Original Article

Urban and rural differences in dietary intake, weight status and nutrition knowledge of black female students

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The objective of this study was to examine dietary intake, weight status and nutrition knowledge of young black South African women in order to identify urban–rural differences. A group of 115 black female students attending a first-year pre-registration program at the University of the North participated in the study. A quantified food frequency questionnaire was used to gather data on each student's diet prior to entering the university. Height, weight, waist and hip measurements were taken, and body mass index (BMI) and waist-to-hip ratio (WHR) were calculated for each participant. Each student also completed a nutrition knowledge test (NKT). Mean dietary intakes were generally comparable to the recommended dietary allowances (RDA), with the exception of calcium, zinc and iron, which were lower. Urban women consumed significantly more sugar (65.8 *vs* 52.2 g) and confectionery (290.4 *vs* 183.7 g), and significantly less legumes (6.3 *vs* 18.9 g), than did rural women. The prevalence of overweight (BM1 ≥ 25) was high in urban (22.7%) and rural (22.9%) women and WHR was significantly greater ($P = 0.0003$) in rural women (0.76) compared with urban ones (0.73). Nutrition knowledge test scores were poor (mean = 40.7%) and no urban–rural differences were found. There was a positive correlation between NKT and energy, protein, carbohydrate, fibre, calcium, zinc, thiamin, niacin, and folate intakes.

Key words: students, black women, South Africa, obesity, dietary intake, food frequency, body mass index, foods, nutritional status.

Introduction

Developed countries have been facing an alarming increase in the prevalence of obesity over the last century.[1] Over the past two decades economic development in Africa, coupled with rapid urbanization, have also led to an increase in obesity on this continent, particularly among urban slum-dwellers.[2] Cardiovascular disease is predicted to increase in Sub-Saharan African over the next 20 years.[3] Obesity is known to be an important risk factor for cardiovascular disease, yet little data is available on the weight status of the adult population on this continent.[4]

South Africa is undergoing a process of rapid epidemiological transition in terms of patterns of health and disease as communities transform their social and economic structures.[5] In common with many African countries there has been a continuous migration from rural areas to urban centres.[2] One of the consequences of urbanization could be an increase in chronic diseases of lifestyle such as obesity, hypertension and diabetes mellitus.[2] Many of these are related to changes in lifestyle, particularly in dietary intake.

Rapid urbanization in Sub-Saharan Africa is predicted to result in a shift in the composition of dietary staples and an increase in fat and sugar consumption.[6] One of the few studies that examined the effects of urbanization on the diet of the African population was undertaken in Cape Town.[7] Ingestion of dairy products and cereals showed a marked decline with increased time spent in the city. Consumption of non-basic food items increased the most. Obesity (body mass index ≥ 30) has been found in 44% of black urban women[8] and in 32% of rural women,[9] indicating that black women had the highest prevalence of obesity of all ethnic groups in South Africa.[8] By contrast, obesity is rare among black South African men.[10]

Two studies in South Africa have reported on the basic nutrition knowledge of older black women.[11,12] Both of these studies highlighted poor dietary practices related to lack of nutrition knowledge. Further, they stressed the need to improve nutrition knowledge in order to bring about desired changes in dietary practices. Nutrition knowledge has been examined in young white university females,[13] but not in a similar black group in South Africa. The students participating in this study represent a complex group comprising students from a cultural/traditional background as well as those who are in various stages of urbanization.

The aim of this study was to examine dietary intake, nutrition knowledge and weight status of young black women in order to identify urban–rural differences which might provide guidelines for nutrition education programs

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aimed at the prevention of weight gain and subsequent chronic diseases of lifestyle.

Subjects and methods

No standard definition for urban/rural has been formulated and applied in South Africa; therefore, in the South African context, students residing on farms and in villages were classified as being of rural origin and students residing in townships and cities were classified as being of urban origin. During February 1994, 431 black female students attended a pre-registration (orientation) program at the University of the North, which is held for first year students during the first week of entry to the university. The University of the North is situated in the Northern Province, which has a population of 4.1 million, of whom 76.3% are black South Africans and 88% live in rural areas. The Northern Province has the lowest literacy rate (53%) of all of South Africa's provinces and the highest unemployment rate (41%).[14,15]

