Central obesity among adults in Egypt: prevalence and associated morbidity

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سِمْنَةُ الخَصْر بين البالغين في مصر: معدَّلُ انتشارها والمراضة المرتبطة بها

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الخلاصة: أُجريَتْ لجميع الأشخاص البالغين من العمر 18 عاماً فما فوق (وعددهم = 1800) من القاطنين في مناطق يتولَّى العناية بمرضاها اثنا عشر مركزاً من مراكز الرعاية الصحية الأولية، قياسات معيارية لمنطقة الخَصْر والوركين، وذلك من خلال مسح منزلي أجري في أربع محافظات مصرية؛ وحُدِّدت سِمْنَة الخَصْر استناداً إلى مؤشِّرَيْ محيط الخَصْر WC ونسبة الخَصْر إلى الورك WRH. وبلغت نسبة انتشار سمنة الخصر المصحَّحة بحسب العمر بين البالغين 24.1٪ و28.7٪ استناداً إلى المؤشرَيْن على التوالي. وبعد إجراء التصحيح بحسب الجنس، وغيره من عوامل التدقيق، تبيَّن ترابُط محيط الخَصْر، ترابُطاً يُعْتَدُّ به إحصائياً، باختطار الإصابة بالسكري وفرط ضغط الدم، في حين لم تترابَطْ نسبة الخَصْر إلى الورك بأيٍّ منهما. كما لم يتبيَّن وجود ترابُط يُعْتَدُّ به إحصائياً بين مَنْسَب index كتلة الجسم BMI وبين حدوث السكري أو فرط الضغط.

ABSTRACT Through a home-based survey, all people aged 18 years and over (***n*** = 1800) in the catchment areas of 12 primary health care centres in 4 Egyptian governorates were subjected to standardized waist and hip measurements. Central obesity was determined based on the waist circumference (WC) and waist-to-hip ratio (WHR) indicators. The age-adjusted prevalence of central obesity among adults was 24.1% and 28.7% based on the WC and WHR indicators respectively. After adjustment for sex and other confounding factors, WC was significantly associated with the risk of diabetes and hypertension, while WHR was not significantly associated with either diabetes or hypertension. No significant association was seen between body mass index and diabetes or hypertension.

L'obésité centrale de l'adulte en Égypte : prévalence et comorbidité

RÉSUMÉ Dans le cadre d'une enquête à domicile, il a été procédé à une mesure normalisée du tour de taille et du tour de hanche de chacun des individus de 18 ans et plus (n = 1800) résidant dans le secteur de 12 centres de soins de santé primaires répartis dans 4 gouvernorats égyptiens. L'obésité centrale (dite également abdominale ou androïde) a été déterminée sur la base du tour de taille (TT) et du rapport taille/hanche (T/H). Selon l'indicateur considéré, la prévalence ajustée sur l'âge de l'obésité centrale chez l'adulte était de 24,1 % (TT) et 28,7 % (T/H). Après ajustement sur le sexe et autres variables confondantes, il est apparu une association significative entre le TT et les risques de diabète et d'hypertension artérielle, association qui s'est révélée non significative entre le rapport T/H et ces pathologies. De même, il n'existe pas d'association significative entre l'indice de masse corporelle et le diabète ou l'hypertension.

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Introduction

Obesity represents one of the most serious global health issues. The prevalence of obesity has increased at an alarming rate over the past 2 decades to the extent that it could be considered a pandemic. Over 3000 million adults worldwide are obese [*1*].

Obesity can be divided into general and "regional". There are 2 main types of regional obesity in terms of fat distribution and the risk for development of disease, gynoid and android. The gynoid type of fat distribution is common in women. The "pear" shape indicates that heavier deposits of fat occur around the thigh and buttocks. The main function of this fat is as energy reserves to support pregnancy and lactation. Individuals with this type of distribution typically do not develop impairment of glucose metabolism. On the other hand, the android type of fat distribution or "apple" shape is typical of men and features fat around the waist and upper abdomen. This pattern is associated with significant risk of hypertension [*1–4*], cardiovascular disease [*5–7*] and non-insulin-dependent diabetes mellitus [*1,4,7–13*].

Generalized obesity in Egypt and its association with certain chronic diseases has been reported in the literature [*14*]. However, none of the studies has been conducted on central obesity on a national scale. The aim of the present study is to study central obesity among adult men and women, and to determine the association between obesity and some comorbidities such as diabetes and hypertension.

