
The Epidemic of Obesity in South Africa: A Study in a Disadvantaged Community

Norman J. Temple, PhD; Krisela Steyn, MD; Margaret Hoffman, MBChB;
Naomi S. Levitt, MD; Carl J. Lombard, PhD

Objective: The objective of this study was: 1) to determine the anthropometric profile of adults in Mamre, a small town in South Africa, which has a population of mixed ancestry ("colored" people of Afro-Euro-Malay-Khoisan ancestry); and 2) to determine the change in this profile between 1989 and 1996.

Design: Cross-sectional surveys conducted in random samples of adults in 1989 and 1996.

Participants: The subjects were 684 women and 529 men in 1989, and 546 women and 430 men in 1996, aged 15 and older.

Main Outcome Measures: The following measurements were recorded: height, weight, and circumference of waist, hips, and mid-upper arm.

Results: Based on data from the 1996 survey, 32% of women are obese (body mass index [BMI] ≥ 30) at ages 25–44 years, rising to 49% at ages 45–64 years. A much lower prevalence of obesity is seen in men: 14% at ages 35–64 years. Obesity levels significantly increased in women between the two surveys ($P=.015$): up from 44% in 1989 to 49% in 1996 at ages 45–64 years. There was an increase in the prevalence of overweight (BMI 25–29.9) in men, though not in obesity. Mean BMI increased by about 3% in women and 2% in men between 1989 and 1996.

Conclusions: This study conducted among people of mixed ancestry living in a disadvantaged community in South Africa shows that half of middle-aged women are obese. A rising trend in BMI was seen in adults of both sexes between 1989 and 1996. This trend may be explained by factors associated with rural-urban transition, including electrification, reduced physical activity, and increasing availability of energy-dense food. (*Ethn Dis.* 2001;11:431–437)

Key Words: Blacks, Body Mass Index, Body Weight, Obesity

Introduction

*They are as sick that surfeit with too much
as they that starve with nothing.*

Shakespeare, Merchant of Venice

From Athabasca University, Athabasca, Alberta, Canada (NJT), Chronic Diseases of Lifestyle Programme (KS) and Centre for Epidemiological Research in South Africa, Medical Research Council, Cape Town, South Africa (CJL), Departments of Community Health (MH) and Medicine (NSL), University of Cape Town Medical School, Cape Town, South Africa. This work was conducted at the Chronic Diseases of Lifestyle Programme, Medical Research Council, Cape Town, South Africa.

Address correspondence and reprint requests to Norman Temple, PhD; Centre for Science; Athabasca University; Athabasca, Alberta T9S 3A3, Canada; 780 469 3982; 780 675 6186 (fax); normant@athabascau.ca.

Obesity is known as a "Western" disease.¹ As such, its occurrence is rare in those populations eating a traditional diet based on carbohydrate-rich staple foods. However, as traditional foods are replaced by foods relatively rich in fat and depleted in dietary fiber, thereby inducing a positive calorie balance, its prevalence is seen to rise sharply.

South Africa, because of its varied ethnic groups with distinctive dietary patterns, is, in effect, a fascinating "laboratory" for research into the relationship between diet and disease. Studies over recent years have documented the emergence of obesity in the Black population, especially in women.^{2–4}

The population of mixed ancestry (“colored” people of Afro-, Euro-, Malay, or Khoi-ancestry) manifest a similar pattern.⁵

In this paper we further characterize the epidemic of obesity in a community of mixed ancestry, and examine aspects of diet and lifestyle that may help explain it. The focus of the study is the small town of Mamre, a working class community of approximately 6000 people located 50 km north of Cape Town. Founded as a Moravian mission station in 1808, its residents are descended primarily from the Khoi people and liberated slaves from Indonesia, but also from Blacks and Whites. Its entire population shares this ancestry. Like all non-White communities, until recent years it suffered systematic discrimination under apartheid laws. Until the past few decades, Mamre was considered rural and the majority of the population was still employed as laborers on surrounding farms. Mamre was selected for study because of the rural-urban transition (including electrification) it was undergoing during the 1980s. Today, many people in the community work in various manufacturing industries. A detailed description of the community was provided previously.⁶

Methods

In this study, we recorded the anthropometric patterns in random samples from 1989 and 1996. In order to help explain the high prevalence of obesity seen in the 1989 survey, we used qualitative methodology to estimate the typical diets consumed in 1986.

