Prevalence of Pre-hypertension and Hypertension in a sample of Egyptian Adults and its Relation to Obesity


Biological Anthropology Department, Medical Research Division, National Research Centre (NRC).

Community Medicine Division, national Research Centre., Cairo, Egypt.

Abstract: Objective: to study the prevalence of prehypertension and hypertension in Egyptian adults and its relation to obesity. Subjects and Methods: The blood pressure of 5534 Egyptian subjects was measured (2663 females – 2871 males) aged 20 to 75 years old. They represented different geographic localities and different social classes. Anthropometric measurements including height, weight, waist circumferences, and hip circumferences were also measured. Waist to hip ratio and body mass index (BMI) were calculated. Fasting blood sugar was tested. Results: The prevalence of prehypertension and hypertension was 49.22 % (54.4 and 43.1 for males and females) and 16.84 % (18.5% and 15.1% for males and females) respectively. There was a tendency to increase of both prehypertension and hypertension in males as compared to females. The percentages of the hypertensive individuals were increased with age and degree of obesity. Prehypertension was higher in the cases having glucose intolerance, while hypertension was increased mainly in those suffering from diabetes mellitus. Conclusion: High rates of prehypertension and hypertension were observed in the studied Egyptian adults. Overweight/obesity and diabetes are important risk factors for hypertension. Strategies that can enhance public awareness of hypertension and increase access to affordable medications are urgently needed.

Key words: Obesity; Prehypertension; Hypertension; Body Mass Index; Waist Circumference; Waist-to-Hip ratio; Egyptians.

INTRODUCTION

Hypertension is now a major public health problem that affects approximately one billion individuals worldwide (Erem et al., 2009). However, the prevalence of hypertension shows a significant variability among different countries (Gupta, 2004; Yadav et al., 2008; Park et al., 2011; Meng et al., 2012). The Seventh Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure identified hypertension if blood pressure is ≥ 140/90. Moreover, it introduced a new category of blood pressure status termed “prehypertension” and defined as systolic blood pressure (SBP) of 120–139 mmHg or diastolic blood pressure (DBP) of 80–89 mmHg in adults aged 18 years or older, with the recommendation that healthcare providers monitor these patients closely (Chobanian et al., 2003).

In previous years, studies have assessed the prevalence and associated risk profiles of prehypertension (Yadav et al., 2008). Moreover, the increased cardiovascular disease (CVD) risk in prehypertensive subjects has been confirmed in some reports (Yadav et al., 2008). Few studies have assessed the epidemiology of prehypertension among Egyptians, especially among urban adults (NICHP 2004; El-Zanaty and Way 2009; Arafa and Ez-Elarab, 2011).

Meanwhile, obesity has already been shown to play an important role for hypertension and cardiovascular disease (Feng et al., 2012). Overweight and obesity are important predictors of elevated blood pressure; overweight and obese people had more high mean systolic and diastolic blood pressure than normal weight people in both sexes (Jerant and Franks, 2012).

Abdominal adiposity is a risk factor for obesity-related complications, and there is increasing evidence that abdominal adiposity may be a contributing factor to complications related to adiposity at the waist (Hu et al., 2011; Recio-Rodriguez et al., 2012).

Body mass index (BMI), waist-to-hip ratio, and waist circumference are commonly used measures for estimating abdominal adiposity (de Koning, 2007; Coutinho et al., 2011). BMI is a simple and widely used clinical measure; however, BMI may not be a reliable indicator of health risk across all racial and ethnic groups (Czernichow et al., 2011; Schneider et al., 2011). This may be due, at least in part, to errors inherent in the use of self-report measures of BMI (de Koning, 2007). Considerable attention has been given to waist circumference as a complementary (Czernichow et al., 2011) and, in some cases, superior (Schneider et al., 2011) assessment.
to BMI. This study aimed to study the prevalence of prehypertension and hypertension in Egyptian adults and its relation to obesity (BMI, waist circumference, hip circumference and waist-to-hip ratio).

