

## THE ASSOCIATION BETWEEN OBESITY AND BLOOD PRESSURE AMONG ADOLESCENTS IN DUBAI, UAE

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### ABSTRACT

**Objective:** To investigate the association between obesity and the risk of elevated blood pressure (BP) in adolescents in Dubai, United Arab Emirates (UAE).

**Methodology:** Representative sample of 661 adolescents aged 12 to 17 years were selected by means of a multistage stratified random sampling technique.

**Results:** The mean body mass index (BMI) of males was higher than that of females at all ages except at 13 years of age, where the females had higher mean BMI values (24.1kg/m<sup>2</sup>) compared to males (21.9 kg/m<sup>2</sup>). Males had higher levels of systolic blood pressure (SBP) (117.1mm Hg - 126.8 mm Hg) than females (109.2mmHg -117.1mmHg). The prevalence of high SBP increased as the weight increased, as 50% of males with high SBP were obese, compared with 62.5% among females. Male and female adolescents with elevated SBP were 5 times (95% CI 2.3, 9.7) and 16 times (95% CI 3.5, 17.3) respectively, more likely to be obese compared to those with normal SBP. Similarly, those with elevated diastolic blood pressure (DBP) were two times (95% CI 1.1, 4.4) and four times (95% CI 1.6, 8.5) more likely to be obese compared to those with DBP in the normal range.

**Conclusion:** The high prevalence of obesity among adolescents in Dubai and its association with high BP calls for urgent action to prevent and control obesity in this age group.

**KEY WORDS:** Adolescents, Dubai, Body Mass Index, Blood Pressure, Obesity.

Pak J Med Sci April - June 2010 Vol. 26 No. 2 271-276

### How to cite this article:

Zaal AB, Musaiger AO, D'Souza R. The Association between Obesity and Blood Pressure among Adolescents in Dubai, UAE . Pak J Med Sci 2010;26(2):271-276.

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\* Received for Publication: March 20, 2008

\* Accepted: July 10, 2008

## INTRODUCTION

Changes in lifestyle is an important factor in the global epidemic of overweight and obesity<sup>1</sup> and the prevalence of obesity is increasing in virtually all populations and age groups worldwide.<sup>2</sup> This is particularly true in case of the Arab Gulf countries where a gradual shift from traditional foods to more westernized foods characterized by high energy intake from either fat or from carbohydrates is occurring. In addition, the sedentary lifestyle among most of the population in this region contributes the rise of obesity.<sup>3</sup>

Childhood and adolescent obesity is a serious public health problem and in 1998, the

World Health Organization designated obesity as a global epidemic affecting adults and children.<sup>4</sup> In United Arab Emirates (UAE) a high proportion of adolescents female were reported to be overweight or at risk for overweight, ranging from 13% for the age of 17 and 33% for the age of 11 years.<sup>5</sup> It is reported that the frequency of obesity among UAE youth is two to three times greater than the published international standard and could lead to profound public health implications such as prevalence of adult chronic diseases.<sup>6</sup> Studies on obesity in Kuwaiti children indicated that biochemical variables and blood pressure (BP) were adversely affected in obese children.<sup>7</sup> A study to evaluate the prevalence of hypertension among Kuwaiti children indicated that 61.1% of hypertensive subjects were obese and that obesity was most commonly associated with hypertension in children.<sup>8</sup> In Bahrain it was reported that body mass index (BMI) and body fat were significantly and positively associated with risk of having high BP among both male and female adolescents.<sup>9</sup>

Social and lifestyle factors were reported to be the most important factors for the occurrence of obesity amongst the UAE adolescents.<sup>10</sup> Freedman et al.,<sup>11</sup> found that overweight American children were 2.4 times as likely to have elevated diastolic blood pressure (DBP) and 4.5 times as likely to have elevated systolic blood pressure (SBP).

Unfortunately many people in the general population do not consider childhood obesity to be a problem of more than aesthetic dimensions.<sup>12</sup> As far as the UAE is concerned available data on relationship between of the body composition and BP in adolescents has so far not been investigated. The purpose of this study therefore was to assess the association of adiposity with elevated blood pressure in a large population-based representative sample of adolescents in Dubai, UAE.

