Original Article

موضوع أصيل

BLOOD PRESSURE PROFILE AND PREVALENCE OF HYPERTENSION IN PRIMARY SCHOOL CHILDREN IN BASRA CITY CENTER

تقدير معدلات ارتفاع ضغط الدم لدى طلاب المدارس الابتدائية في مركز مدينة البصرة

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ملخص البحث

هدف البحث: إن انتشار ومعدلات تشخيص ارتفاع التوتر الشرياني لدى الأطفال والمراهقين يبدو أنه في ازدياد، يعزى ذلك جزئياً إلى الزيادة في انتشار حالات البدانة عند الأطفال بالإضافة إلى ازدياد الوعي المتعلق بهذا المرض. تهدف هذه الدارسة إلى تقييم قراءات ضغط الدم وانتشار فرط التوتر الشرياني عند أطفال مرحلة الدارسة الإبتدائية في مركز مدينة البصرة.

طرق البحث: تم إجراء دراسة مقطعية مستعرضة شملت 1010 من الطلاب (48% ذكور، و52% إناث) أعمارهم بين 8 و12 سنة تم اختيارهم من 10 مدارس ابتدائية في مركز مدينة البصرة خلال الفترة بين كانون الأول 2007 وأبريل 2008 وذلك لتوضيح مستويات ضغط الدم وانتشار ارتفاع الضغط الشرياني بالإضافة إلى تحديد المتغيرات الوبائية المساهمة في ارتفاع ضغط الدم. تم قياس ضغط الدم بثلاث مرات منفصلة على الأقل باستخدام قياس الضغط النبضي المعياري مع استخدام قياس مناسب للكم. تم قياس الوزن والطول لدى جميع الأطفال وحساب مشعر كتلة الجسم لديهم.

النتائج: لوحظ عند كلا الجنسين أن متوسط قيمة الضغط الشرياني الانقباضي والانبساطي قد بلغت (109.2، 105.3 و104.9 مم. زئبق) و(58.5، 65.4 و63.6 مم. زئبق) على الترتيب. بلغ معدل انتشار حالة ما قبل ارتفاع التوتر الشرياني وارتفاع التوتر الشرياني 3.07، كما أورد وجود بدانة 10.9% من الأطفال في الدراسة. لوحظ وجود ارتباط إحصائي هام بين ارتفاع التوتر الشرياني وزيادة مشعر كتلة الجسم، وجود قصة عائلية لارتفاع التوتر الشرياني، وجود قرابة بين الوالدين، نوعية الإرضاع خلال الأشهر الستة من الحياة وتقدم عمر الأم خلال الحمل. من جهةٍ أخرى لم يلاحظ وجود علاقة هامة إحصائياً بين ارتفاع التوتر الشرياني وعمر الطفل أو جنسه.

الاستنتاجات: يفيد الكشف الباكر لحالات ارتفاع التوتر الشرياني عند الأطفال بشكلٍ كبير وذلك نتيجة الزيادة في انتشار هذه الحالة واختلاطاتها المستقبلية المحتملة في المراحل العمرية اللاحقة.

ABSTRACT

Objective: *The prevalence and rate of diagnosis of hypertension in children and adolescents appear to be increasing, this is due in part to the increasing prevalence of childhood obesity as well as growing awareness of this disease. The aim of this study was to assess blood pressure profile and prevalence of hypertension in primary school children in Basra City Center.*

Methods: *A cross sectional study was conducted on 1010 (48% boys and 52% girls) students aged (8-12 years) selected from ten primary schools in Basra city center during the period from December 2007 till April 2008; to elucidate blood pressure level and the prevalence of hypertension as well as to address some epidemiological variables which contribute to blood pressure. The blood pressure was measured on*

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at least three separated occasions using standardized sphygmomanometers with appropriate cuff size. Weight and height of all children were measured and body mass index was calculated.