Methods

A cross-sectional home-based clinical and questionnaire survey was made of people aged 18 years and over in the catchment areas of 12 primary health care centres.

Study setting

Primary health care units were selected in 4 governorates; 3 representing governorates of lower Egypt (Damietta, Dakahlia and Ismailia), and 1 representing those of upper Egypt (Beni Sueif). These 4 governorates were chosen purposely to ensure easy cooperation, as the Egyptian Ministry of Health and Population (MOHP) had already begun the implementation of its family medicine programme in these governorates. One district had been allocated in each of these governorates to start the programme. The communities are typical semi-urban and rural populations who nevertheless enjoy many of the facilities of modern life, such as electricity and cars, while retaining their basic dietary and social habits. Houses are generally of lower hygienic standards compared to those of urban communities. Rice, meat and chicken constitute the major dietary items. Health services are provided by primary health care centres (PHCCs).

Study sample

Three PHCCs were allocated from each of the 4 districts allocated by the MOHP to represent the centres with the largest population in their catchment areas. Thus, a total of 12 PHCCs were allocated, representing both semiurban and rural centres. The target population for the present study was all subjects aged 18 years or more in the catchment areas of the selected centres who were willing to participate during the time of the study. A sample of 1800 subjects was allocated (450 subjects from each governorate). Thus, using an equal allocation method of sampling, a total of 150 subjects from each of the allocated PHCCs, representing around 5% of the adult population in the catchment area of that centre, were invited to participate in the study until the required sample was achieved.

Those subjects were contacted via the female health educators who work for the MOHP. Each team of 2 health educators was responsible for contacting 150 adult subjects in the catchment area of 1 centre via home visits, interviewing them and inviting them to the centre. These subjects were chosen randomly from those willing to participate.

Data collection

Through a home-based survey, within a period of 3 months from January to March 2004, all subjects who agreed to participate in the present study were given a health and lifestyle questionnaire. Respondents were asked about their perceptions of harm from specific lifestyle behaviours (current diet, smoking habits and exercise performance). They were also asked whether they wanted to modify their current lifestyle and whether they had made a serious attempt to do so during the previous year.

The degree of physical activity and sedentary lifestyle were assessed in terms of frequency and type of current activity. This was categorized as: vigorous physical activity for at least 20 minutes 3 times or more per week; non-vigorous activity for less than 20 minutes for less than 3 times per week; and physical inactivity [*15*].

Smokers were classified into daily, weekly and experimental smokers as recommended by the World Health Organization (WHO) [*16*]. To estimate the prevalence of smoking, the proportion of daily and weekly smokers were counted as smokers, the remainder as non-smokers [*17*].

Diet was assessed using a 12-item food-frequency questionnaire modified from Soori [*18*]. All 12 food items were scored on a scale of 1 to 3 according to their health giving properties and how often they were eaten, with a higher score indicating a healthier diet. A composite dietary behaviour score was obtained, and respondents were categorized into 3 groups: good, moderate and bad eaters.

The target subjects were invited to come to the PHCCs the day after the interview to have their weight, height, waist and hip circumferences measured. Waist circumferences (WC) and hip circumferences were measured with subjects undressed from the waist up to the lower border of the ribcage, in a standing position. WC was measured halfway between the upper border of the lateral iliac crest and the lower border of the lowest rib, and hip circumference under the inferior rim of the symphysis, in the midline. All measures were performed twice using a tape measure and recorded to the nearest centimetre. Waist-to-hip ratio (WHR) was calculated. Abdominal obesity was diagnosed when WC was ≥ 95 cm for women, and ≥ 100 cm for men, and/or when WHR was > 0.85 in women and > 0.95 in men [*19,20*]. Body mass index (BMI) was also calculated from height and weight measurements.

The presence of diabetes mellitus and/or hypertension was recorded for each subject, based upon the previous diagnosis and/or medications. Personal and family history of coronary artery disease was also investigated. Diabetes mellitus was diagnosed based on a fasting blood sugar > 110 mg/dL [*21*], while diagnosis of hypertension was done according to the WHO criteria of systolic blood pressure ≥ 140 mmHg and/or or diastolic blood pressure ≥ 90 mmHg [*22,23*].

Postgraduate students in family health/family practice specialties performed the anthropometric measurements and the accuracy of measurements was assured by practical training sessions. The interviews were conducted by the female health educators who live in the catchment areas of the present study to facilitate communication with the target population via home visits. They also received practical training sessions. Daily meetings were held between the data collectors and field supervisors following field activities to solve logistic problems and to emphasize standardization of measurements.

