Male	N	291	23	14		
		%	40.6%	30.3%	37.8%		
Social class	High	N	26	10	6		
		%	3.6%	13.2%	16.2%		
	low	N	37	2	13	81.46	0.00**
		%	5.2%	2.6%	35.1%		
	Moderate	N	654	64	18		
		%	91.2%	84.2%	48.6%		
Total		N	717	76	37		
		%	100.0%	100.0%	100.0%		

*: Significant, **: Highly significant

HTN and Pre HTN cases were significantly associated with obesity and overweight (Table 5).

Table (5): Relation between HTN and obesity

			BP grade			**F/X²**	**P**
			Normal	**PRE HTN**	**HTN**		
Obesity	Obese	N	42	25	21		
		%	5.9%	32.9%	56.8%		
	Overweight	N	29	17	7		
		%	4.1%	22.3%	18.9%		
	Underweight	N	108	4	3	148.6	0.00**
		%	15.1%	5.3%	8.1%		
	Normal	N	538	30	6		
		%	75.1%	39.4%	16.2%		
Total		N	717	76	37		
		%	100.0%	100.0%	100.0%		

**: Highly significant

HTN and Pre HTN were significantly associated with higher number of meals, high caloric and high salt (Table 6).

Table (6): Relation between HTN and diet behaviors

			BP grade			F/X^2	P
			Normal	PRE HTN	HTN		
N meals	2.00	N	8	0	0	218.8	0.00**
		%	1.1%	0.0%	0.0%		
	3.00	N	661	44	13		
		%	92.2%	57.9%	35.1%		
	4.00	N	41	18	10		
		%	5.7%	23.7%	27.0%		
	5.00	N	7	14	14		
		%	1.0%	18.4%	37.8%		
	Mean ±SD		3.06±0.32	3.7±0.78	4.02±0.86	138.5	0.00**
High Caloric	No	N	674	41	11	218.39	0.00**
		%	94.0%	53.9%	29.7%		
	Yes	N	43	35	26		
		%	6.0%	46.1%	70.3%		
High Salt	No	N	713	48	24	243.1	0.00**
		%	99.4%	63.2%	64.9%		
	Yes	N	4	28	13		
		%	0.6%	36.8%	35.1%		
Total	N		717	76	37		
	%		100.0%	100.0%	100.0%		

**: Highly significant

DM, HTN and obesity positive family history were significantly associated with HTN then Pre HTN (Table 7).

Table (7): Relation between HTN and family history

			BP grade			X^2	P
			Normal	PRE HTN	HTN		
DM	No	N	699	61	22	123.28	<0.01**
		%	97.5%	80.3%	59.5%		
	Yes	N	18	15	15		
		%	2.5%	19.7%	40.5%		
HTN	No	N	678	48	7	246.3	<0.01**
		%	94.6%	63.2%	18.9%		
	Yes	N	39	28	30		
		%	5.4%	36.8%	81.1%		
Obesity	No	N	694	63	22	102.45	<0.01**
		%	96.8%	82.9%	59.5%		
	Yes	N	23	13	15		
		%	3.2%	17.1%	40.5%		
Total		N	717	76	37		
		%	100.0%	100.0%	100.0%		

**: Highly significant

13.6% were reported with abnormal finding in sonar and 5.4% in ECHO (Table 8).

Table (8): Abnormality in sonar and ECHO distribution in HTN group only

	N	%
Abnormal finding in sonar	5	13.6
Abnormal finding in ECHO	2	5.4
Total	37	100.0

DISCUSSION

This study was held at three primary schools in Dyrb Negm City, Sharqia Governorate on (830) students (6 to 11) years old from both sexes; male and female.

In this study, we found that hypertension prevalence varied widely among the groups we analyzed. HTN were (37 cases) 4.5% and pre HTN (76 cases) 9.2%, and normal were 86.4%. This agrees with **Ibrahim et al.** [8] who found that the hypertension prevalence was (3%). This coincides also with **Kapil et al.** [9] who found that the hypertension prevalence was (4%). This is lower than **Muhihi et al.** [10] who found that the percentage of kids with hypertension was 15.2%. (pre-hypertension 4.4 percent and hypertension 10.8 percent).

This study showed that 4.5% had hypertension (3.2% 1st grade and 1.3% 2nd grade). This agrees with **Kumar et al.** [11] who found 1st grade of hypertension was most common among children.

This study showed that among hypertensive cases, 37.8% of the hypertensive children have abnormal lipid profile. This was in agreement with **Man et al.** [12].