Results: *For both genders, the combined mean±SD systolic and diastolic blood pressure were recorded in three visits (109.2, 105.3, 104.9 mm.Hg) and (68.5, 65.4, 63.6 mm.Hg) respectively. The prevalence rate of pre-hypertension and hypertension was 3.07% and obesity was reported in 10.9% of studied children. There was a significant statistical correlation between hypertension and increasing body mass index, family history of hypertension, parental consanguinity, feeding history during first six months of life and advance maternal age during pregnancy. There was no significant statistical correlation between hypertension with child age, gender.*

Conclusions: *Early detection of children with hypertension is potentially beneficial because of increasing prevalence of hypertension, and later on preventing it's the long-term complications.*

INTRODUCTION

The prevalence and rate of diagnosis of hypertension in children and adolescents appear to be increasing, this is due in part to the increasing prevalence of childhood obesity as well as growing awareness of this disease. There is evidence that childhood hypertension can lead to adult hypertension.[1]

Pediatric hypertension may be secondary to another disease process or it may be essential hypertension. Primary or essential hypertension rarely is found in children younger than 10 years and is a diagnosis of exclusion. Significant risk factors for essential hypertension include family history and increasing BMI. Some sleep disorders and black race can be potential risk factors for essential hypertension.[2]

Data on the relationship between dietary sodium and blood pressure are mainly based on adult populations. Significant correlations have not been shown between sodium intake and blood pressure in children and adolescents.[3]

Physical inactivity is an independent risk factor for cardiovascular disease, as well as for high blood pressure, high cholesterol levels and obesity.[4] The strong association of high BP with obesity and the marked increase in the prevalence of childhood obesity, indicate that both hypertension and pre hypertension are becoming a significant health issue in the young.[5]

The development of a national database on normative blood pressure levels throughout childhood has contributed to the recognition of elevated blood pressure in children and adolescents.[6]

Secondary hypertension is more common in children than in adults, and common causes of hypertension in children include renal disease, coarctation of the aorta, and endocrine disease.[7] However, as with adults, the majority of children and adolescents with mild to moderate hypertension have primary hypertension in which a cause is not identifiable.[8]

METHODS

A cross sectional study was carried out on 1010 students from primary schools; aged 8-12 years. Ten primary schools were selected randomly from a total list of 316 primary schools in Basra city center only, over a period of five months from (December 2007 to April 2008).

Through questionnaire filled by parents, data were collected regarding age, sex, age of mother when child was born, address, demographic and health information including feeding history in 1st six months of life, maternal smoking, family history of hypertension, consanguinity among parents, time spending in front of electronic games or TV watching if more or less than 2 hours,[4] eating habit regarding the consumption of salty food .

1010 papers were received from a total 1030 papers given (20 papers missed) which were excluded from the study.

For all students; weight and height were measured and blood pressure was recorded throughout daily

school attendance in a quite setting with the students in a sitting position. BP recorded three times, each time separated by at least 30 seconds and an average of 3 readings recorded using mercury sphygmomanometer.

All BP figures were matched against age, gender and height (the normative values are based on the National High Blood Pressure Education Program.[4] (appendix 1).

Normal BP was defined as SBP and DBP less than 90th percentile for age and gender while pre-hypertension was defined as an average SBP or DBP equal or greater than 90th percentile but less than 95th percentile, hypertension was defined as an average SBP or DBP equal or greater than 95th percentile for age and gender measured on at least 3 separated occasions.

Those with initial blood pressure readings equal or greater than 90th percentile were rechecked 3 times at interval of two to four weeks to ensure persistent elevation of BP and 3rd reading was taken for final analysis.

Body mass index was calculated for each student using pediatric normative data based on age and gender.[9] Over weight was defined when BMI at 85th-95th percentile, obesity was defined when BMI exceeding 95th percentile based on a growth charts available from the center for disease control and prevention (CDC).

RESULTS

Total number (1010) students were studied; of those 485 (48%) were males and 525 (52%) were females. Obesity and overweight found in (10.9% and 14.7%) respectively. Parental consanguinity found only in 28.5%. History of TV watching and video games playing more than 2 hours per day or less was distributed in (35% and 65%) of children respectively.

