Physical Inactivity Is the Major Determinant of Obesity in Black Women in the North West Province, South Africa: The THUSA Study

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OBJECTIVE: We investigated the association between measures and determinants of obesity in African women.

METHODS: For a cross-sectional study of adult black women in the North West Province, South Africa, we used a stratified sample of 1040 volunteers from 37 randomly selected sites in the province according to the level of urbanization. We analyzed the association between measures of obesity, namely body mass index (BMI), waist circumference, waist-to-hip ratio, triceps and subscapular skinfolds, and socioeconomic factors, dietary intakes, and physical activity.

RESULTS: The rate of obesity (BMI $>$ 30) in the sample was 28.6%. We found a significant positive association between household income and measures of obesity. After exclusion of underreporters and adjustments for age, smoking, and household income, we found significant positive correlations between total energy intake, fat intake, and BMI. Physical activity index (derived from a subset of 530 subjects) correlated negatively with BMI and waist circumference. Subjects in the highest third of physical activity were less likely to be obese (odds ratio-0.38, 95% confidence interval-0.22–0.66).

CONCLUSIONS: Women with higher incomes and lower physical activity were at the greatest risk of increased BMI. Physical inactivity showed the strongest association with measures of obesity in this study. *Nutrition* 2002;18:422–427. ©Elsevier Science Inc. 2002

KEY WORDS: obesity, body mass index, waist-to-hip ratio, waist circumference, physical activity, dietary intake, black women

INTRODUCTION

There is an exceptionally high prevalence of obesity among black South African women.[1,2] The reasons for this phenomenon are not well understood. It seems that many black South African women do not want to lose weight because obesity is culturally and esthetically looked upon with far less disfavor in black women than in white women.[3] Factors such as higher parity and lower levels of physical activity may contribute to the tendency of black women to gain weight.[4] Increased body mass index (BMI) among women is associated with chronic diseases, especially coronary heart disease. Results from the coronary artery risk development in young adults (CARDIA) and atherosclerosis risk in communities (ARIC) studies have shown that black and white women should avoid excess adiposity.[5] To prevent and treat obesity in black women, more should be known about the underlying causes of obesity among these women to develop appropriate and culturally accepted interventions.

The Transition and Health During Urbanisation of South Africans (THUSA) study assessed the relation between stratum of urbanization and measures of health status in the black population of the North West Province. This part of the study investigated the association between measures of obesity and factors contributing to obesity such as socioeconomic factors, dietary intakes (total energy, total fat, percentage of energy from fat, total carbohydrate, and sugar), and level of physical activity.

MATERIALS AND METHODS

Subjects

Strata of urbanization had to be defined to plan the drawing of a sample from the study population. The definitions of urban and rural used in epidemiologic research should be determined by the aim of the study.[6] Given the aim of the THUSA study, subjects who stayed only temporarily in the city or a rural area were not included in the study sample. In addition to two rural strata (people living in tribal areas and on farms), three different strata of urbanization were distinguished for urban subjects, namely stratum 3 for the subjects living in informal settlements, stratum 4 for subjects living in established townships with full access to water and electricity, and stratum 5 for fully Westernized subjects living in Western-type houses in upper-class suburbs.

This project was supported by research grants from the South African Sugar Association, the National Research Foundation of South Africa, and the Research Fund of the Potchefstroom University for Christian Higher Education.

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Nutrition 18:422–427, 2002 0899-9007/02/$22.00

PII S0899-9007(01)00751-1

With the assistance of a biostatistician, 37 study sites were randomly selected from the four geographic quarters of the North West Province of South Africa after studying the database compiled from census data, with proportionally more sites in densely populated areas to represent the five strata of urbanization. Visits were made to the 37 sites during the weeks preceding the collection of data to obtain permission from government officials and tribal chiefs to work in the area and to notify the local community of the visit of the research team. Because research is strange to many of the black people in the province and rural communities are often suspicious, randomization of a sample is sometimes unacceptable to the study population.[6] Due to logistical reasons, it was not possible to select subjects randomly from those sites. During a period of 5 d at each site, as many volunteers as possible were recruited according to inclusion criteria. Subjects had to be apparently healthy, 15 to approximately 70 y old, and living in the area. Exclusion criteria were pregnancy, lactation, casual visitors, drunkenness, and treatment for chronic diseases such as hypertension and diabetes mellitus, mental diseases, or other serious diseases. Subjects were grouped into five age categories: 15 to 24, 25 to 34, 35 to 44, 45 to 54, and 55+ y. A convenience sample of all volunteers who complied with the inclusion criteria was recruited from each of the 37 randomly selected sites over a period of 2 y (1996 and 1998). Sites from the four quarters of the province were selected so that rural and urban subjects were included during both years and the demographic data of the subjects of 1996 did not differ significantly from those of the subjects included during 1998. A total of 1040 women was included in the study. The subjects gave informed consent and the study was approved by the Ethics Committee of Potchefstroom University. A local organizer at each site helped identify subjects from all age groups from locations around the selected sites. The organizers received detailed instructions to assist in the recruitment of subjects and had to ensure that the subjects fasted overnight before the day of the study.