**Subjects and Methods:**

In 2010 a team from NRC started a community – based cross-sectional survey for establishing comprehensive anthropometric measurements for the dimensions of the Egyptian human body to be used for obtaining the standards needed for the Egyptian clothing industry.

The study sample for this survey included 8250 adult subjects of both sexes aged 20-75 years old. The blood pressure of 5534 subjects was measured (2663 females – 2871 males). The subjects represented different geographic localities and different social classes.

All subjects completed a questionnaire which includes personal, socioeconomic, demographic and medical data.

Socio-demographic data, including the number of family members, crowding index, education, and occupation of the subject and house (owned or rented). These data were summed in a total socioeconomic score following the methods used by Fahmy and El Sherbini (1983) with some modifications. The socioeconomic class was classified as “high”, “middle”, or “low”.

Anthropometric measurements including height, weight, waist circumferences, and hip circumferences were also measured by practitioners. Body weight was measured in light clothing with electronic scales to 0.1 kg precision (Seca, Hamburg, and Germany). Height was measured in a standing position with fixed stadiometers (Seca). Waist circumference (WC) was measured at the midpoint between the lower rib margin and the iliac crest with the subject standing at the end of normal expiration. Hip circumference was measured at the level of the greater trochanters with the subject wearing minimum clothing. Non stretchable tap was used for both circumferences. The mean of two readings was taken in for calculating the waist-to-hip ratio. Body mass index (BMI) was calculated as weight divided by height squared (kg/m²). BMI was divided into the following categories: normal weight < 25 kg/m², overweight, 25-<30 kg/m², class 1 obesity, 30-<35 kg/m², and class 2 obesity ≥35 kg/m² (WHO, 2004).

Systolic and diastolic blood pressures were measured in the sitting position using a standard mercury sphygmomanometer with appropriate cuff sizes after a 5-min rest. Systolic blood pressure was measured at the first appearance of a pulse sound (Korotkoff phase 1) and diastolic blood pressure at the disappearance of the pulse sound (Korotkoff phase 5). Two blood pressure readings were averaged, and it was used for analyses. According to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII) criteria (Chobanian et al., 2003) hypertension was defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg, or current use of antihypertensive medication; prehypertension was if the systolic blood pressure was 120 to 139 mmHg and/or diastolic blood pressure was 80 to 89 mmHg; and normal was if the systolic blood pressure was < 120 mmHg and diastolic blood pressure was < 80 mmHg (Lee et al., 2011).

Fasting blood sugar after an 8 hour fast was tested using blood glucose monitoring system for in vitro diagnostic use. Normal Glucose level < 110 mg/ dl, a level of 110 to <126 mg/dL indicates impaired fasting glucose commonly known as prediabetes. Diabetes was considered when fasting glucose level ≥126 mg/dl (Selvin et al., 2007).

**Ethics Statement:**

This study protocol was approved by the ethical committee board of the National Research Centre of Egypt (No.09/038). An informed written consent was obtained from all participants.

**Results:**

Among the adult Egyptians aged 20-75 years, the prevalence of prehypertension and hypertension was 49.22 % (54.4 and 43.1 for males and females) and 16.84 % (18.5% and 15.1% for males and females) respectively (Table 1).

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Prehypertension</th>
<th>Hypertension</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Males</td>
<td>779</td>
<td>27.1</td>
<td>1561</td>
<td>54.4</td>
</tr>
<tr>
<td>Females</td>
<td>1099</td>
<td>41.3</td>
<td>1163</td>
<td>43.1</td>
</tr>
</tbody>
</table>

Tables 2 and 3 present the percentages of prehypertension and hypertension of the study cases according to location, social class and age groups in both sexes. Results show a tendency to increase of both prehypertension and hypertension in males as compared to females.
No significant difference was observed either in the pre-hypertension and hypertension between the studied samples from urban or rural areas in each sex.

Table 2: Prevalence of prehypertension and hypertension in adult Egyptian males by locality area, social class, and age groups.

