Determinants of obesity in an urban township of South Africa

[a,b]Malhotra R, [a]Hoyo C [a,b]Østbye T, [c]Hughes G, [a]Schwartz D, [d]Tsolekile L, [d]Zulu J, [d]Puoane T

[a] Department of Community and Family Medicine, Duke University, Durham, North Carolina, USA, [b] Duke-National University of Singapore Graduate Medical School, Singapore

[c] Departments of Family Medicine and Surgery, Brody School of Medicine, East Carolina University, Greenville, North Carolina, USA,

[d] School of Public Health, University of the Western Cape, Bellville, South Africa

Correspondence to: Thandi Puoane, e-mail: tpuoane@uwc.ac.za

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Abstract

Objective: To estimate the prevalence of overweight and obesity, and identify factors associated with Body Mass Index (BMI) and waist circumference (WC) among adults residing in an urban township in South Africa.

Design: Cross-sectional study.

Setting: Khayelitsha, a large black township located in Cape Town.

Subjects: 107 males and 530 females, aged ≥ 18 years.

Methods: The prevalence of overweight/obesity (BMI ³ 25 kg/m^2) and abdominal obesity (WC ≥ 94 cm for men and ≥ 80 cm for women), and their relationship with factors previously found to increase the risk of obesity, such as age, gender, marital status, educational level, employment status, immigrant status from rural to urban, and physical activity level, were assessed using logistic regression analyses.

Results: The prevalence of obesity (BMI ³ 30 kg/m^2) was 53.4% and 18.7%, and that of abdominal obesity was 71.5% and 23.4%, among women and men respectively. However, more women (21.3%) than men (11.2%) reported walking more than 45 minutes per day. Female gender and being married were associated with a high BMI and large WC. Recent migration was associated with a smaller WC. The level of physical activity was not associated with BMI or WC.

Conclusions: These findings suggest that physical activity may play less of a role in obesity control, or that more than 45 minutes of physical activity per day is required to reduce the risk of obesity, especially in women. At least among South African women, obesity control focused on nutritional interventions may be more beneficial than increasing the intensity or duration of physical activity.

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Introduction

Like other sub-Saharan countries, South Africa today faces an increasing burden of non-communicable diseases.[1] Obesity is an important risk factor for the development of hypertension,[2] coronary heart disease,[3] diabetes mellitus[4] and certain cancers.[5] The reported prevalence of obesity (Body Mass Index (BMI) ≥ 30.0 kg/m^2) in South Africa ranges from 3.0% to 20.4% among men and from 25.9% to 54.3% among women, with a higher prevalence in the urban areas.[2,6–10]

Paralleling the situation in the United States,[11] the black population in South Africa, especially women, are at an increased risk of overweight and obesity compared to other ethnic groups.[8,12] Little attention has been paid to this issue until recently, perhaps in part due to the concept of 'healthy or benign obesity'[13] among the black population, especially women. This concept implied that obesity in this group was not associated with dyslipidemia, hypertension, glucose intolerance or ischemic heart disease,[13–15] thus being considered a less serious health problem. However, recent studies from South Africa refute the 'healthy obesity' concept, showing similar associations between obesity and these conditions among the South African black population to those observed in other populations.[16,17]

The underlying mechanism for the adverse health effects of obesity is the likely development of insulin resistance in peripheral tissues due to increased levels of polypeptides such as Tumor Necrosis Factor-α (TNF-α) and hormones such as restin with increasing adiposity,[18,19] and the neural and hormonal mechanisms linking obesity and hypertension.[20]

While regional and national studies document the age- and gender-specific prevalence of overweight, obesity and distribution of BMI,[2,7,9,10] there are few studies[8,12] evaluating the association of obesity with socio-demographic factors. Such studies are useful for identifying priority groups for public health obesity control programmes. In general, lower levels of physical activity have been shown to be associated with higher BMI and higher risk of obesity.[21–27] This could be a contributing factor to the high prevalence of obesity in urban South Africa, as the levels of physical activity among those residing in urban areas of South Africa have been reported to be low.[28]

We present the findings of a cross-sectional study conducted to estimate the prevalence of overweight and obesity, and identify factors associated with BMI and waist circumference (WC) among adults residing in an urban township in South Africa.