Questionnaires

The following questionnaires were developed specifically for the THUSA study population, according to the above-mentioned objectives: a demographic questionnaire, a quantitative food frequency questionnaire (QFFQ) with a food portion picture book,[7] and a physical activity questionnaire based on the short questionnaire developed by Baecke et al.[8] and validated specifically for this population.[9] The physical activity index (PAI), calculated from the questionnaire data, was validated against calculated energy expenditure during physical activity over a 24-h period. Six Setswana-speaking black women were trained as fieldworkers to administer the demographic questionnaires, the QFFQ, and the physical activity questionnaire. The physical activity questionnaire was administered to a subsample of 530 subjects during the 1998 survey. The 1998 subjects were similar to the 1996 subjects with regard to representing all strata of urbanization and age groups. The fieldworkers conducted face-to-face interviews with the subjects in their own languages.

The demographic data were collected to confirm the stratum of urbanization of each subject, provide information on sex and age distribution, and determine socioeconomic and smoking status, and parity. The QFFQ data were coded and analyzed with a computer program based on the South African Food Composition Tables.[10] The physical activity data were coded and analyzed according to the Baecke scoring system[8] adapted for this population.[9]

Anthropometric Data

For anthropometric measurements subjects were examined in their underwear. Weight was measured on a portable electronic scale (Precision Health Scale, A&D Company, Tokyo, Japan) to the nearest 0.1 kg and height was measured to the nearest 0.5 cm with a stadiometer (IP 1465, Invicta, London, UK). Subjects, without shoes, stood upright with their heads in the Frankfort plane for height measurements.[11] The BMI (kg/m^2) was calculated as weight divided by height squared. The waist circumference (WC) was measured at the midpoint between the lower rib margin and the iliac crest, and the hip was measured at the maximal circumference of the buttock with a 7-mm-wide flexible steel tape (Lufkin, Cooper Tools, Apex, NC). Circumferences were measured with the cross-hand technique, with the tape at right angles to the body segment that was being measured and with no indentation of the skin.[11] The waist-to-hip ratio (WHR) was calculated from waist and hip circumferences. A John Bull (British Indicators, London, UK) skinfold caliper was used to measure triplicate skinfold thicknesses at the triceps (TSF) and subscapular (SSF) areas. Trained biokineticists made all the anthropometric measurements.

Statistical Analyses

Statistical analyses were performed using SPSS 2.0 for Windows (SPSS, Inc., Chicago, IL, USA). Due to skewed distributions, total energy and fat intakes were logarithmically transformed. For descriptive statistics, results were expressed as means and standard deviation or 95% confidence intervals. The frequency of subjects in the different BMI categories[12] (underweight, normal weight, overweight, and obese) were calculated. The ratio of total energy intake to basal metabolic rate (EI:BMR) was calculated as a guide for the accuracy of dietary reporting,[13] with an EI:BMR below 1.2 regarded as energy intake that was too low for the maintenance of body weight,[14] and women with ratios below that value were defined as underreporters.

For comparison between categories, univariate analysis of variance (ANOVA) was used to test for significant associations between age, smoking, income category, educational status, dietary intakes, and level of physical activity and the following measures of body composition, respectively: BMI, TSF, SSF, WC, and WHR. The associations between total energy, food energy (total energy minus alcohol energy), and log-transformed energy intake to income category also were assessed. The post hoc test of least-significant differences measured significant differences between categories. Partial Spearman rank-order correlation coefficients with adjustments for age, smoking, and income level assessed the associations between total dietary energy intake, food energy (total energy minus alcohol), and log-transformed food energy, as well as PAI and indices of obesity. Because we found a positive association between age and household income and between age and BMI and a negative association between BMI and smoking with univariate ANOVA, adjustments were made for age, smoking, and household income in correlation analysis.