<table>
<thead>
<tr>
<th>Locality area</th>
<th>Normal BP No.</th>
<th>Prehypertension No.</th>
<th>Hypertension No.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>663 26.9</td>
<td>1332 54.0</td>
<td>473 19.2</td>
<td>2468</td>
</tr>
<tr>
<td>Rural</td>
<td>116 28.8</td>
<td>229 56.8</td>
<td>58 14.4</td>
<td>403</td>
</tr>
</tbody>
</table>

Social class

<table>
<thead>
<tr>
<th>Social class</th>
<th>Normal BP No.</th>
<th>Prehypertension No.</th>
<th>Hypertension No.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>75 18.5</td>
<td>228 56.3</td>
<td>102 25.2</td>
<td>405</td>
</tr>
<tr>
<td>Middle</td>
<td>317 27.3</td>
<td>650 55.9</td>
<td>195 16.8</td>
<td>1162</td>
</tr>
<tr>
<td>Low</td>
<td>363 30.1</td>
<td>634 52.7</td>
<td>207 17.2</td>
<td>1204</td>
</tr>
</tbody>
</table>

Age groups

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Normal BP No.</th>
<th>Prehypertension No.</th>
<th>Hypertension No.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;35 years</td>
<td>416 33.3</td>
<td>709 56.8</td>
<td>123 9.9</td>
<td>1248</td>
</tr>
<tr>
<td>35-44 years</td>
<td>209 25.8</td>
<td>449 55.5</td>
<td>151 18.7</td>
<td>809</td>
</tr>
<tr>
<td>45-54 years</td>
<td>108 21.7</td>
<td>253 50.9</td>
<td>136 27.4</td>
<td>497</td>
</tr>
<tr>
<td>≥55 years</td>
<td>40 14.8</td>
<td>132 48.7</td>
<td>99 36.5</td>
<td>271</td>
</tr>
</tbody>
</table>

*Normal BP=normal blood pressure.

The social classes were divided to high, middle and low classes. In both sexes, no significant differences could be observed between the three social classes either in prehypertension or hypertension (tables 2&3).

The percentages of the hypertensive individuals increase with age advancement where there is a significant increase in the age groups 45-54 years and 55+ years compared to younger age groups (Figures 1 and 2).

![Fig. 1: Age distribution of normal, prehypertension and hypertension in adult Egyptian males.](image)

Fasting blood sugar was tested in some cases. They were divided to normoglycemic, those having glucose intolerance and individuals suffering from diabetes mellitus.

Figures 3 & 4 show the percentages of prehypertension and hypertension in adult Egyptian males and females having glucose intolerance and diabetic subjects. It was observed that prehypertension was higher in the cases having glucose intolerance, while hypertension increased most with those suffering from diabetes mellitus.
Fig. 2: Age distribution of normal, prehypertension and hypertension in adult Egyptian females.

Fig. 3: The percentages of prehypertension and hypertension in adult Egyptian males having glucose intolerance and diabetic subjects.

Fig. 4: The percentages of prehypertension and hypertension in adult Egyptian females having glucose intolerance and diabetic subjects.

Obesity is one of the risk factors of the prehypertension and hypertension. It was observed in this study that percentages of prehypertension and hypertension were increased significantly in overweight and obese individuals (figures 5 and 6).
Women classified as obese class 1 were around five times as likely (17.1 percent) as women with BMI within the normal range (3.2 percent) to be hypertensive, while women classified as overweight were three times as likely (9.6 percent and 3.2 percent, respectively). Among men, 26.5 percent of those who were obese class 1 and 14.6 percent of those who were overweight were hypertensive compared to only 7.9 percent of men whose BMI fell within the normal range.

Table 4 expresses means, standard deviations of waist circumferences, hip circumferences, waist-to-hip ratio and body mass index of the studied sample in relation to normal, prehypertension and hypertension groups in both sexes. All anthropometric measurements were increased in prehypertension and hypertension groups compared to normal weight group. ANOVA analysis revealed highly significant differences between groups in both sexes.