Table 1 shows the distribution of systolic, diastolic, systolic and diastolic BP in three readings, there is higher frequency of children with pre-hypertension and hypertension in first reading with decreasing frequency in subsequent readings (52%, 34%) respectively.

Hypertension (3rd reading) was recorded in 17 (1.68%); and high BP in 18 (1.78%) of children, the overall prevalence of pre-hypertension and hypertension was 3.07%. The distribution of BP according to the age and gender of studied children shows no statistical significant effect.

Depending on the 3rd reading; there is an increment in the means of systolic and diastolic pressure in both male and female with increasing age, with a higher

Readings		Systolic BP	Diastolic BP	Systolic and diastolic BP	
		No.(%)	No.(%)	No.(%)	Total
1st reading	Pre-hypertension	18 (37.5)	13 (27)	17 (35.4)	48
	Hypertension	21 (38.8)	6 (11.1)	27 (50)	54
2nd reading	Pre-hypertension	7 (29.1)	7 (29.1)	10 (41.6)	24
	Hypertension	5 (17.2)	4 (13.7)	20 (68.9)	29
3rd reading	Pre-hypertension	6 (33.3)	3 (16.6)	9 (50)	18
	Hypertension	2 (11.7)	3 (17.6)	12 (70.5)	17

Table 1. Frequency of pre-hypertension and hypertension in studied children.

Age (years)	Prevalence rate	Male		Female	
		Systolic (SD)	Diastolic (SD)	Systolic (SD)	Diastolic (SD)
-9	2.02%	101.9 (9.8)	62.1 (7.6)	100.0 (8.6)	64.3 (8.6)
-10	2.07%	102.3 (9.5)	62.4 (8.7)	103.3 (8.1)	64.5 (6.8)
-11	3.1%	103.2 (9.4)	63.4 (7.7)	105.1 (9.3)	66.3 (4.5)
-12	5.2%	104.2 (9.7)	65.1 (7.9)	105.7 (10.0)	66.5 (4.8)

Table 2. Mean systolic and diastolic blood pressure according to the age and gender (3rd reading).

BMI	Normal BP	Pre-hypertension	Hypertension	p-value
	No.(%)	No.(%)	No.(%)	
Normal (752)	742 (98.7)	5 (0.7)	5 (0.7)	<0.05
Over weight (148)	137 (92.5)	6 (4.1)	5 (3.4)	
Obese (110)	96 (87.3)	7 (6.4)	7 (6.4)	
TV watching	Normal BP	Pre-hypertension	Hypertension	>0.05
>2 hours (353)	338 (95.8)	10 (2.8)	5 (1.4)	
<2 hours (657)	637 (97.0)	8 (1.2)	12 (1.8)	
Total (1010)	975 (96.5)	18 (1.8)	17 (1.7)	

Table 3. Blood pressure status according to BMI and TV watching of the studied children.

Consanguinity	Normal BP	Pre-hypertension	Hypertension	Total
	No.(%)	No.(%)	No.(%)	
Non consanguineous	712 (98.6)	5 (0.7)	5 (0.7)	722
Consanguineous marriage	263 (91.3)	13 (4.5)	12 (4.2)	288
Family history of HT	Normal BP	Pre-hypertension	Hypertension	Total
No family history	712 (98.3)	6 (0.8)	6 (0.8)	724
Positive in first degree	118 (90.8)	7 (5.4)	5 (3.8)	130
Positive beyond first degree	145 (92.9)	5 (3.2)	6 (3.8)	156
Total	975 (96.5)	18 (1.8)	17 (1.7)	1010

p-value < 0.05

Table 4. Blood Pressure status according to parental consanguinity and family history of hypertension.