Obesity was defined[12] as a BMI higher than 30 kg/m^2 and subjects were categorized into two BMI groups, namely non-obese ($BMI < 30$) and obese ($BMI \geq 30$) for the purpose of regression analysis. In a binary logistic regression model with BMI category as the dependent variable, the following independent variables were introduced: age, educational status, income category, smoking status (current smoker versus non-smoker), physical activity category (inactive, moderately active, most active), and dietary energy intake. To account for the cluster sampling technique (subjects recruited from 37 randomly selected sites), site was also introduced as an independent variable in the regression model.

RESULTS

Demographic Data

The demographic data of the subjects showed that most spoke Setswana (75.7%), with a low level of school education (53.7%

TABLE I.

BODY MASS INDEX DISTRIBUTION OF SUBJECTS ACCORDING TO AGE GROUP (N = 1021)*

		Age groups (y)					
Weight status	BMI range (kg/m^2)	15–24 (n = 199)	25–34 (n = 276)	35–44 (n = 228)	45–54 (n = 176)	55+ (n = 142)	15–55+ (n = 1021)
Underweight	<18.5	18 (9.0%)	16 (5.8%)	7 (3.1%)	13 (7.4%)	11 (7.7%)	65* (6.4%)
Normal weight	18.5–24.99	129 (64.8%)	118 (42.8%)	61 (26.8%)	57 (32.4%)	42 (29.6%)	407* (39.9%)
Overweight	25–29.99	34 (17.1%)	74 (26.8%)	71 (31.1%)	44 (25.0%)	34 (23.9%)	257* (25.2%)
Obese grade							
I	30–34.99	13 (6.5%)	35 (12.7%)	46 (20.2%)	32 (18.2%)	30 (21.1%)	156* (15.3%)
II	35–39.99	4 (2.0%)	18 (6.5%)	27 (11.8%)	13 (7.4%)	17 (12.0%)	79* (7.7%)
III	>40	1 (0.5%)	15 (5.4%)	16 (7.0%)	17 (9.6%)	8 (5.6%)	57* (5.6%)

* A complete dataset was available for only 1021 subjects. BMI, body mass index.

primary school or less), a high unemployment rate (64.3%), and a low household income (77.4% less than R1000, or US $130, per month). There were no significant differences between the demographic profiles of subjects in the 1996 and the 1998 surveys.

Socioeconomic Data

There were significant differences between the BMI, TSF, SSF, and WHR of subjects in the different income groups ($P < 0.01$). Despite the differences between the measures of obesity of subjects in the different income groups, no significant differences between the total energy intakes of the different income categories were found ($P = 0.088–0.498$). Educational status was not significantly associated with BMI. In the logistic regression model, with BMI category as the dependent variable, age group ($P < 0.001$) and household income ($P = 0.001$) were significantly associated with BMI. The analysis showed that a higher income level was associated with a 1.5-fold increase in the probability to be obese. No significant correlation between parity and BMI, WC, or WHR was found.

Anthropometric Data

The BMI distribution of the subjects according to age group is shown in Table I and Figure 1. The weight status of the subjects was categorized according to World Health Organization cutoff points.[12] Of the total sample, 6.4% of subjects were classified as underweight, 39.9% as normal weight, 25.2% as overweight, and 28.6% as obese. Therefore, 53.8% of these women had BMIs exceeding the normal-weight cutoff point of 25 kg/m^2.[12]

In univariate ANOVA, significant positive associations between all indices of obesity (BMI, WC, WHR, TSF, and SSF) and