In terms of hypertension, the results of this study showed no statistically significant difference between boys and girls. Our results are consistent with those of **Mushengezi and Chillo** [13], who found no difference in the prevalence of hypertension between the sexes. This is in contrast to research done in Nigeria by **Also et al.** [14] and in Turkey by **Discigil et al.** [15], where it was discovered that females had greater rates of hypertension (both systolic and diastolic). In contrast, **Bugaje et al.** [16] who reported a higher hypertension in females.

According to the results of this study, there was no correlation between kids' ages and their risk of hypertension. **Umar et al.** [17] found a higher rate of hypertension in older children, hence these findings contradict our results. Putting on weight as children get older contributes to blood pressure going up as children get older. Also, **Nengom et al.** [18] in Bertoua also found that students whose ages were more than 10 had a higher prevalence of hypertension.

Among our findings, obesity was found to increase the risk of hypertension. **Arun and Kavinilavu** [19] also noticed this result. Overactivation of the renin-angiotensin and sympathetic nerve systems, insulin resistance, and aberrant vascular anatomy and function may all contribute to the increased risk of hypertension seen in overweight children. This agrees with **Sorof and Daniels** [20] who showed that as body mass index (BMI) percentiles were higher, so did the rates of hypertension.

Our study showed that 17% were overweight and obese. This agrees with a study done by **Hassan et al.** [21], who found the prevalence of overweight and obesity was 19% among 5798 Egyptian school students. Also,

El-Shafie et al. [22] did research in Egypt and found that 20.3% of kids in the El-Bagour district were overweight or obese. **Pawar et al.** [23] who undertook a cross-sectional study of students at four Mumbai-area schools. In all, 1828 students from 4 different schools were surveyed. There were 590 females and 1238 males in all. They determined that 25.3% of the population was overweight or obese.

High salt intake was found to be strongly linked with high blood pressure and prehypertension in our study. This agrees with **Ha** [24] who reported that, sodium is a vital electrolyte for healthy nerves and muscles. High blood pressure is a risk factor for a high salt diet.

Our study showed that, HTN and Pre HTN were significantly associated with higher number of meal and high caloric diet. This was in agreement with **DeMarco et al.** [25].

Our study showed that, A higher risk of developing HTN than Pre HTN was seen among families having a history of the disease. This is consistent with the findings of **Ranasinghe et al.** [26], who determined that a family history of hypertension is a significant, non-modifiable risk factor. The research showed that parents and children have similar blood pressure connections. Increased renal proximal sodium reabsorption, genetic traits related to high blood pressure like high sodium-lithium counter-transport, low urinary kallikrein excretion, elevated uric acid level, and other hypotheses have all been put forth to explain the association between hypertension and a positive family history of hypertension. Common environmental variables include salt intake and heavy metal exposure; high fasting plasma insulin concentrations; high-density LDL sub-fractions; fat pattern index; oxidative stress; and body mass index. This contradicts the findings of **Ibrahim et al.** [8], who found no significant connection between family history of hypertension and other risk factors for hypertension (P = 0.793).

In our research, we found that there was a significant link between having a family history of obesity and having hypertension. This coincides with **Kanciruk et al.,** [27] who revealed family history of obesity was associated with hypertension. In contrast to what was found in **Nengom et al.** [18] study, which found no significant link between the two variables,

Our study showed that, 13.6% of hypertensive children had abnormal finding in sonar. This agrees with **Davran et al.** [28] who found some abnormal finding in sonar (like renal atrophy) was associated with hypertensive children.

CONCLUSION

HTN among studied group was found in 37 cases (4.5%; 3.2% 1st grade and 1.3% 2nd grade). This study provides crucial data linking obesity (as measured by

BMI) and hypertension. HTN was significantly associated with high salt intake, higher number of meal and high caloric diet. There was a stronger association between HTN and obesity in the family than between HTN and Pre HTN.

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- **Competing interests:** Nil.