Mother age (years)	Normal BP	Pre-hypertension	Hypertension	Total
	No.(%)	No.(%)	No.(%)	
<20	71 (87.7)	5 (6.2)	5 (6.2)	81
20 – 40	890 (98.6)	7 (0.8)	6 (0.7)	903
>40	14 (53.8)	6 (23.1)	6 (23.1)	26
Feeding history	Normal BP	Pre-hypertension	Hypertension	
Breast feeding	686 (98.4)	5 (0.7)	6 (0.9)	697
Artificial feeding	190 (93.6)	8 (309)	5 (2.5)	203
Mixed	99 (90.0)	5 (4.5)	6 (5.5)	110
Total	975 (96.5)	18 (108)	17 (1.7)	1010

p-value<0.05

Table 5. Blood pressure status according to mothers' age during pregnancy and feeding history in first two years of life.

Variables	S.E	B coefficient	p-value
BMI	0.281	1.385	0.000
Mother age	0.595	2.717	0.000
Feeding pattern	0.308	0.705	0.022

Table 6. Logistic regression analysis of different variables in relation to blood pressure.

values for female than male. Regarding age specific prevalence rate for HT; those children aged 9 years rate is (2.02%) while those above 11 years have prevalence rate 5.2%, so there is an increment in the prevalence rate with increasing age. Table 2.

Distribution of BP status and body mass index was studied in Table 3, it shows that 6.3% and 6.4% of children with obesity have pre-hypertension and HT respectively while only 0.7% of normal BMI children have pre-hypertension and HT, which give high statistical significant correlation between BMI and BP (p-value<0.05), while TV watching or electronic games playing shows no statistical significant difference with BP.

Consanguinity and family history of hypertension studied in Table 4. It shows that 4.5% and 4.2% of children with pre-hypertension and hypertension respectively have consanguineous parents and 0.7% of children for both pre hypertension and hypertension respectively have non consanguineous parents, these results are statistically significant (p-value<0.05).

As well as positive family history of hypertension in 1st degree had been observed in 5.4% and 3.8% of children with pre-hypertension and hypertension

respectively, while 0.8% of children have no family history of HT, this results was statistically significant (p-value<0.05).

Mothers' age during pregnancy and feeding history during first 6 months of life had been studied with status of BP in Table 5; 6.2% of children with pre-hypertension and HT their mothers aged below 20 years while 23.1% of children with pre-hypertension and HT their mothers aged above 40 years which is statistically significant (p-value<0.05). As well as breast feeding history show less frequency of high BP with a statistically significant result (p-value<0.05).

Logistic regression analysis was done and the results shown in Table 6; there was a significant correlation between HT and increasing BMI, advanced maternal age during pregnancy and formula feeding in the first six months of life .

DISCUSSION

Several longitudinal studies have suggested that systemic arterial hypertension (SAH) in adults is a disease that has its beginnings in childhood. Because of the lack of routine examination and the belief that systemic arterial hypertension is rare in childhood, many children have failed to receive the diagnosis of hypertension over recent decades.[10]

The prevalence rate of hypertension among primary school children in Basra city center in this study is 3.07%, other countries had reported prevalence rate ranging from 3.6% to 9.6%.

In Jordanian study which was carried out by Jaddou et al in 2001, reported that the prevalence rate of HT was 3.6%,[11] while in other studies like in Saudi Arabia (4.8%),[12] Kuwait (5.1%),[13] Tunisia (9.6%).[14] Meanwhile, it is less than those reported in foreign countries as in Brazil (9.4%),[53] India (5.7%),[15] Ireland (5.2%)[16] and USA (4.5%).[17]

These differences may be attributed to variations in methodologies that have been used makes it difficult to compare results and contributes enormously towards the discrepant prevalence between the different studies. Among the methodological variations, the following can be cited: type of sphygmomanometer, positioning of the child, cuff selection criteria, number of measurements made, interval between the measurements and criteria for defining the basal blood pressure levels to be used in defining which individuals were considered hypertensive.[10]

Although the age prevalence rate of HT increased with increasing age; the blood pressure study show no significant statistical correlation with age, probably the number of studied children not enough to meet the p-value<0.05 criterion, this is in agreement with other studies carried out in Kuwait by Saleh et al in 2000[13-56] and in Brazil,[10] which also show no significant statistical difference with age. While in Japan, the study conducted by Hashimoto et al in 1997[18] shows that the age affects DBP only.