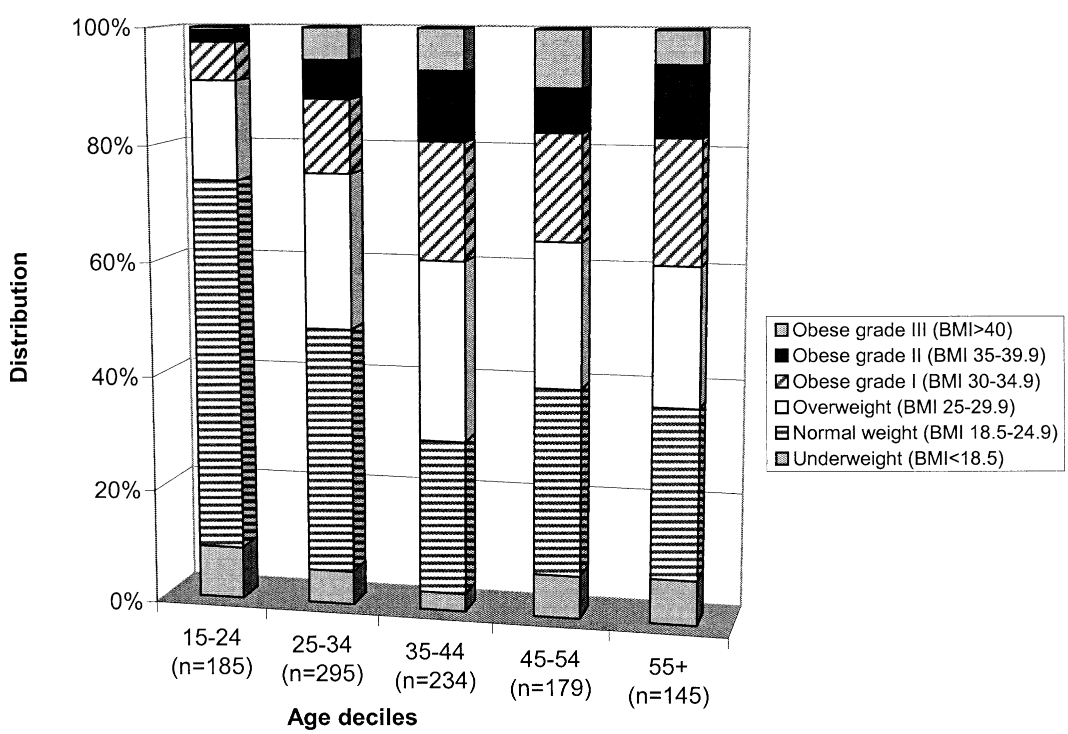

FIG. 1. BMI distribution of subjects by age group (N = 1021). BMI, body mass index.

TABLE II.

MEAN ENERGY AND MACRONUTRIENT INTAKES OF SUBJECTS

Dietary component	Total sample (n = 1014)*		Subjects not underreporting† (n = 573)	
	Mean	SD	Mean	SD
Total energy (kJ)	7992.9	3059.7	9894.7	2579.7
Food energy‡ (kJ)	7907.3	3024.9	9775.1	2566.5
Total protein (g)	57.9	21.9	69.4	20.1
Energy from protein (%)	10.3	3.1	9.6	2.9
Animal protein (g)	26.9	15.9	30.6	17.3
Total fat (g)	54.4	25.9	65.7	26.6
Energy from fat (%)	25.8	7.4	25.0	7.5
Total carbohydrate (g)	295.0	130.7	371.0	118.8
Energy from carbohydrate (%)	63.9	9.9	65.4	9.8
Fiber (g)	16.4	7.6	20.3	7.2
Added sugar (g)	52.2	47.6	67.1	54.9

* A complete dataset was available for 1014 subjects.
† Not underreporting = subjects with ratios of energy intake to basal metabolic rate above 1.2.
‡ Total energy minus energy from alcohol.
SD, standard deviation.

age were found ($P < 0.0001$). Similarly, significant positive associations between all indices of obesity and stratum of urbanization were found ($P < 0.0001–0.007$). The BMI of the cigarette smoking group was significantly lower than the BMI of non-smokers ($P = 0.016$).

Dietary Data

The EI:BMR was calculated as a guide for the accuracy of the dietary records. An EI:BMR below 1.2 is regarded as an energy intake too low for the maintenance of body weight.[14] In this group 44% of the subjects had EI:BMRs below 1.2 and may be classified as underreporters. The mean dietary energy and macronutrient intakes of the subjects are shown in Table II. The mean intakes of the subjects with an EI:BMRs exceeding 1.2, i.e., the subjects who were more likely not to underreport their intakes, are also shown.