Methods

Setting:

The study was undertaken in Khayelitsha, the largest black township in Cape Town. It consists predominantly of informal settlements (57.4%). The 2001 census estimated the population of Khayelitsha to be 329 002,[29] although others have estimated the population to be as high as 1 million,[30] with a slightly higher percentage of females (51.9%) than males (48.1%). The population is relatively young: 75% is under the age of 35. Fifty-one per cent of the population of working age is unemployed, with unemployment higher among females. The majority of households (72%) earn less than R1 600 per month, and 69.3% of households consist of four people or less.[29]

Study population:

The University of the Western Cape (UWC) has been running a community-based health promotion programme since 2002 to prevent non-communicable diseases in an area of the township. For the sake of convenience, this area was selected as the study site. At the time of the present survey (June–August 2005), six community health workers (CHWs) were coordinating this programme, and each CHW was responsible for 100–150 households. To select the households for the present survey, each CHW provided a list of the households located in his or her service area. These six individual lists were then combined to form a larger list, from which 650 households were randomly selected. Because nutrition was an important component of the study, respondents were adult females aged 18 years or more, resident in the township for at least one year and without mental disabilities preventing them from giving informed consent. One such female was chosen from each selected household. In households where there was no adult female, an adult male was invited to participate. For administering the questionnaire and taking anthropometric measurements, the selected respondents were invited to one of three venues of their choice, namely a school, a health centre or a day care centre. Of the 650 individuals invited, a total of 638 (98.2%) reported for data collection. The main reasons for non-participation were that some of the participants were in the process of relocating to formal housing and some had recently gone to health facilities for routine check-ups. A loaf of brown bread was given as an incentive to those who reported for data collection.

Questionnaire and data collection:

A questionnaire developed in English and translated into Xhosa (the majority of Khayelitsha residents are Xhosa-speaking) was administered to the study participants by 14 interviewers comprising four final-year Dietetics students from UWC, four interviewers who did not reside in the area, and six CHWs. The interviewers received five days of training, covering anthropometric measurement (weight, height, WC), a didactic component where the overall goal of the study and the role of the interviewer were explained, and role playing, where the interviewers interviewed each other under supervision. The questionnaire was pilot tested in a population with characteristics similar to the study population to determine its length, question flow, duration and clarity. Corrections were made accordingly. Information was collected regarding socio-demographic characteristics, migration, body image perception, medical history, physical activity, social support, approach to life, healthcare access and utilisation and food consumption. To assess the level of physical activity, the question "How many minutes a day do you usually walk from work, school or shopping/going to shop", with the responses of "less than five minutes", "at least five but less than fifteen minutes", "at least 15 but less than 30 minutes", "at least 30 but less than 45 minutes" and "at least 45 minutes", was asked. In the analysis, the level of physical activity (minutes of walking per day) was categorised as < 30 minutes, 30–44 minutes, ≥ 45 minutes.

Anthropometric measurements (weight, height and WC) were taken and recorded by the Dietetics students. Participants were weighed using a calibrated bathroom scale (Soenhle, Germany), wearing light clothing and no shoes, and their weight was rounded off to the nearest 0.5 kg. Height was measured using a metre stick. Subjects were asked to stand barefoot with their backs, buttocks and heels as close to the wall as possible. Their heads were positioned in such a way that the angle of their eye and the opening of the external auditory meatus were on a horizontal line. Height was measured to the nearest 0.1 cm.[8] WC was measured midway between the lowest rib and the iliac crest to the nearest 0.1 cm using a tape measure.[31]