Data analysis

Data was analysed using *SPSS,* version 10 and *Epi-info* 2000 statistical packages. Percentiles of WC and WHR (10th, 25th, 50th, 75th and 90th percentiles) were calculated exactly using the frequencies procedure. A computer program placed each value of WC and WHR in one of the following centile bands: < 10th, 10th–24th, 25th–49th, 50th–74th, 75th–89th and > 90th.

The Pearson chi-squared test was used to compare categorical data. The chi-squared test for linear trend (lt) was used to establish whether the increasing percentiles of WC and WHR were associated with increased diabetes and/or hypertension risk. Odds ratios (OR) were calculated with a 95% confidence interval (CI) for the likelihood of an elderly person being diabetic and/or hypertensive according to the different percentiles. The 10th percentile groups for WC and WHR were used as the reference categories for each risk variable.

To estimate the independent association of each indicator of central obesity with diabetes and/or hypertension risk, logistic regression analysis was applied. Confounding factors included: age, sex, smoking, WHR (in the analysis of WC) and WC (in the analysis of WHR), diabetes (in the analysis of hypertension) and hypertension (in the analysis of diabetes). $P < 0.05$ was used as the level of statistical significance.

Results

Prevalence of central obesity

The overall age-adjusted prevalence of central obesity among the study sample was 24.1% when identified by WC and 28.7% when identified by WHR. Females showed a significantly higher prevalence of central obesity than males based on both WC (34.1% versus 14.0%) ($P < 0.001$) and WHR (44.9% versus 12.4%) ($P < 0.001$). As age increased, the prevalence of central obesity became significantly higher as shown by the χ^2-test for linear trend (χ^2 lt) (Table 1).

Dakahlia governorate showed the highest prevalence of central obesity (46.7%), based on WC and/or WHR, followed by Damietta (44.2%) and Ismailia (40.2%), while Beni Sueif governorate showed the lowest prevalence (28.7%) ($P < 0.001$).

As regards BMI, it ranged from 14.2 to 49.1 kg/m^2, with a mean of 28.1 kg/m^2 (standard deviation 10.7). Females had a significantly higher BMI [mean 28.8 kg/m^2 (SD 11.0)] than that of males [mean 27.1 kg/m^2 (SD 10.5)] ($t = 3.44$, $P = 0.001$).

Prevalence of diabetes and hypertension

Previously diagnosed diabetes mellitus was found in 3.7% of adult Egyptians (age-adjusted), with no sex difference (4.6% for females versus 2.8% for males) ($\chi^2 = 0.34$, $P = 0.53$) (Table 2). Dakahlia governorate showed the highest prevalence of diabetes (4.9%), followed by Damietta (3.8%) and Ismailia (3.6%), while Beni Sueif showed the lowest prevalence (2.9%) ($P < 0.001$).

On the other hand, hypertension had previously been diagnosed in 8.9% of adult Egyptians (age-adjusted), with a significantly higher prevalence among females (12.1% versus 5.7%) ($\chi^2 = 5.53$, $P < 0.02$). Beni Sueif governorate showed the highest prevalence of hypertension (10.2%), followed by Damietta (9.6%) and Dakahlia (9.1%), while Ismailia showed the lowest prevalence (7.8%) ($P < 0.001$).

As age increased, there was a significant increase in the prevalence of both diabetes

Table 1 **Prevalence of central obesity among Egyptian adults according to different obesity indicators by age and sex**

Obesity indicator	Males			Females			Males and females		
	Total no.	No. of cases	%	Total no.	No. of cases	%	Total no.	No. of cases	%
Waist circumference									
18–24 yrs	153	7	4.6	289	31	10.7	442	38	8.6
25–44 yrs	380	54	14.2	569	205	36.0	949	259	27.3
45–64 yrs	187	46	24.6	171	99	57.9	358	145	40.5
65+ yrs	35	6	17.1	16	6	37.5	51	12	23.5
Total	755	113	15.0	1045	341	32.6	1800	454	25.2
(Age-adjusted)			(14.0)			(34.1)			(24.1)
P–value	$\chi^2 = 72.52$, $P < 0.001$[a]						$P < 0.001$[b]		
Waist-to-hip ratio									
18–24 yrs	153	10	6.5	289	95	32.9	442	105	23.8
25–44 yrs	380	48	12.6	569	257	45.2	949	305	32.1
45–64 yrs	187	32	17.1	171	98	57.3	358	130	36.3
65+ yrs	35	9	25.7	16	9	56.3	51	18	35.3
Total	755	99	13.1	1045	459	43.9	1800	558	31.0
(Age-adjusted)			(12.4)			(44.9)			(28.7)
P–value	$\chi^2 = 194.53$, $P < 0.001$[a]						$P < 0.001$[b]		