In the total study population, no correlation was found between food energy intake or log-transformed food energy and the measures of obesity, namely BMI, TSF, SSF, and WC. The food energy value represents the total energy intake minus energy intake from alcohol. Adjustments were made for age, smoking, and total household income and Spearman's partial correlation coefficient for those associations were calculated. After the adjustment, statistically significant, positive correlations between BMI and total energy intake ($r = 0.054$, $P = 0.04$) and between BMI and total fat intake ($r = 0.050$, $P = 0.05$) were found.

The mean fat intake of the subjects was relatively low (54.4 ± 25.9g/d, 25.8% of energy). The subjects living in the urban areas (strata 4 and 5) had higher fat intakes than did the subjects living in rural areas (strata 1 and 2).

Physical Activity

The PAI of the subjects ranged from 1.14 to 9.17, with a mean and standard deviation of 2.75 ± 1.03. Because the mean PAI of the subjects was closer to the minimum than to the maximum PAI, subjects were categorized into three tertile groups of PAI. The cutoff point for the lowest third ranged from 1.14 to 2.249, followed by a middle third that ranged from 2.25 to 2.806, and the top third above 2.807. A PAI of 2.25 represents a middle-level occupation, e.g., cleaning service, commuting by taxi, no sports participation, and some standing or walking leisure time activities. A PAI of 2.9 also represents a middle-level activity occupation, e.g., cleaning services, but also walking at a moderate pace to work for 31 to 60 min each day and spending most leisure time (time off from the main occupation) in standing, walking, or at low-level sports activities (2 to 3 h/wk, 7 to 9 mo/y).[8] The distribution of the subjects in these activity tertile groups is shown in Table III.

TABLE III.

DISTRIBUTION OF A SUBSAMPLE OF SUBJECTS IN TERTILE GROUPS OF PHYSICAL ACTIVITY*

Tertile of physical activity	n Subjects	% Subjects
Lowest third (PAI 1.14–2.249)	179	33.8
Middle third (PAI 2.25–2.806)	177	33.4
Highest third (PAI 2.807–9.17)	174	32.8

* The physical activity data were collected from a subsample of 530 subjects (year 1998 subjects).
PAI, physical activity index.

Statistically significant, negative correlations between PAI and BMI ($r = -0.135$, $P = 0.001$) and between PAI and WC ($r = -0.147$, $P < 0.0001$) were found after adjustment for age, smoking, and total household income. Spearman's partial correlation coefficient for the association between PAI and SSF was −0.104 ($P = 0.03$). With logistic regression, PAI showed a significant negative association with BMI ($P = 0.001$), as shown in Table IV.

DISCUSSION

We assessed the association between measures of obesity and socioeconomic factors, dietary intakes, and physical activity. The prevalence of obesity (BMI > 30) in the THUSA study sample was slightly lower than that reported for black South African

TABLE IV.

β-COEFFICIENTS, ODDS RATIOS, AND 95% CONFIDENCE INTERVALS FOR REGRESSION OF BODY MASS INDEX CATEGORY BY AGE, HOUSEHOLD INCOME, AND PHYSICAL ACTIVITY (SIGNIFICANT VARIABLES)

Variable	β coefficient	SE	P	Odds ratio	95% CI Lower	95% CI Upper
Age group*			0.0001			
2 (25–34 y)	1.12	0.44	0.01	3.08	1.30	7.28
3 (35–44 y)	1.93	0.46	<0.0001	6.90	2.82	16.92
4 (45–54 y)	2.07	0.50	<0.0001	7.91	2.97	21.06
5 (55+ y)	1.98	0.52	<0.0001	7.22	2.59	20.14
Household income	0.397	0.114	0.001	1.49	1.19	1.86
Physical activity†			0.001			
Middle third	−0.66	0.26	0.01	0.52	0.31	0.86
Top third	−0.973	0.28	0.001	0.38	0.22	0.65

* The youngest age group was used as the reference group.
† The bottom third of PAI was used as the reference group.
CI, confidence interval; PAI, physical activity index; SE, standard error.

TABLE V.