During the orientation week students completed a battery of questionnaires and tests as the first phase (baseline) of a longitudinal study concerning comprehensive health status of young black women. Details of this have been published elsewhere.[16] This paper reports on nutrition knowledge, dietary intake and weight status only. A nutrition knowledge test was completed as part of the initial battery of tests and additional appointments were made with the students for them to return to have anthropometric measurements taken and to complete a dietary frequency questionnaire. Not all students attended their appointments and a complete data set for anthropometry, dietary questionnaires and knowledge tests was obtained for 115 students, a response rate of 32%. It is possible that the absence of non-responders could have caused bias in the data; however, as there is a paucity of data on women in this age group in South Africa, we feel that the data do make an important contribution when interpreted and applied with caution. Permission for the study was obtained from the University Ethics Committee.

A quantified food frequency questionnaire was used to gather data on each student's diet over 6 months prior to entering the University. The frequency questionnaire was adapted from one developed and validated on an African adult population.[17] Personal interviews were conducted with each respondent by senior dietetic students who attended a 4-day intensive training program on using the dietary questionnaire. Study participants were required to reflect on their eating pattern prior to entering the university and this data was recorded on a pre-coded form as quantified frequency of intake. Food models based on local foods were developed and used during the study. Other dietary aids, such as empty food containers and volume measures, were also used. Nutrient intakes were calculated using local food tables[18] and a statistical package developed by the South African Medical Research Council.[19] Food items were classified into 13 specific food groups according to the categories given in the food tables.

Anthropometric measurements were taken by trained and standardized fieldworkers according to standard techniques.[20] Standing height of each subject was measured to the nearest 0.1 cm without shoes, using a stature meter. Participants were weighed to the nearest 0.01 kg, in their underclothes, on a load-cell-operated digital scale having a weighing capacity of 140 kg. The scale used during the survey was first calibrated with a standard weight and checked on a daily basis. Body mass index (BMI) was calculated for each participant by dividing weight in kilograms by the square of height in metres.[21] Waist circumference was measured around the waist through a point one third of the distance between the xiphoid process and the umbilicus, using a non-stretchable tape measure.[22] Hip circumference was measured around the hips through a point 4 cm below the superior anterior iliac spine.[22] Waist-to-hip ratio (WHR) was calculated for each participant by dividing the waist measurement by the hip measurement. A WHR greater than 0.80 is associated with android obesity.[22]

Each student completed a nutrition knowledge test (NKT) developed by Gericke *et al.*[23] The NKT was developed for use on a lay population aged 17–20 years and comprises 62 multiple-choice questions with four alternatives. A score of ≤ 30 is regarded as poor. The NKT has a Kuder-Richardson reliability coefficient of 0.90, a measurement error of 3.3 and an index of difficulty of 0.60. The NKT tests knowledge on four basic concepts: (i) use of food by the body; (ii) relationship between nutrients and health; (iii) nutrients and the life cycle; and (iv) food safety. The basic food groups served as the point of departure for compiling the items within the theoretical framework. The American dietary goals and dietary guidelines were also covered.[23] When the NKT is used as a pretest of nutrition knowledge, the results enable the educator to do program planning in a meaningful way.

Statistical analysis was performed using the Statistical Analysis Systen (SAS) software.[24] Mean nutrient intakes of subjects in the present study were compared to the Recommended Dietary Allowances (RDA).[25] The Student's *t*-test was used to compare mean values of dietary, anthropometric and NKT data between urban and rural groups. Pearson's product moment correlation coefficients were used to test for significant correlations between variables. Findings from the present study were also compared with a group of white female students (n = 316) at the University of Stellenbosch, which is located in Stellenbosch, an urban centre in the Western Cape Province.[13] Dietary intake data in the Stellenbosch study was also collected with a quantified food frequency questionnaire and the same NKT was used.

Results

The students ranged in age from 17 to 34 years, with a mean age of 21.4 (5.4) years. Sixty-one percent were from homes in the rural areas (n = 70) and 39% were from urban areas (n = 45).

Table 1 presents energy and macronutrient intakes of students. The only significant difference in mean intakes of black women lies with sugar intake. Urban students had a greater mean sugar intake (65.8 g *vs* 52.2 g) and a greater percentage contribution of sugar (10.4% *vs* 8.9%) to total energy intake than did rural students. Intakes of other macronutrients and contributions to energy intake were similar in the two groups. Female students at the University of Stellenbosch had comparable energy intakes; however, carbohydrate intake of the white females was considerably lower (264 g *vs* 343 g) and fat intake was higher (89.4 g *vs* 78.6 g) than those of black students.