## METHODOLOGY

The study population included UAE national male and female adolescents, aged 12 to 17 years. A sample of these adolescents (661

adolescents, 324 males and 337 females) was selected by means of a multistage stratified random sampling technique. Dubai was first divided into four administrative areas. One preparatory and one secondary school for each sex were then selected by a simple random method for each area. One class from each educational level (3 for preparatory and three for secondary) were then selected from each school by a simple random method and only the Dubai adolescents were included in the study. Student reported age and date of birth were verified against the school records which in turn were based on the birth certificate. The study was approved by the Research Ethics Committee of the Ministry of Health, Dubai Medical District. All adolescents, parents and teachers were clearly informed about the purpose and content of the study and written consent was obtained from parents.

Weight and height were measured as described by Gibson.<sup>13</sup> Weight was measured to the nearest 0.1kg using an electronic portable scale (Seca). To ensure accuracy in measurement the scale was checked for zero reading before each weighing and calibrated with a known weight on the morning of each data collection. Student's height was measured, in the standing position, to the nearest 0.1 cm using a portable stadiometer which was attached to the "Seca" weighing scale. The student was asked to stand without shoes and socks, back against the scale, heels together and head in the upright position. The movable headboard was lowered until it firmly touched the upper part of the subjects head and a direct reading of height was obtained. From these measurements the BMI (weight in kilograms divided by height in meters squared) was computed.

For the BP, an automatic BP monitor was used; the SBP and the DBP were recorded under standardized conditions.<sup>14</sup> Anthropometric measurements and blood pressure of adolescents was measured by trained nurses. The BP status of the adolescents was defined according to the recommendations of the World Health Organization expert committee of Hypertension control,<sup>15</sup> which were based on the age and sex

specific guidelines of the Second Task Force on Blood Pressure Control in Children.<sup>14</sup>

Spearman correlations, linear regression coefficients and odds ratio were used to examine the relationship between adolescent's obesity and blood pressure. Statistical analysis was performed using the SPSS software package. Weight status was determined using the cut-off values of BMI as recommended by the World Health Organization,<sup>16</sup> as underweight: <5<sup>th</sup> percentile of BMI for age; normal weight: 5<sup>th</sup> to <85<sup>th</sup> percentile of BMI for age; overweight: 85<sup>th</sup> to <95<sup>th</sup> percentile of BMI for age and obese: ≥95<sup>th</sup> percentile of BMI for age

## RESULTS

The mean, median and standard deviation of BMI, SBP and DBP by age and gender are presented in Table-I. In males, the mean BMI was the lowest at 13 years of age (21.9kg/m<sup>2</sup>), and was the highest at 14 years of age (23.6kg/m<sup>2</sup>). In females the lowest mean BMI was at 12 years

of age (19.8kg/m<sup>2</sup>) and the highest was at 13 years of age (24.1kg/m<sup>2</sup>). Male adolescents had higher levels of SBP (117.2mm Hg - 126.8mm Hg) than female adolescents (109.2 mm Hg - 117.2mm Hg). The DBP ranged between 74.1-75.2mm Hg in males to 71.0-75.5 mmHg in females. The lowest SBP and DBP were both at the age 12 years in females (109.2 and 71.0mmHg) whereas the highest SBP (126.8mmHg) and lowest DBP (74.1mmHg) were at the age 17 years in males.

The proportion of adolescent with BP according to their BMI categories is presented in Table-II. In both the genders, greater proportions of high SBP were found among those who were obese (50.0% of males and 62.5% of females). The association between weight status and SBP was found to be highly statistically significant ( $p < 0.000$  for both the sexes). Similar trends were observed for DBP as 46.3% of males and 44.4% of females who had high DBP were obese. However, a high proportion of DBP was also found

Table-I: Means, medians, and standard deviation of body mass index and blood pressure of Dubai adolescents