Other studies show that BP increase gradually with age, may be attributed to increase body mass,[9] a number of studies come in line with this relation like those carried in Iraq (Baghdad) by Mahmood in 2006 and Murad et al in 2002,[19,20] as well as in Turkey[21] and Ethiopian,[22] where they show a significant statistical correlation of BP status with age.

Although there is a slight difference between the means of BP readings toward female gender; the BP study show no significant statistical correlation with gender during analysis, this is in agreement with studies carried out in Brazil,[10] Kuwait[13] and contradict with other studies in Iraq,[19] Ethiopia,[22] Turkey,[21] and Jordan[11] which show a significant statistical effect of gender on BP and reveal that female has more chance for developing HT than male which explained by the physiological changes of puberty where menarche and development of secondary general characters impose tension and anxiety in girls.[19]

Children and adolescents with primary hypertension are frequently overweight, data on healthy adolescents obtained in school health-screening programs demonstrate that the prevalence of hypertension

Appendix 1. Blood pressure levels for boys by age and height percentile.

Age, years	Blood pressure percentile	Systolic blood pressure (mm Hg) Percentile of height							Diastolic blood pressure (mm Hg) Percentile of height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	80	81	83	85	87	88	89	34	35	36	37	38	39	39
	90th	94	95	97	99	100	102	103	49	50	51	52	53	53	54
	95th	98	99	101	103	104	106	106	54	54	55	56	57	58	58
	99th	105	106	108	110	112	113	114	61	62	63	64	65	66	66
2	50th	84	85	87	88	90	92	92	39	40	41	42	43	44	44
	90th	97	99	100	102	104	105	106	54	55	56	57	58	58	59
	95th	101	102	104	106	108	109	110	59	59	60	61	62	63	63
	99th	109	110	111	113	115	117	117	66	67	68	69	70	71	71
3	50th	86	87	89	91	93	94	95	44	44	45	46	47	48	48
	90th	100	101	103	105	107	108	109	59	59	60	61	62	63	63
	95th	104	105	107	109	110	112	113	63	63	64	65	66	67	67
	99th	111	112	114	116	118	119	120	71	71	72	73	74	75	75
4	50th	88	89	91	93	95	96	97	47	48	49	50	51	51	52
	90th	102	103	105	107	109	110	111	62	63	64	65	66	66	67
	95th	106	107	109	111	112	114	115	66	67	68	69	70	71	71
	99th	113	114	116	118	120	121	122	74	75	76	77	78	78	79
5	50th	90	91	93	95	96	98	98	50	51	52	53	54	55	55
	90th	104	105	106	108	110	111	112	65	66	67	68	69	69	70
	95th	108	109	110	112	114	115	116	69	70	71	72	73	74	74
	99th	115	116	118	120	121	123	123	77	78	79	80	81	81	82
6	50th	91	92	94	96	98	99	100	53	53	54	55	56	57	57
	90th	105	106	108	110	111	113	113	68	68	69	70	71	72	72
	95th	109	110	112	114	115	117	117	72	72	73	74	75	76	76
