Prevalence of hypertension in obese and non-obese Saudis

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Objective: Obesity occurs at a high prevalence in the Saudi population. Studies in literature show that hypertension occurs more frequently in obese individuals. This study was designed to determine the prevalence of hypertension in obese Saudis in comparison with results obtained in non-obese individuals.

Methods: The screening involved a statistically designed household screening program. Only adults 14-70 years of age were included in the study. Blood pressure (systolic and diastolic) was measured when the individuals were in sitting position and height and weight were used to calculate Body Mass Index. All individuals with Body Mass Index > 30 were classified as obese and hypertension was measured as systolic blood pressure > 140 and diastolic blood pressure > 90 or both. The prevalence of hypertension was calculated in the obese and non-obese group. Chi square analysis was carried out to determine the significance of the difference in prevalence in different groups.

Results: In the non-obese males and females the prevalence of hypertension was 4.8% and 2.8%. While in the obese group the prevalence was almost 1.6 times higher in the males (8%) and 3.52 times higher (8%) in the female obese. The results were separated on the basis of the province to which the population belonged and hypertension prevalence was calculated in the obese and non-obese. In each region the prevalence of hypertension was higher in the obese group compared to the non-obese group. Non-obese females had significantly lower hypertension prevalence than the male in the same province but the hypertension prevalence was higher in the females compared to the male in the obese group. Male in the Eastern, Southern and Western provinces did not show an increased hypertension prevalence in the obese.

Conclusion: Since the prevalence of obesity is high in Saudis and since obesity and hypertension occur together and cause serious complications, it is strongly suggested that measures are adopted to decrease prevalence of obesity and its underlying complications. Awareness programs are required at the level of the general public for successful implication of preventive programs.

Keywords: Obesity, hypertension, cardiovascular disease.
Methods. This study was conducted as a component of a major National Project to investigate the prevalence of diabetes mellitus in Saudi population. The screening was based on a statistically designed "Household Screening Programme", the details of which have been published elsewhere.29 The population screened were Saudi males and females living in different provinces of Saudi Arabia. Randomly selected areas in each province were divided into sectors and in selected sector, every tenth street and on every street, every tenth house was selected for screening. The family was contacted and the purpose of the screening was explained. Only those families who volunteered were included in the study. An early morning visit was made to the family house and essential details were recorded for each member above the age of 14 years. Blood pressure (systolic and diastolic) was recorded by an experienced and trained nurse using mercury sphygmomanometer using standard method, when the individual was in sitting position. The height (in meters) and weight (in kilograms) were recorded. Height was recorded using a measuring tape, with the individual standing without shoes, next to the wall, with the heels, buttocks, shoulders and occiput touching the wall. The head was kept erect and the measuring tape was stretched slightly to measure the height to the nearest 0.1 cm. Weight was recorded on a measuring scale calibrated daily at the beginning of each working day. Each individual was requested to wear a light dress and the weight was recorded by taking two successive readings to the nearest 100g.

Results. The study group comprised of 14,805 adult individuals (males = 6225; females = 8580) with ages ranging from 14-70 years. There were 2581 adults (males = 896 and females = 1685) who were classified in the obese group and 12224 (males = 5329; females = 6895) who were in the non-obese group. The prevalence of hypertension was calculated in the obese and non-obese males and females and the results in the total group are presented in Table 1. A significant increase in the prevalence of hypertension was observed in the obese, where the females had almost 3.5 times higher prevalence of hypertension compared to their non-obese counterpart, while the obese males had about 1.6 times higher prevalence than the non-obese males.

Table 1 - Prevalence of hypertension in obese and non-obese Saudis.

<table>
<thead>
<tr>
<th>Sex</th>
<th>No</th>
<th>No</th>
<th>No. with HT</th>
<th>Prevalence of HT (%)</th>
<th>No</th>
<th>No with HT</th>
<th>Prevalence of HT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male*</td>
<td>6225</td>
<td>896</td>
<td>70</td>
<td>7.8</td>
<td>5329</td>
<td>256</td>
<td>4.8</td>
</tr>
<tr>
<td>Female*</td>
<td>8580</td>
<td>1685</td>
<td>146</td>
<td>8.7</td>
<td>6895</td>
<td>174</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td>14805</td>
<td>2581</td>
<td>216</td>
<td>8.4</td>
<td>12224</td>
<td>430</td>
<td>3.5</td>
</tr>
</tbody>
</table>

*Statistical significance of the difference in the prevalence of hypertension in obese and non-obese individuals
Male: \( \chi^2=13.4 \) df=1 \( p<0.002 \)
Female: \( \chi^2=140.5 \) df=1 \( p<0.0001 \)
Total: \( \chi^2=119.0 \) df=1 \( p<0.0001 \)
HT: Hypertension
Hypertension in obese and non-obese Saudis ... El-Hazmi & Warsy

general, weight gain in adults is a potent risk factor for the later development of hypertension and several studies have shown that weight reduction in the obese hypertensive often reduces arterial blood pressure.11,13,31,32 It has also been suggested that birth-weight may also be linked to adult blood pressure, possibly as a result of its relationship with later obesity.32 The mechanism of development of hypertension in obese individuals is shown to be due to hyperinsulinemia, a characteristic of obesity, and insulin resistance.27,33-35 This is believed to contribute to the probability of developing hypertension by activating the sympathetic nervous system and by causing sodium retention.27 In addition, the pressor effect of insulin in obesity may be further enhanced by the observation that its vasodilator action can be blunted in obese subjects. Furthermore, Leptin, a hormone, which is often increased in obese individuals, may contribute to development of hypertension, through its effects on insulin, sympathetic nervous system and sodium retention. In addition, the kidney may also play a role in producing hypertension by abnormal renal sodium handling coupled with structural changes in the kidney of an obese patient and these can raise blood pressure.27