[a]*Difference in ratio between men and women.*

[b]*Difference in rates by age, χ^2-test for linear trend.*

Table 2 **Prevalence of diabetes and hypertension among Egyptian adults by age and sex**

Morbidity	Males			Females			Males and females		
	Total no.	No. of cases	%	Total no.	No. of cases	%	Total no.	No. of cases	%
Diabetes									
18–24 yrs	153	0	0.0	289	0	0.0	442	0	0.0
25–44 yrs	380	5	1.3	569	18	3.2	949	23	2.4
45–64 yrs	187	17	9.1	171	22	12.9	358	39	10.9
65+ yrs	35	4	11.4	16	2	12.5	51	6	11.8
Total	755	26	3.4	1045	42	4.0	1800	68	3.8
(Age-adjusted)			(2.8)			(4.6)			(3.7)
P-value	$P = 0.34$[a]						$P < 0.001$[b]		
Hypertension									
18–24 yrs	153	1	0.7	289	6	2.1	442	7	1.6
25–44 yrs	380	16	4.2	569	43	7.6	949	59	6.2
45–64 yrs	187	31	16.6	171	54	31.6	358	85	23.7
65+ yrs	35	7	20.0	16	7	43.8	51	14	27.5
Total	755	55	7.3	1045	110	10.5	1800	165	9.2
(Age-adjusted)			(5.7)			(12.1)			(8.9)
P-value	$P < 0.02$[a]						$P < 0.001$[b]		

[a]*Difference in ratio between men and women.*

[b]*Difference in rates by age, χ^2-test for linear trend.*

and hypertension in both sexes, as shown by the χ^2-test for linear trend.

Central obesity: associated morbidities

There was an appreciable increase in the risk of diabetes with increasing WC percentile (χ^2 lt = 4.92, $P < 0.002$), but not with increasing WHR percentile (χ^2 lt = 0.17, $P = 0.68$). The odds ratio for the 90th percentile versus the 10th percentile of WC was 5.4 (95% CI: 1.5–18.9).). On the other hand, there was an increased risk of hypertension with increasing WC (χ^2 lt = 49.30, $P < 0.001$), and with increasing WHR percentile (χ^2 lt = 8.84, $P < 0.003$). The odds ratio for the 90th percentile versus the 10th percentile of WC was 6.6 (95% CI: 2.9–15.2), and for the 90th percentile of WHR versus the 10th percentile was 2.1 (95% CI: 1.0–4.2) (Table 3).

After adjusting for sex and other potentially confounding factors in logistic regression models, WC was significantly associated with the risk of diabetes ($P = 0.02$) and hypertension ($P = 0.0007$). However, neither WHR nor BMI was significantly associated with either diabetes ($P = 0.36$, 0.11) or hypertension ($P = 0.70$, 0.96) (Table 4).

Table 5 shows that 352 of the study sample (19.6%) were smokers, about two thirds of them (62.5%) wanted to quit, and more than half of smokers (54.0%) had previously tried to quit. The majority of the study sample (1336, 74.2%) was physically inactive, yet only 21.1% of them wanted to practise exercise, and 19.7% reported previous attempts at exercise.

Table 3 **Frequency and odds ratio of diabetes and hypertension according to different centiles of waist circumference and waist-to-hip ratio among Egyptian adults**