For the 1989 study, we used an age- and sex-stratified random sample of approximately one third of the 2314 community members aged 15–44 years. This sample was selected using the census from the 1986 Mamre Community Housing Project household survey as the sampling frame. All 748 Mamre residents aged 45 years and older were also included. For the 1996 study, a random sample of 500 plots was

drawn from the 1079 plots identified from maps of the area. All occupants of the selected plots, aged 15 years or older, were invited to participate. Selected plots that were unoccupied were not replaced. Households were visited three times before being classified as non-respondents. Pregnant women and bedridden individuals were excluded.

Trained field workers took anthropometric measurements. Height and weight were measured with the subjects dressed in light clothing without shoes, using a balance beam scale and height measure. Body mass index (BMI) was calculated by dividing weight (kg) by height squared (m). Subjects were classified as underweight, normal weight, overweight, or obese based on BMI values of <18.5, 18.5–24.9, 25.0–29.9, and ≥ 30 , respectively. Waist and hip circumferences were measured to the nearest 0.1 cm using a measuring tape, with the individual standing relaxed and dressed in a single layer of light clothing. The waist circumference was taken as the smallest diameter between the xiphisternum and the umbilicus on normal expiration, and the hip circumference as the maximum diameter between the waist and the thigh. Mid-upper arm circumference was measured to the nearest 0.1 cm on the right arm at the mid-point between the acromion and olecranon process of the humerus.

During 1998–1999, we estimated the typical diet consumed in Mamre around 1986. The qualitative methodology that was employed⁷ was first piloted by questioning a focus group of eight women, aged 40 to 67, who had lived in Mamre for at least 15 years, about their usual food intake around 1986. We then conducted in-depth questioning of five women, aged 33 to 51, who were also long-time Mamre residents. The questions focused on the typical daily diet eaten by adults around 1986. Food portion sizes were quantified using food models.⁸ Based on this information, 33 typical diets were formulated, each representing the food

eaten by an adult during one day. These diets were then analyzed using a computer program designed for South African foods.⁹

Statistical analysis

Basic descriptive statistics were calculated for the anthropometric measurements by survey year, gender, and age group. For comparison of the two cross-sectional surveys, the 1996 sample was standardized to the age and gender profile of the 1989 sample. The cross-sectional surveys were taken as independent samples for the statistical inferences. The overlap between the samples was less than 30%. A weighted chi-square test and *t* test were used to compare the frequencies and mean values, respectively, of the two samples.

Results

In the 1989 survey, there were 1213 participants (684 women and 529 men; overall response rate was 73%). In the 1996 survey, there were 976 participants (546 women and 430 men; overall response rate was 65%).

Tables 1 and 2 present the anthropometric data from the 1989 and 1996 surveys. Mean height of the 1996 sample was significantly greater (by approximately 0.8 cm in women and 2.4 cm in men). The mean of the mid-arm circumference measurement was greater by approximately 10% in women and 8% in men ($P < .0001$).

Mean BMI increased in women by 0.8 kg/m² (3%) between 1989 and 1996, meaning a significant increase in the prevalence of obesity (BMI ≥ 30) (Table 3). For women aged 45 to 64, obesity increased from 44% to 50%. In men, mean BMI increased by 0.5 kg/m² (2%), signifying an increase in the prevalence of overweight, though not in obesity (Table 4). In both sexes, the most pronounced increase in the prevalence of obesity was at ages 15–34.

A separate comparison was made of the 261 subjects who participated in both surveys (163 women and 98 men). After cor-

recting for the expected change in BMI due to aging (based on the 1989 data), a significant increase in BMI was seen ($P < .05$). This is consistent with the above findings for all subjects in the two surveys.