### Table 4: Means and standard deviations of waist circumference, hip circumference, waist hip ratio and body mass index in normal, prehypertensive and hypertensive adult Egyptian males and females.

<table>
<thead>
<tr>
<th></th>
<th>Males N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P</th>
<th>Females N</th>
<th>Mean</th>
<th>S.D.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waist Circumference</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>771</td>
<td>92.63</td>
<td>12.498</td>
<td>0.001</td>
<td>1029</td>
<td>86.50</td>
<td>11.485</td>
<td>0.001</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>1523</td>
<td>97.78</td>
<td>12.006</td>
<td></td>
<td>1011</td>
<td>92.38</td>
<td>11.091</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>495</td>
<td>104.65</td>
<td>10.516</td>
<td></td>
<td>292</td>
<td>97.36</td>
<td>8.757</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2799</td>
<td>97.58</td>
<td>12.597</td>
<td></td>
<td>2332</td>
<td>90.41</td>
<td>11.641</td>
<td></td>
</tr>
<tr>
<td><strong>Hip Circumference</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>780</td>
<td>102.73</td>
<td>10.538</td>
<td>0.001</td>
<td>1100</td>
<td>108.97</td>
<td>12.083</td>
<td>0.001</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>1564</td>
<td>106.25</td>
<td>10.616</td>
<td></td>
<td>1168</td>
<td>115.11</td>
<td>12.739</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>530</td>
<td>111.22</td>
<td>10.427</td>
<td></td>
<td>399</td>
<td>120.59</td>
<td>12.201</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2874</td>
<td>106.21</td>
<td>10.925</td>
<td></td>
<td>2667</td>
<td>113.40</td>
<td>13.060</td>
<td></td>
</tr>
<tr>
<td><strong>Waist-to-Hip Ratio</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>771</td>
<td>90.84</td>
<td>24.002</td>
<td>0.002</td>
<td>1028</td>
<td>80.28</td>
<td>8.318</td>
<td>0.001</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>1522</td>
<td>92.88</td>
<td>23.311</td>
<td></td>
<td>1010</td>
<td>81.90</td>
<td>7.348</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>495</td>
<td>95.29</td>
<td>0.782</td>
<td></td>
<td>292</td>
<td>83.65</td>
<td>6.681</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2788</td>
<td>92.74</td>
<td>21.651</td>
<td></td>
<td>2330</td>
<td>81.40</td>
<td>7.811</td>
<td></td>
</tr>
<tr>
<td><strong>Body Mass Index</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>753</td>
<td>26.318</td>
<td>4.72067</td>
<td>0.001</td>
<td>1065</td>
<td>28.2452</td>
<td>6.02684</td>
<td>0.001</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>1511</td>
<td>28.1143</td>
<td>5.00515</td>
<td></td>
<td>1107</td>
<td>31.4868</td>
<td>6.38152</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>497</td>
<td>31.0544</td>
<td>5.22933</td>
<td></td>
<td>366</td>
<td>35.1429</td>
<td>7.12140</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2761</td>
<td>28.1538</td>
<td>5.20834</td>
<td></td>
<td>2538</td>
<td>30.6538</td>
<td>6.77707</td>
<td></td>
</tr>
</tbody>
</table>
**Discussion:**

The exact magnitude of the prevalence of hypertension and pre-hypertension at a national level were few. This information is important both for local health planners and for the international scientific community.