BMI was computed as weight (in kilograms) divided by the square of the height (in metres) and then categorised using the World Health Organization (WHO)[31] categories of underweight (BMI < 18.5 kg/m^2), normal weight (BMI 18.5 kg/m^2 to 24.99 kg/m^2), overweight (BMI 25.0 kg/m^2 to 29.99 kg/m^2) or obese (BMI ≥ 30.0 kg/m^2). Those obese were further categorised into obese class I (BMI 30.0 kg/m^2 to 34.99 kg/m^2), obese class II (BMI 35.0 kg/m^2 to 39.99 kg/m^2) and obese class III (BMI ≥ 40.0 kg/m^2). Abdominal obesity was defined on basis of WC, with a WC of ≥ 80 cm in women and ≥ 94 cm in men considered abdominal obesity.[31]

Statistical analysis:

SAS for Windows, Version 9.1 (SAS Institute Inc, Cary, NC, USA)[32] was used for data management and analysis. Information on gender was missing for one individual, who was excluded, resulting in a final analysis sample of 637 individuals, comprising 107 males and 530 females. Chi-square tests and t-tests were used to assess differences between categories with respect to categorical and continuous data respectively. Among the three indicators suggestive of socio-economic status, there was significant correlation between monthly income and employment status ($r = -0.16$, $p < 0.0001$) and between monthly income and educational status ($r = 0.15$, $p = 0.0003$) but not between employment status and educational status ($r = 0.0003$, $p = 0.99$). The monthly income variable was therefore dropped, and employment status and educational status were used in subsequent multivariable analysis as indicators of socio-economic status. Variables found to be associated with overweight/obesity in previous studies, namely age, gender, educational status, marital status, employment status, year of arrival (migration) and level of physical activity,[6,8,12,21,22,26] were included as independent variables in multivariable analysis. The multivariable logistic regression models gave adjusted odds ratios for each of the independent variables in the model, in relation to the two dependent variables, viz overweight/obesity (BMI ≥ 25 kg/m^2) and abdominal obesity. For each independent variable, indicator variables were created, giving an estimate of the odds of being overweight/obese or having abdominal obesity in a particular category compared to the independent variable's comparison category. Ethical approval for the study was obtained from the Ethics Committee of the UWC, and exemption from full review for the present analysis was given by Duke University Medical Center's Institutional Review Board since data was transferred to Duke University with no identifying information.

Results

The distribution of socio-demographic variables, BMI categories, abdominal obesity categories and level of physical activity is presented, by gender, in Table I. Despite a similar proportion of men and women who were married (39.3% vs 38.7%) or educated (90.7% vs 90.8%), unemployment was lower among men (63.6% vs 69.8%), though not significantly [$\chi^2 = 1.62$, $p = 0.20$]. This may be in part due to their longer duration of stay in the township; 29.0% men vs 10% women reported having moved to the township more than 25 years prior. The prevalence of overweight/obesity was high (76.5%) and more than 60% had abdominal obesity. Obesity was more common among women (53.4%) than among men (18.7%) [$\chi^2 = 44.66$, $p < 0.01$]. Further, prevalence of abdominal obesity was higher among women (71.5%) than among men (23.4%) [$\chi^2 = 93.30$, $p < 0.0001$]. Only around 20% of the individuals reported walking more than 45 minutes per day. This proportion was higher among women (21.3%) than men (11.2%) [$\chi^2 = 3.915$, $p = 0.048$], which may in part be due to the different age distribution of the two genders.

Table IIA shows the distribution of BMI categories by gender and level of physical activity. Among females, the proportion that was obese was slightly higher among those who walked for 30–44 minutes per day (59.3%) and more than 45 minutes per day (58.9%) than among those who walked for less than 30 minutes per day. This relationship was not found among males. Mean BMI values by gender and age are presented in Table IIB. Mean BMI values were observed to be significantly higher ($p < 0.05$, t-test) among females compared to males in the same age category.