Centile	Total	Diabetes			Hypertension		
	No.	No.	%	OR (95% CI)	No.	%	OR (95% CI)
Waist circumference centile							
< 10th	170	3	1.8	1[a]	7	4.1	1[a]
< 50th	644	20	3.1	1.8 (0.5–6.1)	31	4.8	1.2 (0.5–2.7)
< 90th	805	29	3.6	2.1 (0.6–6.9)	87	10.8	2.8 (1.3–6.2)
> 90th	181	16	8.8	5.4 (1.5–18.9)	40	22.1	6.6 (2.9–15.2)
Total	1800	68	3.8		165	9.2	
***P*-value[b]**			0.002			0.001	
Waist-to-hip ratio centile							
< 10th	182	6	3.3	1[a]	13	7.1	1[a]
< 50th	729	28	3.8	1.2 (0.5–2.9)	53	7.3	1.1 (0.5–1.9)
< 90th	715	26	3.6	1.1 (0.5–2.7)	75	10.5	1.5 (0.8–2.8)
> 90th	174	8	4.6	1.4 (0.5–4.2)	24	13.8	2.1 (1.0–4.2)
Total	1800	68	3.8		165	9.2	
***P*-value[b]**			0.68			0.003	

[a]Reference category.
[b]χ^2-test for linear trend.
OR = odds ratio; CI = confidence interval.

Table 4 **Logistic regression models of diabetes and hypertension according to waist circumference (WC), waist-to-hip ratio (WHR) and body mass index (BMI) among Egyptian adults**

Obesity indicator/ Morbidity	β (SE)	*P*-value	Exp. β	95% CI
Waist circumference				
Diabetes mellitus[a]	0.02 (0.01)	0.02	1.02	1.01–1.04
Hypertension[b]	0.02 (0.01)	0.0007	1.02	1.01–1.04
Waist-to-hip ratio				
Diabetes mellitus[c]	–1.49 (1.64)	0.36	0.23	0.01–5.57
Hypertension[d]	–0.39 (1.02)	0.70	0.68	0.09–4.98
Body mass index				
Diabetes mellitus[e]	0.01 (0.01)	0.11	1.01	0.99–1.02
Hypertension[f]	–0.01 (0.01)	0.96	0.99	0.98–1.02

[a]Adjusted for age, sex, hypertension and smoking; [b]Adjusted for age, sex and diabetes, smoking and WHR; [c]Adjusted for age, sex, hypertension, smoking and WC; [d]Adjusted for age, sex, diabetes, smoking and WC; [e]Adjusted for age, sex, hypertension, smoking WC and WHR; [f]Adjusted for age, sex and diabetes, smoking, WC and WHR.
SE = standard error; CI = confidence interval.

Table 5 **Distribution of the study sample according to different lifestyle and behaviours and the desire and previous attempts to change behaviour**

Lifestyle behaviour and/or condition	Total No.	Want to change No.	Want to change %[a]	Tried to change No.	Tried to change %
Smoking					
Non-smoker	1448	–	–	–	–
Smoker	352	220	62.5	190	54.0
Physical exercise					
Non-exerciser	1336	282	21.1	263	19.7
Exerciser	464	–	–	–	–
Weight perception					
Abnormal	567	410	72.3	337	59.4
Normal	1233	142	11.5	169	13.7
		χ^2 = 675.12, ***P*** < 0.001		χ^2 = 401.91, ***P*** < 0.001	
Eating behaviour					
Good	560	166	29.6	143	25.5
Fair	675	178	26.4	168	24.9
Bad	565	104	18.4	143	25.5
		χ^2 = 20.26, ***P*** < 0.001		χ^2 = 14.28, ***P*** < 0.001	

χ^2 = Pearson test.

Regarding eating behaviour, 565 people (31.4%) were classified as "bad eaters". Of these, only 18.4% said they wanted to change their bad eating habits, while 25.3% had previously attempted to change. Nearly one third of the study sample (560, 31.5%) considered their weight abnormal; 72.3% of them reported a desire to change their weight, and 59.4% of those had previously attempted to change weight. Attitude and previous attempts to change behaviour were significantly associated with both abnormal weight perception and good eating behaviour.

Discussion

It has been reported that the prevalence of obesity in adults is very high in Egypt, particularly among women, and that the prevalences of diabetes and hypertension parallels that of obesity [*24*]. In the present study, the overall prevalence of central obesity among Egyptian adults, according to the 2 indicators—WC and WHR ratio—was 24.1% and 28.7% respectively. These figures are relatively high if the association of central obesity with morbidity and mortality is taken into consideration.

Many studies of general obesity have indicated a significantly higher prevalence of obesity among females than among males [*14,24–27*]. Such findings are in agreement with the findings of the present study, and may be attributed to sociocultural factors in Egyptian communities, such as high unemployment, restricted outdoor activities and the high illiteracy rate among females [*14*].