	99th	116	117	119	121	123	124	125	80	80	81	82	83	84	84
7	50th	92	94	95	97	99	100	101	55	55	56	57	58	59	59
	90th	106	107	109	111	113	114	115	70	70	71	72	73	74	74
	95th	110	111	113	115	117	118	119	74	74	75	76	77	78	78
	99th	117	118	120	122	124	125	126	82	82	83	84	85	86	86
8	50th	94	95	97	99	100	102	102	56	57	58	59	60	60	61
	90th	107	109	110	112	114	115	116	71	72	72	73	74	75	76
	95th	111	112	114	116	118	119	120	75	76	77	78	79	79	80
	99th	119	120	122	123	125	127	127	83	84	85	86	87	87	88
9	50th	95	96	98	100	102	103	104	57	58	59	60	61	61	62
	90th	109	110	112	114	115	117	118	72	73	74	75	76	76	77
	95th	113	114	116	118	119	121	121	76	77	78	79	80	81	81
	99th	120	121	123	125	127	128	129	84	85	86	87	88	88	89
10	50th	97	98	100	102	103	105	106	58	59	60	61	61	62	63
	90th	111	112	114	115	117	119	119	73	73	74	75	76	77	78
	95th	115	116	117	119	121	122	123	77	78	79	80	81	81	82
	99th	122	123	125	127	128	130	130	85	86	86	88	88	89	90
11	50th	99	100	102	104	105	107	107	59	59	60	61	62	63	63
	90th	113	114	115	117	119	120	121	74	74	75	76	77	78	78
	95th	117	118	119	121	123	124	125	78	78	79	80	81	82	82
	99th	124	125	127	129	130	132	132	86	86	87	88	89	90	90
12	50th	101	102	104	106	108	109	110	59	60	61	62	63	63	64
	90th	115	116	118	120	121	123	123	74	75	75	76	77	78	79
	95th	119	120	122	123	125	127	127	78	79	80	81	82	82	83
	99th	126	127	129	131	133	134	135	86	87	88	89	90	90	91
13	50th	104	105	106	108	110	111	112	60	60	61	62	63	64	64
	90th	117	118	120	122	124	125	126	75	75	76	77	78	79	79
	95th	121	122	124	126	128	129	130	79	79	80	81	82	83	83
	99th	128	130	131	133	135	136	137	87	87	88	89	90	91	91
14	50th	106	107	109	111	113	114	115	60	61	62	63	64	65	65
	90th	120	121	123	125	126	128	128	75	76	77	78	79	79	80
	95th	124	125	127	128	130	132	132	80	80	81	82	83	84	84
	99th	131	132	134	136	138	139	140	87	88	89	90	91	92	92
15	50th	109	110	112	113	115	117	117	61	62	63	64	65	66	66
	90th	122	124	125	127	129	130	131	76	77	78	79	80	80	81
	95th	126	127	129	131	133	134	135	81	81	82	83	84	85	85
	99th	134	135	136	138	140	142	142	88	89	90	91	92	93	93
16	50th	111	112	114	116	118	119	120	63	63	64	65	66	67	67
	90th	125	126	128	130	131	133	134	78	78	79	80	81	82	82
	95th	129	130	132	134	135	137	137	82	83	83	84	85	86	87
	99th	136	137	139	141	143	144	145	90	90	91	92	93	94	94
17	50th	114	115	116	118	120	121	122	65	66	66	67	68	69	70
	90th	127	128	130	132	134	135	136	80	80	81	82	83	84	84
	95th	131	132	134	136	138	139	140	84	85	86	87	87	88	89
	99th	139	140	141	143	145	146	147	92	93	93	94	95	96	97

Adapted with permission from National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Pediatrics 2004;114(2 suppl 4th report):558.

Appendix 2. Blood pressure levels for girls by age and height percentile.