The prevalence of hypertension in the worldwide adult population varies from 5.2 to 70.7% (Erem et al., 2009). Previous studies on adult Egyptians showed different results e.g., both results estimated for the Egyptian National Hypertension (NHP) in 1991 (Ibrahim et al., 1995) and the stepwise survey conducted in 2005-2006 recorded 26% as the prevalence rate of hypertension (Elibalby and Ahmed, 2010). In 2009 El-Zanaty and Way published the results of Egypt Demographic and Health Survey of year 2008 in which they found that 11% of men and 13% of women were considered to be hypertensive. While in 2011, Arafa and Ezz-ElArab found that the prevalence of prehypertension and hypertension in Egypt were 57.2% and 17.6% respectively. In this study the prevalence of prehypertension and hypertension among adult Egyptians were 49.22% and 16.8% respectively. The discrepancies found between the results of these studies could be explained by the differences in the sample size and also which is more important the age distribution of the studied samples. As some studies surveyed adults up to 59 years (Arafa and Ezz-ElArab, 2011) others to 75 or 95 years old. The sample of this study considered the adults (20-75 years old) and most of them were in favor of young adults as about 72% of males and 63% of females were <44 years old.

The result obtained in this study is quite near to that found in Isfahan, Iran, namely 17.3% (Shirani et al., 2009), and in Eastern Saudi Arabia (15.6%) (Almajwal et al., 2009). However, over the past decade, the prevalence of hypertension has either remained stable or has decreased in economically developed countries, and has shown a tendency to increase in economically developing countries (Erem et al., 2009).

In various reports in Turkey between 1995 and 2003, the prevalence was found to be between 29.6 and 35.5% while, the prevalence of hypertension among Turkish adults in 2008 was 44% (Erem et al., 2009). In a comparative study of the prevalence of hypertension in five European countries, Canada and US (Wolf-Maier et al., 2004) cited that in Germany it was 55% followed by Finland 49%, Spain 47%, England 42%, Sweden 38% and Italy 38%. Moreover in US and Canada are 28% & 27% respectively. Regarding prehypertension studies from different regions of India and China has indicated the prevalence of prehypertension in the range of 40-60% and 40% respectively (Yadav et al., 2008; Meng et al., 2012).

Many studies demonstrated that individuals with blood pressure >120/80 mmHg, but <140/90 mmHg, had an increased risk of hypertension, cardiovascular disease and early death from cardiovascular causes. This classification of blood pressure was later used by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (Chobanian et al., 2003). Estimation of prevalence of prehypertension and its risk factors is important for designing strategies for the control and prevention of cardiovascular diseases (Ferguson et al., 2008). Among the Egyptian population, the prevalence of normal blood pressure (SBP/DBP <120/80 mmHg) is surprisingly low, at only 27.1% for males while, it was 41.3% for females. This prevalence is much lower than estimates in other parts of the world such as the US, Iran and Turkey, where it ranges from 41 to 49% of the population (Azizi et al., 2002; Erem et al., 2009; Egan et al., 2010). It is also lower than the previous estimate of 58.3%, provided by National Hypertension Project (NHP) which was carried out in 1991 among Egyptians aged 25 and above (Ibrahim et al., 1995).

However, it is difficult to compare directly with the NHP study, since the definition of normal blood pressure used in that study was SBP/DBP of <130/85 mmHg. Other countries such as China and India have also recorded very low rates of normotension in their populations (13.1% and 11.4% respectively) (Pang et al., 2008; Vimala et al., 2009).

In the present study, the prevalence of prehypertension and hypertension has been more or less equal in both rural and urban regions. This could be attributed to changes in diet and lifestyle that have occurred with industrialization, urbanization, economic development and market globalization which have accelerated over the past decade. These have had a significant impact on the health and nutritional status of populations, particularly in developing countries, like Egypt (Erem et al., 2009; Arafa and Ezz-ElArab, 2011).

Moreover in the current study the prevalence of prehypertension and hypertension are higher in males versus females in all age group (54.4 and 18.5% for males and (43.1 and 15.1% for females). In the literature, hypertension is more prevalent among males than females (Velazquez et al., 2002; Jeneti et al., 2002). Although the reverse could be observed in other studies (Choi et al., 2006; Ahmad and Jafar, 2005). However few studies showed no sex differences (Lai et al., 2001; Onal et al., 2004). The variation may be explained by differential distribution in risk factors (e.g., genetic predisposition, dietary factors, lack of physical activity) between women and men across populations.