		Males				Females			
		N	BMI (kg/m <sup>2</sup> )	Systolic BP	Diastolic BP	N	BMI (kg/m <sup>2</sup> )	Systolic BP	Diastolic BP
Age (years)									
12	Mean	37	22.6	117.3	74.8	15	19.8	109.2	71.0
	Median		22.0	116.5	77.0		18.6	107.5	69.5
	SD		5.3	15.0	11.1		4.6	13.1	10.6
13	Mean	59	21.9	117.2	74.2	65	24.1	116.6	74.5
	Median		20.3	116.5	75.0		23.3	116.0	74.0
	SD		5.8	11.2	9.2		7.0	14.8	8.6
14	Mean	82	23.6	121.6	74.7	67	23.1	115.6	75.5
	Median		21.2	119.8	74.5		21.0	117.0	75.0
	SD		7.5	14.4	9.5		6.4	13.3	8.9
15	Mean	51	23.0	122.4	74.2	64	22.6	112.2	73.5
	Median		21.5	120.5	74.5		20.6	112.0	72.8
	SD		5.6	15.2	8.9		6.0	11.7	9.5
16	Mean	47	23.1	123.5	75.2	63	23.0	117.2	74.2
	Median		22.1	122.5	74.0		20.9	116.0	74.0
	SD		4.4	13.4	9.0		6.6	11.4	8.4
17	Mean	48	23.2	126.8	74.1	63	22.7	115.0	72.8
	Median		20.8	126.6	72.8		20.8	115.0	73.0
	SD		5.5	12.4	10.6		5.7	11.1	8.2

among normal weight adolescents. The association between weight status and DBP was found to be highly statistically significant ( $p < 0.001$  and  $p < 0.005$  for males and females respectively).

The risk for BP among adolescents by weight status is presented in Table-III. To obtain odds ratios the adolescents were grouped into two categories as non-obese (underweight and normal weight adolescents) and obese (overweight and obese adolescents). The risk to have high SBP was about five times among the overweight and obese male adolescents compared to 16 times among their counterpart female adolescents. As for DBP the risk was 2.2 and 3.7 times for males and females respectively.

### DISCUSSION

The rise in the blood pressure in the past decade among children and adolescents has increased and evidence suggests that excess weight gain may be responsible for 65-75% of the risk for essential hypertension.<sup>17</sup> This study demonstrates that obese adolescents had a significantly higher SBP and DBP than the non-obese adolescents, and confirms previous observations that increased BMI in adolescence is associated with raised BP. Studies on Bahraini school children aged 12-17 years indicates a close relationship between obesity and risk of developing elevated BP.<sup>9</sup> It was also evident from this study that, at different age groups,

male adolescents have a higher mean level of SBP than females and demonstrate age and sex differences in BP of adolescents. Similar findings have been reported by Dasgupta et al.,<sup>18</sup> that not only are males more likely than females to have high SBP in youth but that this risk difference increases in magnitude during the adolescent period. Further the higher SBP status could likely account for higher prevalence of hypertension among men compared with women in young and middle-aged adults. This study thereby indicates that BMI in males and females is an important predictor of SBP in Dubai adolescents. Lack of physical exercise and high dietary energy intake are considered to be the main factors responsible for the accumulation of fat among children in the Arab Gulf countries.<sup>19</sup>

It was found in this study that the risk for high BP was 5 and 16 times more likely to be in overweight and obese than non-obese adolescents. These findings for males are comparable to those reported in the Bogalusa Heart Study.<sup>11</sup> The mechanisms by which excess weight may lead to elevated BP are poorly understood.<sup>20</sup> Abnormal renal pressure natriuresis, due initially to increased renal tubular sodium reabsorption, is a key factor linking obesity with hypertension.<sup>11</sup> Another study has reported that as in adults, a combination of factors including over activity of the sympathetic nervous system

Table-II: The relationship between Blood Pressure (BP) and weight status of adolescents aged 12-17 years in Dubai, UAE