Age, years	Blood pressure percentile	Systolic blood pressure (mm Hg) Percentile of height							Diastolic blood pressure (mm Hg) Percentile of height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	83	84	85	86	88	89	90	38	39	39	40	41	41	42
	90th	97	97	98	100	101	102	103	52	53	53	54	55	55	56
	95th	100	101	102	104	105	106	107	56	57	57	58	59	59	60
	99th	108	108	109	111	112	113	114	64	64	65	65	66	67	67
2	50th	85	85	87	88	89	91	91	43	44	44	45	46	46	47
	90th	98	99	100	101	103	104	105	57	58	58	59	60	61	61
	95th	102	103	104	105	107	108	109	61	62	62	63	64	65	65
	99th	109	110	111	112	114	115	116	69	69	70	70	71	72	72
3	50th	86	87	88	89	91	92	93	47	48	48	49	50	50	51
	90th	100	100	102	103	104	106	106	61	62	62	63	64	64	65
	95th	104	104	105	107	108	109	110	65	66	66	67	68	68	69
	99th	111	111	113	114	115	116	117	73	73	74	74	75	76	76
4	50th	88	88	90	91	92	94	94	50	50	51	52	52	53	54
	90th	101	102	103	104	106	107	108	64	64	65	66	67	67	68
	95th	105	106	107	108	110	111	112	68	68	69	70	71	71	72
	99th	112	113	114	115	117	118	119	76	76	76	77	78	79	79
5	50th	89	90	91	93	94	95	96	52	53	53	54	55	55	56
	90th	103	103	105	106	107	109	109	66	67	67	68	69	69	70
	95th	107	107	108	110	111	112	113	70	71	71	72	73	73	74
	99th	114	114	116	117	118	120	120	78	78	79	79	80	81	81
6	50th	91	92	93	94	96	97	98	54	54	55	56	56	57	58
	90th	104	105	106	108	109	110	111	68	68	69	70	70	71	72
	95th	108	109	110	111	113	114	115	72	72	73	74	74	75	76
	99th	115	116	117	119	120	121	122	80	80	80	81	82	83	83
7	50th	93	93	95	96	97	99	99	55	56	56	57	58	58	59
	90th	106	107	108	109	111	112	113	69	70	70	71	72	72	73
	95th	110	111	112	113	115	116	116	73	74	74	75	76	76	77
	99th	117	118	119	120	122	123	124	81	81	82	82	83	84	84
8	50th	95	95	96	98	99	100	101	57	57	57	58	59	60	60
	90th	108	109	110	111	113	114	114	71	71	71	72	73	74	74
	95th	112	112	114	115	116	118	118	75	75	75	76	77	78	78
	99th	119	120	121	122	123	125	125	82	82	83	83	84	85	86
9	50th	96	97	98	100	101	102	103	58	58	58	59	60	61	61
	90th	110	110	112	113	114	116	116	72	72	72	73	74	75	75
	95th	114	114	115	117	118	119	120	76	76	76	77	78	79	79
	99th	121	121	123	124	125	127	127	83	83	84	84	85	86	87
10	50th	98	99	100	102	103	104	105	59	59	59	60	61	62	62
	90th	112	112	114	115	116	118	118	73	73	73	74	75	76	76
	95th	116	116	117	119	120	121	122	77	77	77	78	79	80	80
	99th	123	123	125	126	127	129	129	84	84	85	86	86	87	88
11	50th	100	101	102	103	105	106	107	60	60	60	61	62	63	63
	90th	114	114	116	117	118	119	120	74	74	74	75	76	77	77
	95th	118	118	119	121	122	123	124	78	78	78	79	80	81	81
	99th	125	125	126	128	129	130	131	85	85	86	87	87	88	89
12	50th	102	103	104	105	107	108	109	61	61	61	62	63	64	64
	90th	116	116	117	119	120	121	122	75	75	75	76	77	78	78
	95th	119	120	121	123	124	125	126	79	79	79	80	81	82	82
	99th	127	127	128	130	131	132	133	86	86	87	88	88	89	90
13	50th	104	105	106	107	109	110	110	62	62	62	63	64	65	65
	90th	117	118	119	121	122	123	124	76	76	76	77	78	79	79
	95th	121	122	123	124	126	127	128	80	80	80	81	82	83	83
	99th	128	129	130	132	133	134	135	87	87	88	89	89	90	91
14	50th	106	106	107	109	110	111	112	63	63	63	64	65	66	66
	90th	119	120	121	122	124	125	125	77	77	77	78	79	80	80
	95th	123	123	125	126	127	129	129	81	81	81	82	83	84	84
	99th	130	131	132	133	135	136	136	88	88	89	90	90	91	92
15	50th	107	108	109	110	111	113	113	64	64	64	65	66	67	67
	90th	120	121	122	123	125	126	127	78	78	78	79	80	81	81
	95th	124	125	126	127	129	130	131	82	82	82	83	84	85	85
	99th	131	132	133	134	136	137	138	89	89	90	91	91	92	93
16	50th	108	108	110	111	112	114	114	64	64	65	66	66	67	68
	90th	121	122	123	124	126	127	128	78	78	79	80	81	81	82
	95th	125	126	127	128	130	131	132	82	82	83	84	85	85	86
	99th	132	133	134	135	137	138	139	90	90	90	91	92	93	93
17	50th	108	109	110	111	113	114	115	64	65	65	66	67	67	68
	90th	122	122	123	125	126	127	128	78	79	79	80	81	81	82
	95th	125	126	127	129	130	131	132	82	83	83	84	85	85	86
	99th	133	133	134	136	137	138	139	90	90	91	91	92	93	93