REFERENCES
1. **Falkner B (2010):** Hypertension in children and adolescents: epidemiology and natural history. Pediatric Nephrology (Berlin, Germany), 25(7): 1219–1224. doi:10.1007/s00467-009-1200-3
2. **Chiolero A, Madeleine G, Gabriel A** *et al.* **(2007):** Prevalence of elevated blood pressure and association with overweight in children of a rapidly developing country. J Hum Hypertens., 21(2):120–7.
3. **Flynn J (2010):** Pediatric hypertension update. Curr Opin Nephrol Hypertens., 19: 292-7.
4. **Samuels J (2012):** The increasing burden of pediatric hypertension. Hypertension, 60: 276-7.
5. **Okoh B, Alikor E (2013):** Childhood hypertension and family history of hypertension in primary school children in Port Harcourt. Niger J Paediatr., 40: 184-8.
6. **Brady T (2012):** Hypertension. Pediatr Rev., 33:541-52.
7. **Banker A, Bell C, Gupta-Malhotra M** *et al.* **(2016):** Blood pressure percentile charts to identify high or low blood pressure in children. BMC Pediatrics, 16: 98. doi: 10.1186/s12887-016-0633-7.
8. **Ibrahim O, Afolabi J, Adedoyin O** *et al.* **(2019):** Prevalence and risk factors for hypertension among school children in Ilorin, Northcentral Nigeria. J Fam Community Med., 26:181-6
9. **Kapil U, Bhadoria A, Sareen N** *et al.* **(2013):** Association of body mass index and waist circumference with hypertension among school children in the age group of 5-16 years belonging to lower income group and middle income group in national capital territory of Delhi. Indian J Endocrinol Metab., 17: 345-8.
10. **Muhihi A, Njelekela M, Mpembeni R** *et al.* **(2018):** Elevated blood pressure among primary school children in Dar es salaam, Tanzania: prevalence and risk factors. BMC Pediatrics, 18(1). doi:10.1186/s12887-018-1052-8
11. **Kumar H, Uniyal N, Bawa S** *et al.* **(2014):** Prevalence of prehypertension in students of a tertiary care institute of North India. Int J Med Sci Public Health, 3: 212-214.
12. **Man R, Gan A, Fenwick E** *et al.* **(2019):** Prevalence, determinants and association of unawareness of diabetes, hypertension and hypercholesterolemia with poor disease control in a multi-ethnic Asian population without cardiovascular disease. Popul Health Metrics, 17: 0197. doi:10.1186/s12963-019-0197-5

13. **Mushengezi B, Chillo P (2014):** Association between body fat composition and blood pressure level among secondary school adolescents in Dar es Salaam, Tanzania. Pan Afr Med J., 19:327-31.
14. **Also U, Asani M, Ibrahim M (2016):** Prevalence of elevated blood pressure among primary school children in Kano Metropolis, Nigeria. Niger J Cardiol., 13:57-61.
15. **Discigil G, Aydogdu A, Basak O** *et al.* **(2007):** Prevalence and predictors of hypertension in primary school students: A population based study in Aydin, Turkey. Turk J Fam Med Prim Care, 1:17-22.
16. **Bugaje M, Yakubu A, Ogala W (2005):** Prevalence of adolescent hypertension in Zaria. Niger J Paediatr., 32:77-82.
17. **Umar A, Mustafa A, Muuta I (2016):** Prevalence of elevated blood pressure among primary school children in Kano metropolis, Nigeria. Nig J Cardiol., 13(1):57–61.
18. **Nengom J, Mambou R, Epée J (2021):** Blood pressure profile of school children aged 4 to 18 years in the City of Bafoussam. Health Sciences and Disease, 22(8): 20-27.
19. **Arun D, Kavinilavu R (2018):** A study of risk factors associated with hypertension among the school going children in Puducherry. Int J Community Med Public Health, 5:764-8.
20. **Sorof J, Daniels S (2004):** Obesity hypertension in children a problem of epidemic proportions. Hypertension, 40:441-47.
21. **Hassan N, El-Masry S, Fouad W** *et al.* **(2011):** Prevalence of metabolic syndrome among obese school students. The European e-Journal of Clinical Nutrition and Metabolism, 6: 248-252.
22. **El-Shafie M, Hogran H, Dohein A (2014):** Prevalence of obesity in primary school children living in Menoufyia governorate. Menoufia Med J., 27:529-32.
23. **Pawar S, Choksey A, Jain S** *et al.* **(2016):** Prevalence of overweight and obesity in 4 schools of South Mumbai. J Clin Diagn Res., 10(3): OC01–OC02.
24. **Ha S (2014):** Dietary salt intake and hypertension. Electrolyte & Blood Pressure: E & BP., 12(1): 7–18.
25. **DeMarco V, Aroor A, Sowers J (2014):** The pathophysiology of hypertension in patients with obesity. Nature reviews. Endocrinology, 10(6): 364–376.
26. **Ranasinghe P, Cooray D, Jayawardena R** *et al.* **(2015):** The influence of family history of hypertension on disease prevalence and associated metabolic risk factors among Sri Lankan adults. BMC Public Health, 15: 576. doi:10.1186/s12889-015-1927-7
27. **Kanciruk M, Andrews J, Donnon T (2014):** Family history of obesity and risk of childhood overweight and obesity: A meta-analysis. International Journal of Psychological and Behavioural Sciences, 8(5): 261-273.
28. **Davran R, Helvaci M, Davarci M (2014):** Left renal atrophy. Int J Clin Exp Med., 7(6):1603-6.