In 1996, about one third to one half of the women over age 45 had a waist:hip ratio (WHR) which exceeded the recommended upper limit of 0.85 (Table 1). Similarly, 60% of the women in this age group had a waist circumference greater than 88 cm, indicating that much of the excess fat has a central distribution. By contrast, only a small minority of the men had a WHR over 1.0, or a waist circumference greater than 102 cm (Table 2).

Dietary intake

Food was mostly prepared in the home. Our findings indicate that in 1986, there was frequent consumption of fat-rich foods, particularly full-cream milk, margarine, fried food, and fatty meat. The estimated 1986 intake of nutrients and dietary fiber is shown in Table 5.

Discussion

The data described here reveal an epidemic of obesity in women in this South African population of mixed ancestry ("colored"). Our 1996 survey revealed a prevalence of obesity (BMI ≥ 30) of one third for women aged 25 to 44, rising to one half at ages 45 to 64. Only 14% of men were obese between ages 35 and 64. The proportion of people whose waist circumference and waist:hip ratio exceeded the recommended upper limit was similar to the proportion who were obese; this indicates that the population is manifesting central obesity, the type associated with chronic diseases of lifestyle.

Similar observations have been made in studies of the mixed ancestry and Black populations of South Africa. A study conducted in the Orange Free State (central South Africa) reported a prevalence of obesity in Black women and men that closely

Table 1.—Anthropometric data, mean and (SD) in women

Age (y)	1989					1996								
	No.	Height (cm)	Weight (kg)	BMI	MUAC (cm)	No.	Height (cm)*	Weight (kg)	BMI	MUAC (cm)†	WC (cm)	% with WC >88 cm	WHR	% with WHR >0.85
15-24	70	159.3 (7.0)	56.8 (11.6)	22.4 (4.3)	24.7 (3.3)	140	158.8 (6.4)	57.0 (13.6)	22.6 (4.9)	27.0 (3.9)	70.9 (9.7)	7.1	0.74 (0.05)	2.9
25-34	98	157.4 (6.4)	62.9 (13.7)	25.3 (5.1)	27.8 (4.0)	112	159.8 (6.0)	71.0 (20.0)	27.8 (7.1)	31.5 (5.1)	82.0 (14.2)	26.8	0.77 (0.06)	9.8
35-44	130	158.0 (6.7)	67.0 (13.9)	26.9 (5.5)	29.5 (4.2)	105	158.2 (6.1)	69.5 (14.3)	27.8 (5.8)	31.8 (4.5)	84.0 (10.7)	33.3	0.82 (0.06)	17.1
45-54	155	158.3	73.5	29.4	31.2	90	159.0	75.9	30.0	34.2	90.3	51.1	0.82	32.2
55-64	129	154.2 (6.9)	69.6 (15.6)	29.2 (6.3)	30.5 (4.9)	63	155.5 (6.5)	73.6 (16.0)	30.4 (6.5)	34.0 (5.2)	93.2 (11.9)	71.4	0.86 (0.07)	55.6
65+	102	152.6 (6.3)	64.0 (14.0)	27.5 (5.7)	28.9 (4.8)	36	153.5 (7.1)	68.4 (17.4)	28.9 (6.8)	32.0 (5.1)	91.5 (12.6)	61.1	0.85 (0.06)	44.4

SD = standard deviation; BMI = body mass index; MUAC = mid-upper arm circumference; WC = waist circumference; WHR = waist:hip ratio.

* Mean increased 1989 vs 1996 ($P=0.024$).

† Mean increased 1989 vs 1996 ($P<0.0001$).