Adjusted odds ratios for overweight/obesity status and abdominal obesity with respect to various socio-demographic factors and level of physical activity are presented in Table III. Men were less likely to be overweight/obese [odds ratio (OR) = 0.08 (0.04, 0.14)] and have abdominal obesity [OR = 0.09 (0.05, 0.15)] than women. Those who had never been married were also at a lower risk of being overweight/obese [OR = 0.47 (0.27, 0.82)] and of having abdominal obesity [OR = 0.61 (0.38, 0.96)] than those currently married. After adjusting for other factors, including age, time period of arrival in the township was associated with abdominal obesity, with an OR of 0.31 (0.14, 0.72) for those who arrived in the township after the year 2000. Those who were unemployed had a lower risk of being overweight/obese [OR = 0.37 (0.15, 0.92)]. Notably, we did not find an association between physical activity and obesity, measured either through BMI or WC.

Discussion

The black population residing in an urban township in Cape Town, South Africa, showed a high prevalence of obesity, whether measured by BMI (47.6%) or WC (63.4%). Women were significantly more likely to be overweight/obese or have abdominal obesity than men.

Table I: Socio-demographic characteristics, BMI, WC and level of physical activity of study participants, by gender

Characteristic	Gender				Total	
	Male		Female			
	n = 107	% *	n = 530	% *	n = 637	% *
Age (in years)						
18 to 34	33	30.8	176	33.2	209	32.8
35 to 54	43	40.2	270	50.9	313	49.1
≥ 55	31	29.0	79	14.9	110	17.3
Marital status						
Married	42	39.3	205	38.7	247	38.7
Separated/widowed/divorced	22	20.6	121	22.8	143	22.4
Never married	43	40.2	204	38.5	247	38.8
Educational status						
Never attended school	10	9.3	49	9.2	59	9.3
Attending school at present	7	6.5	16	3.0	23	3.6
Attended school, not in school at present						
Grade 1 to 7	40	37.4	186	35.1	226	35.5
Grade ≥ 8	49	45.8	276	52.1	325	51.0
Employment status						
Employed	14	13.1	40	7.5	54	8.5
Unemployed	68	63.6	370	69.8	438	68.8
Self-employed	14	13.1	88	16.6	102	16.0
Temporal employment	9	8.4	23	4.3	32	5.0
Income						
Less than R500	34	31.8	217	40.9	251	39.4
R500 to less than R1 000	34	31.8	166	31.3	200	31.4
R1 000 and above	35	32.7	138	26.0	173	27.2
Year of arrival in township						
Before 1980	31	29.0	55	10.4	86	13.5
1980–1989	30	28.0	201	37.9	231	36.3
1990–1999	27	25.2	178	33.6	205	32.2
2000 or after	17	15.9	87	16.4	104	16.3
BMI category (kg/m²)						
Underweight (BMI < 18.50)	8	7.5	5	0.9	13	2.0
Normal (BMI 18.50 to 24.99)	56	52.3	81	15.3	137	21.5
Overweight (BMI 25.00 to 29.99)	16	15.0	131	24.7	147	23.1
Obese (BMI ≥ 30.00)	20	18.7	283	53.4	303	47.6
Obese Class I (BMI 30.00 to 34.99)	13	12.2	121	22.8	134	21.0
Obese Class II (BMI 35.00 to 39.99)	3	2.8	78	14.7	81	12.7
Obese Class III (BMI ≥ 40.00)	4	3.7	84	15.6	88	13.8
Abdominal obesity						
Present (WC ≥ 80 cm in women, ≥ 94 cm in men)	25	23.4	379	71.5	404	63.4
Absent	80	74.8	139	26.2	219	34.4
Level of physical activity (walking minutes/day)						
< 30 minutes	74	69.2	322	60.8	396	62.2
30 to < 45 minutes	18	16.8	86	16.2	104	16.3
45 minutes or more	12	11.2	113	21.3	125	19.6

* % may not add up to 100% as some variables have missing data.