No significant differences were observed in prehypertension and hypertension in different social classes in both sexes. However, many studies have reported that socioeconomic status is associated with higher prevalence of hypertension (Ibrahim et al., 1995; Ferra et al., 2012; Gupta et al., 2012). While the reverse was proved by others (Kant and Graubard, 2012; Tandon et al., 2012).

Aging of the population will contribute to the increasing prevalence of disease of old age, namely hypertension, coronary disease and diabetes. Cardiovascular diseases constitute now the main cause of mortality in Egyptians (Arafa and Ezz-ElArab, 2011). In this study, there was a progressive increase in blood pressure level and hypertension with advancing age, the increase was greater in men than women in all age groups. In
many studies, it was reported that the prevalence of hypertension increased with age (Onal et al., 2004; Yadav et al., 2008).

In contrast, pre-hypertension was highest in the age group <35 yr (56.8%) in male and 45-54 yr (48.7%) in females. This trend is a result of progression of subjects with pre-hypertension to hypertension this is in agreement with some studies in China, India (Yadav et al., 2008; Meng et al., 2012).

Hypertension has been identified as a major risk factor for the development of diabetes. Patients with hypertension are at a 2-3 times higher risk of developing diabetes than patients with normal blood pressure (Grossman and Messerli, 2008). In the present study it was observed that prehypertension increased with subjects having glucose intolerance, while hypertension was found most with those suffering from diabetes in both sexes. The incidence of hypertension in patients with type 2 diabetes is approximately twofold higher than in age matched subjects without the disease (Grossman and Messerli, 2008). In the present study 9.8% and 29% were the percentages of hypertensive males in the normal and diabetic patients respectively, while they were 9.5% and 32.5% in females. The prevalence of hypertension is particularly high in obese subjects and it increases with age. Since the prevalence of type 2 diabetes is high in obese subjects and it increases with age, the co-existence of diabetes and hypertension is particularly high in obese and/or elderly patients (Grossman and Messerli, 2008). This could be observed also in the results of this study.

Obesity is associated with an increased incidence of hypertension, metabolic syndrome and cardiac target organ damage (Hu et al., 2011). In the Framingham Study, it was found that a 10% rise in body weight explains a 7 mmHg rise in SBP in the population at large (Ashley and Kannel, 1974). It has also been found that every 1 kilogram excess body weight that is lost is associated with decreases of 0.33 and 0.43 mmHg in SBP and DBP, respectively (Stevens et al., 1993). In this study obesity indices represent total body fat and central fat distribution (Jousilahti et al., 1996; Nicklas et al., 2004). i.e. BMI, waist circumference, waist to hip ratio (Fig. 3, 4 and Table 4).

The relationship between obesity and hypertension has been reported by many researchers (Greenlund et al., 2004; Hu et al., 2011; Tandon et al., 2012). Greenlund et al., (2004) demonstrated a relationship between pre-hypertension and both overweight and obesity using data from the National Health and Nutrition Examination Survey, concluding that early clinical detection of pre-hypertension and early intervention could be triggered by elevated BMI instead of waiting for blood pressures to become elevated.

An increased risk of cardiovascular morbidity and mortality has been reported in individuals with increased waist and hip circumferences and waist-to-hip ratio even with a normal BMI (Koster et al., 2008). (Koster et al., (2008) Zhang et al., (2008) suggesting that waist circumference and not BMI explains obesity-related health risk (Janssen et al., 2004; Cameron et al., 2008).

Conclusion:
High rates of prehypertension and hypertension were observed among the Egyptian adults. Prehypertension increases more with prediabetic individuals. Overweight/obesity is an important risk factor for hypertension. Strategies that can enhance public awareness of hypertension and increase access to affordable medications are urgently needed.

ACKNOWLEDGMENT
Authors are greatly thankful to the Science and Technology Development Fund (STDF) for funding the project entitled “Standardization of Adult Egyptian Dimensions for Implementation in Development of Clothing Industries”

REFERENCES
seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure: The JNC 7 report. JAMA., 289: 2560-2572.