MEAN BODY MASS INDEX FOR BLACK SOUTH AFRICAN WOMEN IN THREE STUDIES[1–3]

Study	Age groups (y)				
	15–24	25–34	35–44	45–54	55–64+
Urban Africans[1] (*n*)	171	147	109	64	53
BMI (mean ± SD)	24.8 ± 4.4	27.8 ± 6.2	30.3 ± 6.7	31.7 ± 5.1	31.9 ± 5.1
%BMI > 30	12.9	30.6	47.7	59.4	54.7
QwaQwa Africans[2] (*n*)	—	141	110	99	102
BMI (mean ± SD)	—	27.1 ± 5.5	29.4 ± 6.6	29.8 ± 7.8	30.5 ± 7.3
%BMI > 30	—	27.5	41.8	42.4	49.0
Mangaung Africans[2] (*n*)	—	105	126	105	68
BMI (mean ± SD)	—	27.2 ± 6.2	29.5 ± 7.0	31.1 ± 7.2	30.6 ± 9.0
%BMI > 30	—	31.1	42.9	54.3	47.1
North West Province Africans[3] (*n*)	200	277	228	176	99
BMI (mean ± SD)	23.2 ± 4.8	26.7 ± 6.6	28.9 ± 6.7	27.9 ± 7.7	28.0 ± 6.9
%BMI > 30	9.0	24.6	39.0	35.2	38.7

BMI, body mass index; SD, standard deviation.

women in the Cape Peninsula[1] and the Free State.[2] The mean BMI values of the three study samples are compared in Table V.

It was not possible to measure the skinfold thicknesses of grossly obese subjects with calipers because such measurements were thought to be inaccurate.[11] Correlations between dietary and activity variables and TSF or SSF thus may have smaller correlation coefficients than correlations between the same variables and BMI because the total study sample, including the grossly obese subjects, were included in analyses of BMI and these variables.

The PAI distribution of the subjects indicated a tendency toward lower physical activity (Table III), which indicates that physical inactivity may be an important factor to be considered in this study population. The statistically significant negative correlations between PAI and indices of obesity showed that the most inactive subjects were also the most obese. The correlation between PAI and TSF was not statistically significant ($r = -0.08$, $P = 0.07$), but the skinfold thicknesses of grossly obese subjects could not be measured with calipers and were not included in the data. Negative correlations between level of physical activity and indices of obesity have been found by others.[15] In the logistic regression model, with BMI as the dependent variable, and which included independent variables such as age, total household income, total energy intake, educational level, and smoking, the most significant (negative) association was found between PAI and BMI ($P = 0.001$, Table IV). Subjects in the middle third of physical activity had an odds ratio of 0.52 (95% confidence interval = 0.31–0.86) to be obese, compared with subjects in the most inactive tertile group. Subjects in the top (most active) tertile group had an odds ratio of only 0.38 (95% confidence interval = 0.22–0.66) to be obese.

In this study group, 44% of subjects had EI:BMRs below 1.2, indicating possible underreporting. In the Second National Health and Nutrition Examination Survey, an even higher percentage of underreporting was found, namely 54%.[16] The EI:BMR decreased across categories of BMI, similar to reports that obese subjects are more likely than lean subjects to underreport.[16] In a study in the United States, underreporting was more common in subjects with a low educational level.[16]

A statistically significant positive correlation of low power was found between BMI and total energy intake ($r = 0.054$, $P = 0.04$) and fat intake ($r = 0.05$, $P = 0.05$). With these correlation analyses, adjustments were made for age, smoking, and total household income. When the underreporters were excluded, the power of the positive correlations increased. According to those positive associations between food energy and macronutrient intakes and BMI, dietary factors may be a contributing factor to the high prevalence of obesity in the subjects.

The lowest fat intakes were found in subjects living in rural areas (46.0 ± 20.2 g/d) and the highest in people living in urban middle-class areas (56.3 ± 27.0 g/d), indicating a trend toward higher fat intake with urbanization. The same trend was observed during the nutrition transition in China, where urban households consumed much more energy from fat than did rural ones. In urban households, a higher intake of animal-protein foods were reported.[17] The differences between the fat intakes of urban middle-class subjects (stratum 4) and those living on farms (stratum 2) or in rural areas (stratum 1) were statistically significant ($P = 0.001$ and <0.0001, respectively). Bourne et al.[18] reported that urban Africans prefer refined carbohydrate foods and would like to eat more meat and fat-containing food.