Table II:

A) BMI category by gender and level of physical activity (walking minutes/day)						
Gender	**Level of physical activity (walking minutes/day)**		**BMI category**			
		Total	Underweight	Normal	Overweight	Obese
Male	< 30 minutes	67	4 (6.0)	39 (58.2)	10 (14.9)	14 (20.9)
	30 to < 45 minutes	18	2 (11.1)	10 (55.5)	4 (22.2)	2 (11.1)
	≥ 45 minutes	12	2 (16.7)	5 (41.7)	1 (8.3)	4 (33.3)
Female	< 30 minutes	304	3 (1.0)	48 (15.8)	87 (28.6)	166 (54.6)
	30 to < 45 minutes	81	1 (1.2)	15 (18.5)	17 (21.0)	48 (59.3)
	≥ 45 minutes	107	1 (0.9)	17 (15.9)	26 (24.3)	63 (58.9)
B) Mean BMI by gender and age category						
Gender	**Age category (years)**	**Total**	**Mean BMI ± SD ****			
Male	18 to 34	33	21.6±3.1			
	35 to 54	43	26.0±6.8			
	> 55	31	27.6±8.9			
Female	18 to 34	176	29.8±6.1			
	35 to 54	170	33.8±8.3			
	> 55	79	31.6±6.8			

* Figures in parenthesis are row percentages.

** Mean BMI in the same age category is significantly higher ($p < 0.05$) among females as compared to males (t-test).

Table III: Adjusted OR for overweight/obesity (BMI ≥ 25 kg/m²) and abdominal obesity (WC ≥ 80 cm for women and ≥ 94 cm for men) by socio-demographic factors and level of physical activity (walking minutes/day): Logistic regression analysis

Variable	Adjusted OR for overweight/obesity * OR (95% CI)	Adjusted OR for abdominal obesity** OR (95% CI)
Age (in years)		
18 to 34	1	1
35 to 54	1.60 (0.83, 3.11)	1.33 (0.75, 2.34)
≥ 55	1.29 (0.53, 3.16)	0.84 (0.39, 1.81)
Gender		
Female	1	1
Male	**0.08 (0.04, 0.14)**	**0.09 (0.05, 0.15)**
Marital status		
Married	1	1
Separated/widowed/divorced	0.80 (0.42, 1.54)	0.64 (0.37, 1.09)
Never married	**0.47 (0.27, 0.82)**	**0.61 (0.38, 0.96)**
Educational status		
Never attended school	1	1
Attending school at present	0.36 (0.09, 1.48)	0.27 (0.07, 1.04)
Attended school, not in school at present		
Grade 1 to 7	1.10 (0.46, 2.65)	1.23 (0.59, 2.59)
Grade ≥ 8	1.39 (0.56, 3.42)	1.09 (0.51, 2.32)
Employment status		
Employed	1	1
Unemployed	**0.37 (0.15, 0.92)**	1.01 (0.51, 2.03)
Self-employed	0.65 (0.22, 1.88)	1.33 (0.58, 3.04)
Temporal employment	0.34 (0.10, 1.20)	1.04 (0.35, 3.06)
Year of arrival		
Before 1980	1	1
1980–1989	0.58 (0.25, 1.32)	0.56 (0.28, 1.14)
1990–1999	0.62 (0.25, 1.56)	0.57 (0.26, 1.23)
2000 or after	0.42 (0.16, 1.09)	**0.31 (0.14, 0.72)**
Level of physical activity (walking minutes/day)		
< 30	1	1
≥ 30 to < 45	0.87 (0.48, 1.58)	0.71 (0.42, 1.22)
≥ 45	0.99 (0.55, 1.77)	0.82 (0.50, 1.36)

*n = 559 (complete case analysis); **adjusted for all the other tabulated variables.**

n = 580 (complete case analysis); **adjusted for all the other tabulated variables.

While gender and marital status were associated with overweight/obesity as well as abdominal obesity, the level of physical activity was not associated with either outcome.