Obesity and hypertension are major risk factors for cardiovascular system. Arterial hypertension

Discussion. Obesity and hypertension are closely associated multifactorial disorders and studies in different population groups have confirmed that the prevalence of hypertension increases significantly in the obese.9-12,27,30 The results of this study confirm the same trend in the Saudi population, where the prevalence of hypertension is higher in the obese than the non-obese and the prevalence in the obese females is more than the obese males. The only exception are the male groups in the Eastern, Southern and Western provinces, who have a non-significant difference in the HT prevalence in the non-obese and the obese group. This suggests that not only obesity, but other factors, possibly genetic and environmental also play a role in increasing the prevalence of hypertension in the obese group.

Table 2 - Prevalence of hypertension in obese and non-obese Saudis in different provinces of Saudi Arabia.

<table>
<thead>
<tr>
<th>Province*</th>
<th>Sex</th>
<th>Total No.</th>
<th>No.</th>
<th>No. with HT</th>
<th>Prevalence of HT</th>
<th>No.</th>
<th>No. with HT</th>
<th>Prevalence of HT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>M</td>
<td>1913</td>
<td>295</td>
<td>23</td>
<td>7.82</td>
<td>1619</td>
<td>50</td>
<td>3.90</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>2616</td>
<td>595</td>
<td>48</td>
<td>8.07</td>
<td>2021</td>
<td>50</td>
<td>2.47</td>
</tr>
<tr>
<td>Eastern</td>
<td>M</td>
<td>251</td>
<td>33</td>
<td>3</td>
<td>9.1</td>
<td>218</td>
<td>29</td>
<td>13.3</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>360</td>
<td>71</td>
<td>17</td>
<td>23.9</td>
<td>289</td>
<td>22</td>
<td>7.6</td>
</tr>
<tr>
<td>Southern</td>
<td>M</td>
<td>1926</td>
<td>203</td>
<td>12</td>
<td>5.9</td>
<td>1723</td>
<td>63</td>
<td>3.66</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>2768</td>
<td>428</td>
<td>30</td>
<td>7.01</td>
<td>2340</td>
<td>39</td>
<td>1.70</td>
</tr>
<tr>
<td>Northern</td>
<td>M</td>
<td>1127</td>
<td>151</td>
<td>17</td>
<td>11.26</td>
<td>976</td>
<td>51</td>
<td>5.22</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>1518</td>
<td>313</td>
<td>26</td>
<td>8.30</td>
<td>1205</td>
<td>36</td>
<td>3.00</td>
</tr>
<tr>
<td>Western</td>
<td>M</td>
<td>1008</td>
<td>215</td>
<td>15</td>
<td>7.0</td>
<td>793</td>
<td>63</td>
<td>7.94</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>1318</td>
<td>278</td>
<td>25</td>
<td>9.0</td>
<td>1040</td>
<td>27</td>
<td>2.60</td>
</tr>
</tbody>
</table>

M: Male, F: Female, HT: Hypertension

*Significance of the difference in the prevalence of HT in obese and non-obese.

Central: M: $\chi^2=13.82, df=1, p<0.01$, F: $\chi^2=38.34, df=1, p<0.0001$
Eastern: M: $\chi^2=0.156, df=1, p=0.7$, F: $\chi^2=14.1, df=1, p<0.0001$
Southern: M: $\chi^2=1.9, df=1, p=0.167$, F: $\chi^2=40.3, df=1, p<0.0001$
Northern: M: $\chi^2=7.36, df=1, p<0.005$, F: $\chi^2=4.69, df=1, p<0.05$
Western: M: $\chi^2=0.107, df=1, p=0.743$, F: $\chi^2=22.0, df=1, p<0.0001$
increases afterload to the left ventricle, while obesity produces an increase in stroke volume and increases preload. Hence, as a result of this double burden, the heart adapts with eccentric left ventricular hypertrophy. Contractility becomes impaired early in the course of obesity hypertension and ventricular ectopy is observed. Thus, as a consequence, the obese hypertensive patient is at a high risk for congestive heart failure and sudden death.33,26,16 It has been shown that childhood obesity is the single marker of the child at risk for development of cardiovascular disease later in life.37 Obesity and a high dietary intake of carbohydrates, salts etc. or both can induce several potential pressor mechanisms: (1) higher plasma norepinephrine and epinephrine levels; (2) a tendency to hyperaldosteronism; (3) enhanced sensitivity of blood pressure to salt; (4) increased total blood volume leading to increased cardiac output and eventually eccentric left ventricular hypertrophy, and finally (5) increased cystolic free Ca++ levels and reduced intracellular Mg++ levels.38 These factors play a role in predisposing to the development of hypertension in the obese individuals. Since several studies have shown that weight reduction in obese patients not only reduces blood pressure, but also reduces the cardiovascular changes,22,24,31 it is of utmost importance to adopt measures to decrease childhood and adult obesity in the Saudi population. This requires awareness programs for the general public, in order to educate them about the causes, consequences and ways and means of prevention of obesity. The importance of physical exercise and dietary restriction of calories, plays an important role in weight reduction and the awareness about those need to be spread to all including children and adults. These steps are essential in Saudi population who have a high prevalence of obesity and these prevention steps will play an essential role to reduce the complications associated with obesity.

References