Popkin et al.[17] followed Chinese subjects during a period of nutrition transition accompanied by increased fat intake and found that the increase in fat intake was significantly related to an increase in BMI. Paeratakul et al.[15] reported a significant positive association between fat intake and BMI in the total Chinese study population, but not in women when studied separately. Using ANOVA, there was no significant difference between the total fat intakes of subjects in the THUSA study across categories of BMI, even after adjustment for age and smoking. A positive correlation between total fat intake and BMI ($r = 0.050$, $P = 0.05$) was found. The fact that high prevalences of overweight (25.2%) and obesity (28.6%) were found in the total population, with a relatively low fat intake (54.4 ± 25.9 g/d, 25.8 ± 7.4% energy from fat), indicates that obesity can occur even with relatively low fat intakes.[19] The relatively large standard deviation of 25.9 to a mean of 54.4 g/d shows that there was considerable variation in the fat intakes of the subjects, although the mean intake was low.

This weak correlation between energy, fat intakes, and BMI may be due to confounding factors such as differences in physical activity and underreporting. The most obese subjects in this study had the lowest EI:BMRs, indicating that the most obese underreported the most. Other researchers reported difficulty in obtaining accurate dietary data from a free-living population.[16] Cross-sectional studies of dietary fat and obesity have shown mixed results. Dietary fat is generally positively associated with body weight.[20] Bray and Popkin[21] found a significant regression coefficient ($R^2 = 0.78$, $P < 0.001$) between the increase in fat intake and prevalence of overweight, South Africa represents an outlier, with a high prevalence of overweight but a low percentage of energy from fat. The weak correlation between dietary fat intake and BMI in this study confirms the findings of Bray and Popkin regarding South African populations[21] and the statement that dietary fat intake does not promote obesity independently of total energy intake.[22] There was a strong positive correlation between dietary fat intake and total energy intake ($r = 0.733$, $P < 0.0001$).

The prevalence of obesity increased with age from the youngest age group and peaked at the age category of 35 to 44 y. This pattern of change in BMI with age is consistent with the report of Mueller.[23] The lower prevalence of obesity in older age groups may be due to weight loss occurring in older age or to differential mortality by weight.[24] A negative association between smoking and BMI ($P = 0.016$) was found in this study, which is consistent with the results of Paeratakul et al.[15] in China.

BMI was positively associated with household income in this study sample. In developing countries, income is positively associated with intakes of fat and animal-protein food.[17] Total energy and fat intakes in this study were not associated with income level, which may indicate that factors other than dietary intake but associated with income level, such as physical activity level, may be more important determinants of BMI. Mean household income was also positively associated with other indices of obesity.[16] The high prevalence of obesity in groups of low socioeconomic status has been attributed to a more tolerant social climate toward obesity.[3] Although no statistically significant correlations between parity and BMI ($r = 0.026$. $P = 0.30$), parity and WC ($r = 0.04$, $P = 0.19$), and parity and WHR ($r = 0.05$, $P = 0.13$) were found, there was a tendency toward higher WC and WHR with increasing number of births. Higher parity was suggested to be a factor contributing to the tendency of black women to gain excessive weight.[4]

CONCLUSION

The subjects most at risk of being obese were those from the higher income categories and habitual low physical activity. These findings are consistent with the results of Paeratakul et al.[17] in a Chinese population. Weak, but statistically significant, positive correlations between total energy and fat intakes and BMI were found. The highest fat intakes in this study were in subjects living in urban areas. A high fat intake and a high energy intake may be among the contributing factors to the high prevalence of obesity in black South African women living in urban areas. However, it is questionable whether dietary fat intake, independent of energy intake, is an important determinant of obesity.[19] Cross-sectional studies have shown non-directional relations and cannot distinguish the sequence of events or establish a causal relation. Socioeconomic factors and underreporting appear to be important confounding factors that modulate the relation between diet, physical activity, and indices of obesity.[16]

Besides age and household income, physical activity showed a significant (negative) association with BMI and may be one of the most important factors affecting BMI as an index of obesity among black South African women. Public-health programs for the prevention and treatment of obesity among black South African women should include a component of increased physical activity such as enjoyable culture-sensitive dancing exercises.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the assistance of all members of the THUSA research team, especially Dr. A Kruger, for drawing of blood samples, Professor J. H. de Ridder for supervision of the anthropometrical measurements, and Dr. U. E. MacIntyre for supervision of the dietary assessment. Support with statistical analyses was received from Professor H. S. Steyn, DSc, of the Statistical Consultation Service, Potchefstroom University for CHE, who was responsible for drawing the sample. The authors also thank the subjects for their participation.

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