The proportion of males (18.7%) and females (53.4%) who were obese in the present study was higher than those reported in other studies conducted in South Africa[2,6–8,10,12] and other African countries,[21–23,33,34] except for the study conducted by Mollentze et al,[9] which reported a slightly higher prevalence (20.4% for males, 54.3% for females). The higher prevalence in the present study could be related to dietary practices of the urbanised population.[35] The disproportionately high prevalence of obesity, especially among women, coupled with evidence refuting the 'healthy obesity' concept[16,17] demonstrates an urgent need to reduce levels of obesity in the country, which also might help to stem the rising incidence of non-communicable diseases.

Similar to findings from other South African[2,9,12] and African studies,[21–23,34] the prevalence of obesity was significantly higher among females compared to males in the present study. Further, gender also showed a strong association with overweight/obesity and abdominal obesity in the multivariable analysis, with men at a lower risk than women. Though the sample may have been biased towards retired or unemployed men, this finding merits attention. Other studies from South Africa[8,36,37] have shown that few overweight and obese women view themselves as overweight and that, among women, being overweight is often perceived to be attractive by the community and associated with respect, dignity and affluence. These factors could possibly explain the observed gender difference.

The association between marital status and obesity found in our study has been reported in studies from other countries. A study of Uzbek men[38] found a higher risk of obesity among men currently in union compared to those never married. However, a Jamaican study[39] reported lower BMI levels among men and women who were currently married. In South Africa, a previous study[12] also found no such association. Marital status may alter food consumption habits of individuals and this aspect needs to be explored in future studies.

In the present study, individuals who arrived in the township after the year 2000 have a significantly lower risk of having abdominal obesity compared to those who came before 1980. Though not significant, the adjusted point estimates suggest a similar lower risk of having abdominal obesity and being overweight/obese in the other year of arrival categories as well, compared to arrival before 1980. The year of arrival in the township can be considered a proxy for the duration for which an individual has been exposed to the dietary and lifestyle factors present in the urban environment, which may predispose to obesity.[35]

While Senekal et al[12] report the risk of having a BMI > 25 kg/m^2 to be higher among those who have an education of less than Grade 7 and Pasquet et al[22] report it to be higher among those who are literate, Mishra et al,[38] similarly to the present study, report no association between educational status and the risk of being overweight/obese.

Contrary to the expected beneficial effect, no association between level of physical activity and risk of being overweight/obese or having abdominal obesity was found. This lack of association could be due to methodological limitations such as small samples, especially of males, and our assessment of the level of physical activity based on self-reported minutes spent walking from work, school or going to the shop per day, rather than actual measurement of physical activity or use of validated scales.[40] However, measures of physical activity currently in use assume either employment or availability of time to measure physical activity. Capturing physical activity in African populations will require the development of scales that are sensitive to the daily activities of the population. For example, in populations without refrigerators, it is common to make several trips per day to purchase groceries for each meal prepared. Alternatively, the finding may suggest that physical activity at levels reported here does not influence risk of obesity. Some recent studies suggest that there is little association between physical activity and BMI.[25,38] Further, there is evidence of a gender differential in the benefit of physical activity with regard to BMI with studies suggesting a beneficial effect among only males[33,39] or only females.[27] Considering our small sample, especially of males, we are not in a position to comment on this gender differential.

Males were underrepresented in the present study since the primary targets of the study were women. Since males were selected only in the absence of eligible women in the household, there might be an overrepresentation of unemployed males and working females in our sample. The analyses are also not adjusted for the dietary practices or the caloric intake of the study participants. Though limited information was collected on food habits, the information collected could not be used to estimate caloric intake and was not used for the analysis. In spite of these limitations, the present study shows a high prevalence of obesity in the black population of South Africa, especially females, and suggests the need for obesity control programmes beyond interventions promoting physical activity.

If confirmed in larger studies that measure physical activity with measures appropriate for this population , the findings suggest that physical activity may play less of a role in obesity control, or that more than 45 minutes of physical activity a day alone may be inadequate for weight control in women. This would suggest that at least among South African women, and perhaps among other black women, obesity control through nutritional interventions may be as or more beneficial than increasing the intensity or duration of physical activity.

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