Table 2.—Anthropometric data, mean and (SD) in men

Age (y)	1989						1996							
	No.	Height (cm)	Weight (kg)	BMI	MUAC (cm)	No.	Height (cm)*	Weight (kg)	BMI	MUAC (cm)	WC (cm)	% with WC >102 cm	WHR	% with WHR >1.0
15-24	72	168.0 (7.3)	59.9 (8.7)	21.2 (2.8)	26.1 (2.7)	128	171.0 (7.4)	63.6 (13.7)	21.7 (4.3)	27.7 (3.7)	74.7 (9.9)	2.3	0.80 (0.05)	0
25-34	84	168.8 (7.8)	66.6 (10.2)	23.4 (3.1)	27.5 (3.1)	93	170.1 (7.3)	69.0 (13.2)	23.8 (4.1)	30.5 (3.4)	81.5 (9.5)	1.1	0.85 (0.05)	0
35-44	83	168.3 (7.5)	69.7 (15.6)	24.6 (5.1)	29.4 (3.8)	82	169.5 (6.5)	71.5 (15.3)	24.8 (4.7)	31.0 (4.0)	85.4 (11.4)	8.5	0.89 (0.06)	4.9
45-54	123	167.9 (8.8)	68.0 (16.3)	24.1 (4.8)	28.2 (4.2)	69	169.6 (6.5)	73.2 (14.2)	25.4 (5.2)	30.9 (3.6)	89.8 (12.2)	14.5	0.93 (0.06)	15.9
55-64	88	165.5 (8.2)	68.1 (12.6)	24.7 (4.7)	26.5 (3.5)	32	169.3 (5.8)	71.7 (11.6)	25.1 (4.0)	30.4 (4.0)	91.0 (12.5)	12.5	0.93 (0.06)	6.3
65+	79	161.7 (8.2)	62.2 (12.6)	23.9 (4.7)	26.5 (3.5)	26	165.6 (5.8)	65.9 (11.6)	24.0 (4.0)	29.1 (4.0)	89.4 (12.5)	11.5	0.93 (0.09)	26.9

SD = standard deviation; BMI = body mass index; MUAC = mid-arm circumference; WC = waist circumference; WHR = waist:hip ratio.

* Mean increased 1989 vs 1996 ($P=0.0001$).

parallels that which we observed in the mixed ancestry population.³ The pattern was similar in both urban and rural areas. However, in the Orange Free State study, the WHR was somewhat higher than that reported here. In previous studies carried out in the Cape Peninsula, slightly higher figures for obesity were reported in the Black population,² but lower values in the mixed ancestry community.⁵ A survey published in 1985, carried out in rural areas of Kwazulu, South Africa, described the epidemic at a less advanced stage: 17% of women were obese (>140% of ideal body weight) compared to only 2% of men.⁴ In Zimbabwe, the mean BMI of urban and rural Black people of both sexes was found to be similar to that seen in Mamre in 1989.¹⁰ Unfortunately, obesity prevalence data were not given.

The huge epidemic of obesity in Black and mixed ancestry women of South Africa is similar to that among the Black population of the United States. In that country, the prevalence of obesity (BMI ≥ 30) in Black women aged 30-69 is about 44%.¹¹ By contrast, the prevalence among Black men in this age range is far lower (about 24%). These extremely high levels of obesity in Black and mixed ancestry women in the United States and Africa can probably best be characterized as a pandemic.

White South Africans, by contrast, demonstrate a quite different pattern: the prevalence of obesity is about 28% in women and 20% in men at ages 45-64.¹² Similarly, among White Americans, obesity is present in 27% of women and 24% of men at ages 30-69.¹¹

Most non-Black ethnic groups resemble the American and South African White populations in having obesity rates that are generally similar in women and men. However, in Hispanic, Arab, Russian, and southern European populations, obesity may be significantly more common in women, though to a lesser degree than that seen

Table 3.—Body mass index (BMI) categories (%) in women

Age	1989				1996*			
	Underweight (<18.5)	Normal (18.5–24.9)	Overweight (25–29.9)	Obese (≥30)	Underweight (<18.5)	Normal (18.5–24.9)	Overweight (25–29.9)	Obese (≥30)
15–24	15.7	67.1	11.4	5.7	19.3	57.9	12.9	10.0
25–34	3.1	54.1	26.5	16.3	4.5	38.4	25.0	32.1
35–44	3.9	38.5	28.5	29.2	3.8	31.4	33.3	31.4
45–54	1.3	27.1	29.0	42.6	0.0	25.6	26.7	47.8
55–64	4.7	21.1	29.7	44.5	0.0	20.6	28.6	50.8
65+	3.9	35.3	26.4	34.3	5.6	27.8	25.0	41.7