	Males (M) (BMI)								P-value*	Females (F) (BMI)								
	Under weight		Normal weight		Over weight		Obese			Under weight		Normal weight		Over weight		Obese		
Blood Pressure	N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%	P value*
<i>Systolic BP</i>																		
Normal	14	5.0	166	59.3	50	17.9	50	17.9	0.000	18	5.6	204	63.6	40	12.5	59	18.4	0.000
High	0	0.0	12	27.3	10	22.7	22	50.0		0	0.0	2	12.5	4	25.0	10	62.5	
<i>Diastolic BP</i>																		
Normal	14	4.9	161	56.9	55	19.4	53	18.7	0.001	17	5.5	197	63.5	39	12.6	57	18.4	0.005
High	0	0.0	17	41.5	5	12.2	19	46.3		1	3.7	9	33.3	5	18.5	12	44.4	

\* P-value for Chi-square

(SNS), insulin resistance, and abnormalities in vascular structure and function may contribute to obesity-related hypertension in children.<sup>21</sup>

Unless extremely elevated, BP levels in children and adolescents do not appear to be related to disease outcome. However, available data indicates a role for high BP and obesity at this age in increasing risk for cardiovascular diabetes and disease in adulthood.<sup>22</sup> Researchers have found that being overweight in adolescence is associated with an increased risk of morbidity from coronary heart disease and atherosclerosis in adulthood, independent of adult obesity.<sup>23</sup> In Bahrain, it was found that diabetes, hypertension and coronary heart disease are the most prevalent chronic diseases associated with obesity.<sup>24</sup> National data from the UAE strongly indicate that cardiovascular diseases continue to be the leading cause of death with acute myocardial infarction representing 28%, cerebrovascular disease 16.2%, hypertensive disease 13.0%, and ischemic heart disease 12.3% of mortality from cardiovascular diseases. In addition it is also reported that the prevalence of diabetes is approximately 17% amongst the UAE population.<sup>25</sup>

Obesity in the childhood should be considered a chronic medical condition and, thus, is likely to require long-term treatment. Public health initiatives may prove instrumental in stemming the evolving epidemic of pediatric obesity and its complications. One strategy to control obesity could involve reducing the BMI in individuals which has been shown to reduce

ones risk of developing diabetes, hypertension and elevated blood cholesterol.<sup>26</sup> Hence, the key to fighting obesity could be physical activity and studies demonstrated an active life style such as frequent participation in sport at school,<sup>27</sup> had a significantly diminished risk of developing high blood pressure.

To summarize, this study indicates that obesity was higher in males than females and that young adolescents were more obese than older adolescents. Hence, the levels of body mass index that are used to define obese and non-obese should take into account the relationship between body mass index, elevated BP and other health related characteristics. This is all the more important since it is reported that the prevalence of obesity among school children in UAE is two to three times greater than the recently published international data.<sup>6</sup> In order to reverse the current trend towards increasing obesity changes are needed both in the people's lifestyle and in the social and economic environment in which the adolescents live. Considerable attention should be given to strategies aimed at preventing obesity. Part of the solution involves a change in the national diet towards inclusion of more foods of low energy density such as fruit and vegetables. The effectiveness of all public health programmes aimed at preventing weight gain in the population should be evaluated. Any plan should be critically evaluated and the impact of each proposed intervention measured. Successful management of obesity is never a quick or simple process,

Table-III: Association between obesity and Blood Pressure (BP) among adolescents aged 12-17 years in Dubai, UAE

	Males						Females					
	Non-obese <85 <sup>th</sup> P		Overweight & Obese >85 <sup>th</sup> P		Odds Ratio	P Value	Non-obese <85 <sup>th</sup> P		Overweight & Obese >85 <sup>th</sup> P		Odds Ratio	P Value
	n	%	n	%	95% CI		N	%	n	%	(95% CI)	
<i>Systolic BP</i>												
Normal	180	64.3	100	35.7	1.0	0.000	222	69.2	99	30.8	1.0	0.000
High	12	27.3	32	72.7	4.8 (2.3 -9.7)		2	12.5	14	87.5	15.6(3.5-17.3)	
<i>Diastolic BP</i>												
Normal	175	61.8	108	38.2	1.0	0.013	214	69.0	96	31.0	1.0	0.001
High	17	41.5	24	58.5	2.0(1.1-4.4)		10	37.0	17	63.0	3.7(1.6-8.5)	

but urgent steps need to be taken in the right direction if we are to tackle the current rise in obesity.

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