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increases progressively with increasing body mass index (BMI), and hypertension is detectable in 30% of overweight children (BMI >95th percentile).[4] It has been suggested that body fat patterning plays a role in the etiology of hypertension.[23] Studies in industrialized countries have shown that systolic and diastolic blood pressures are significantly higher in obese than in non-obese children.[24-67]

Obesity assessed by BMI was noted in 10.9% of studied children, 6.4% of children with obesity are hypertensive; while only 0.6% of children with normal BMI are hypertensive, this is in agreement with other studies carried out in Ethiopia by Oil K et al in 1994,[22] Turkey, [21] Kuwait,[13] Brazil[10] and Iraq.[19, 20]

The studied children of consanguineous parents and those having a family history of hypertension were found to be much more likely to develop hypertension, these results agrees with other studies carried out in Iran by Azita et al in 2006 which show a significant statistical correlation between BP and family history of HT,[25] Chinese community[26] and Finland.[27]

These studies have shown that cardiovascular disease aggregates in families. This is probably due in part to familial aggregation of important cardiovascular risk factors such as hypertension, obesity and high total serum cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C).[25]

Result of studied children shows significant statistical correlation between BP status and breast feeding, this is in agreement with study done by Martin and his colleagues compared the effects of breast and bottle feeding on blood pressure in 4,763 children enrolled in a longitudinal study of parents and children, a long term studyof health and development in the United Kingdom, in an overall analysis, children who were breastfed for any length of time had lower blood pressure than did formula-fed children.

Differences in the nutrient content of breast milk and formula are a potential explanation for the blood pressure lowering effect of breast feeding. Breastfed children tend to consume less sodium, which is one factor that can influence blood pressure. Breast milk also contains long-chain polyunsaturated fatty acids which impact tissue development in the body, including blood vessels.[28]

Advanced mother's age was also associated with higher blood pressure (child's systolic blood pressure was 0.7 mm. Hg higher for every additional five years of age in women at the time they gave birth).[29] Current study meet the results mentioned above, there is a significant statistical effect on BP by mother age but contradicts the study of Kuwait school children which showed no significant effect of mother age on BP.[13]

As physical activity at home and work have reduced, and more time has been made available for alternative behaviors, greater time spent in sedentary pursuits (TVs, stereos, computers, video games) that have become increasingly sophisticated and comprehensive in coverage. Children's TV viewing time and time spent playing electronic games is associated with overweight and obesity.[30] This study shows no significant statistical correlation between BP and sedentary life style (TV and video games) and counteract with results from a study carried out in Cameroon[31] which also shows significant relation between BP and sedentary life.

History of relevant illness including information about prior hospitalization, renal disease, UTI, to uncover the definable causes for secondary HT included in questionnaire papers and excluded from the study.

Some variables mentioned are not included in this study as; the effect of child snoring, maternal smoking and excess dietary sodium intake on BP because no history can be obtained from questionnaire papers. Physical inactivity as a risk factor for HT not included in this study because of shortening in data concern.

CONCLUSIONS

Early detection of children with hypertension is potentially beneficial because of increasing prevalence of hypertension, and later on preventing it's the long-term complications.

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