* Comparison of the overall distribution of BMI, as categorized in the table, indicated no significant change between 1989 and 1996 ($P=.066$). However, the prevalence of obesity rose from 1989 to 1996 ($P=.015$).

among Black and mixed ancestry populations.^{13,14}

The data reveal that the obesity epidemic was already well-advanced in 1989. In order to help explain this, we analyzed the typical diet eaten in Mamre around 1986, which generally provided 37–45% of calories as fat, while the content of dietary fiber was about 12 to 24 grams per day. We emphasize that these are crude estimates as they are based on a small sample size and on recollections of foods consumed 13 years previously. Nevertheless, this is clearly a high-fat, low-fiber diet, which is entirely consistent with the high levels of obesity.

The epidemic of adiposity in Mamre became more severe during the years 1989 to 1996. This may be explained, at least in part, by decreased levels of physical activity. For instance, the roads became tarred in

the late 1980s; as a result cars, taxis and buses became common means of transportation. At the same time, there was an ongoing trend away from manual labor toward much less physically demanding work. Another contributing factor may have been easier access to energy-dense foods. The coming of electricity in the early 1990s meant that people could store food in a refrigerator and cook on an electric stove. At the same time, convenience foods, which had been available in Mamre throughout the 1980s, became even more ubiquitous. These findings are consistent with the theory that the adoption of a more modern lifestyle leads to increasing levels of obesity.

A rising trend in obesity has been seen around the world.^{13,14} In the United States, between 1976–1980 and 1988–1994, about 7% of people, both Black and White, male and female, became newly obese.¹¹ There is

Table 4.—Body mass index (BMI) categories (%) in men

Age	1989				1996*			
	Underweight (<18.5)	Normal (18.5–24.9)	Overweight (25–29.9)	Obese (≥30)	Underweight (<18.5)	Normal (18.5–24.9)	Overweight (25–29.9)	Obese (≥30)
15–24	16.7	76.4	4.2	2.8	20.3	64.1	10.2	5.5
25–34	6.0	67.9	23.8	2.4	6.5	58.1	28.0	7.5
35–44	3.6	56.6	25.3	14.5	6.1	51.2	28.1	14.6
45–54	4.9	59.4	26.8	8.9	10.1	43.5	31.9	14.5
55–64	10.3	43.7	31.0	14.3	9.7	38.7	38.7	12.9
65+	8.9	54.4	24.1	12.7	11.5	50.0	38.5	0.0

* Comparison of the overall distribution of BMI, as categorized in the table, indicated a significant increase between 1989 and 1996 ($P=.026$). This was due to a rise in the prevalence of overweight but with no change in the prevalence of obesity.

Table 5.—Dietary content of nutrients and dietary fiber in 1986*

Nutrient	Intake
Fat (% En)	37–45
Carbohydrate (% En)	40–52
Protein (% En)	17
Protein (g)	112
Dietary fiber (g)	12–24
Folate (µg)	207
Vitamin C (mg)	67
Iron (mg)	13.2
Calcium (mg)	470

* Intake as % of total energy intake or as quantity per day.

no simple explanation for this worldwide epidemic of obesity. In Africa, obesity is becoming increasingly widespread, especially among women. In the above-mentioned study in Kwazulu, obesity was becoming common in women despite the diet being very low in fat. Most calories came from low-fiber carbohydrates.⁴ These observations suggest a high degree of susceptibility to obesity of women who are Black or among mixed ancestry.

The picture described here gives us no reason for optimism with regard to future obesity trends. Clearly, this pandemic will pose a challenge to health-care professionals for many years to come. This, in turn, will likely precipitate related conditions. Indeed, data from the same population indicates that obesity is associated with diabetes, hypertension, and hyperlipidemia (data not shown).

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