Central obesity has been identified as an important determinant of type 2 diabetes risk [*8–12,28,29*]. The correlations estimated in our study confirm that WC was significantly associated with diabetes risk, with the odds ratio for diabetes increasing monotonically with increasing WC. Even at percentile levels not considered to indicate obesity, WC was associated with significantly elevated diabetes risk. Moreover, after adjustment for other confounding factors by logistic regression, WC emerged as a more powerful predictor of diabetes risk ($P = 0.02$). This might explain the finding in this study of the highest prevalence of both central obesity and diabetes among the subjects of Dakahlia governorate, as well as the lowest prevalence of both conditions among those of Beni Sueif governorate.

An association between hypertension and central obesity has also been reported [*4,30,31*]. Such an association was evidence in the present study based on both WC and WHR. However, after adjusting for other cofounders, this association emerged significantly only for WC. That is, WC was a significant and an independent predictor of both diabetes mellitus and hypertension in the present study. This finding was in agreement with Reeder et al. [*32*] who identified WC as the measure of abdominal obesity most highly correlated with blood pressure and plasma lipid levels. WC was also recommended as a surrogate measure of visceral adipose tissue and coronary heart disease (CHD) risk in men and women with long-standing paraplegia and tetraplegia [*33*]. Abdominal diameter index was also reported as the most powerful anthropometric measure of risk for prevalent CHD [*34*].

Although WC and WHR are both indicators of central obesity, each could be interpreted differently. A measured WC larger than expected may indicate excess abdominal subcutaneous fat or visceral fat accumulation, whereas a hip circumference less than expected may reflect reduced femoral fat, small pelvic bone structure or gluteofemoral muscle atrophy [*35*]. The present study failed to detect any significant association between WHR and diabetes or hypertension. The different validity of each of these 2 measures for body fat distribution [*36*] might explain such a finding. It may also explain the finding of 2 different prevalence figures for central obesity based on the measures used in the present study.

However, this finding was not in agreement with other researchers who reported that central obesity as measured by WHR was significantly and independently associated with diabetes [*4,28,37*]. This disagreement might be attributed to the different lifestyle factors. Han et al. previously concluded that each lifestyle factor influences the size of the waist and hips differently [*35*]. This may explain the finding of different prevalence figures for central obesity based on the measure used in the present study. Ethnic differences in body composition rules and constants are also important, especially in relation to overweight and obesity [*36*].

Central adiposity appears to contribute to a greater extent than general adiposity to the development of cardiovascular risk [*38*]. In an Asian population, both WC and WHR were more strongly associated with fasting plasma glucose and diabetes than were weight and BMI [*39*]. Khongsdier reported that BMI might not always provide accurate information about the variation in body fat and body composition associated with morbidities [*40*]. All these reports are in agreement with the findings of the present study, where BMI was not a significant predictor of diabetes or hypertension. Thus, the use of universal BMI cut-off points might not be appropriate for comparison of obesity prevalence between ethnic groups [*41*]. However, in another study, BMI showed a similar relationship with adiposity to WC and WHR [*42*], a finding that needs further investigation.

In conclusion, these findings suggest that there is a need to promote lifestyle change and to reduce central obesity to prevent the occurrence of diabetes and hypertension among Egyptians. This will be challenging as the majority of the study sample were physically inactive, and only 21% of them reported willingness to practise exercise; one third were bad eaters, and only 18% of them were willing to change their behaviour; and 20% were current smokers, and only two thirds of them were willing to quit smoking. Central obesity was significantly and independently associated with diabetes and hypertension among adults. Obese subjects with predominantly abdominal fat mass (android type) showed a risk profile that was less favourable than gluteofemoral fat distribution (gynoid type). WC was most highly correlated with both diabetes and hypertension, while WHR was not a significant predictor of any of the 2 conditions. WC measurement is a potentially useful tool for clinicians in counselling patients regarding diabetes and hypertension risk and risk reduction. BMI *per se* might not be considered a significant predictor of diabetes or hypertension.

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Facts about overweight and obesity

According to the World Health Organization (WHO) in 2005 approximately 1.6 billion adults (age 15+ years) were overweight and at least 400 million adults were obese.

WHO projects that by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. At least 20 million children under the age of 5 years were overweight globally in 2005.

Once considered a problem only in high-income countries, overweight and obesity are now dramatically on the rise in low- and middle-income countries, particularly in urban settings.

Further information about overweight and obesity and the role of WHO in combating them can be found at: http://www.who.int/mediacentre/factsheets/fs311/en/index.html