Micronutrient intakes are shown in Table 2. Mean intakes of calcium, iron and zinc were less than 100% of the RDA; however, only mean calcium intakes were less than 67% of RDA. Mean intakes of all other micronutrients were greater than 100% of RDA. Mean vitamin A intake of urban women was significantly greater than that of rural women (2105 RE *vs* 1655 RE). Mean intakes of other micronutrients were similar in the two groups. No data on micronutrient intakes of the Stellenbosch group were given.[13]

Consumption of food in terms of food groups is presented in Table 3. Rural women consumed a higher intake of legumes (18.9 g *vs* 6.3 g) and of cereals (569.1 g *vs* 493.4 g), although the latter difference was not statistically significant ($P = 0.11$). However, within the cereal group, rural women consumed significantly more maize meal (297.7 g *vs* 206.7 g). Urban women had a significantly greater mean intake of confectionery and sweets (290.4 g *vs* 183.7 g). They also consumed more beverages (339.6 g *vs* 225.2 g) and fruit (687.1 g *vs* 539.4 g), although these results were not

Table 1. Mean (SD) energy and macronutrient intakes of first year female students

Nutrients	Present study: black students			*P*-value†	White urban*
	All students ($n = 115$)	Urban students ($n = 45$)	Rural students ($n = 70$)		($n = 316$)
Energy (MJ)					
Mean (SD)	10.0 (3.3)	10.4 (3.6)	9.7 (3.0)	0.23	9.5 (3.3)
Q_1–Q_3	7.6–12.1	7.5–13.0	7.9–11.5		
Total protein (g)					
Mean (SD)	76.5 (27.7)	78.8 (30.9)	75.0 (25.5)	0.47	85.0 (27.3)
Q_1–Q_3	55.8–91.8	60.2–95.8	55.1–91.1		
Plant protein (g)					
Mean (SD)	34.6 (12.6)	34.0 (13.1)	35.1 (12.4)	0.64	NA
Q_1–Q_3	26.2–41.3	26.1–41.2	26.4–41.7		
Animal protein (g)					
Mean (SD)	41.8 (22.1)	44.8 (25.9)	39.9 (19.3)	0.24	NA
Q_1–Q_3	26.6–49.9	26.7–57.2	26.6–48.3		
Tctal fat (g)					
Mean (SD)	78.6 (32.9)	79.8 (35.0)	77.8 (31.8)	0.74	89.4 (37.9)
Q_1–Q_3	55.6 -101.5	52.4 -101.5	57.5 -100.9		
Saturated fat (g)					
Mean (SD)	24.6 (12.1)	26.2 (13.8)	23.7 (10.9)	0.27	NA
Q_1–Q_3	16.0–32.5	15.4–33.9	16.5–31.8		
Monounsaturated fat (g)					
Mean (SD)	26.6 (13.1)	27.2 (13.3)	26.3 (13.0)	0.74	NA
Q_1–Q_3	16.9–34.7	15.8–35.6	18.1–32.3		
Polyunsaturated fat (g)					
Mean (SD)	15.4 (7.5)	14.4 (6.8)	16.0 (7.8)	0.28	NA
Q_1–Q_3	9.6–19.3	9.7–17.5	9.5–20.2		
Cholesterol (g)					
Mean (SD)	417 (324)	469 (453)	383 (200)	0.16	NA
Q_1–Q_3	264–488	248–488	266–471		
Carbohydrate (g)					
Mean (SD)	343 (123)	365 (139)	328 (110)	0.11	264 (105)
Q_1–Q_3	256–406	268–497	255–393		
Fibre (g)					
Mean (SD)	28.6 (12.6)	28.8 (12.5)	28.4 (12.7)	0.88	NA
Q_1–Q_3	19.7–35.3	20.4–34.5	19.4–35.4		
Added sugar (g)					
Mean (SD)	57.5 (37.6)	65.8 (4.9)	52.2 (32.9)	0.05	67.6 (35.2)
Q_1–Q_3	31.4–72.3	33.8–90.8	29.5–66.5		
Protein (%E)					
Mean (SD)	13.0 (2.9)	12.8 (2.8)	13.2 (2.9)	0.44	15.2
Q_1–Q_3	11.3–14.6	11.1–14.6	11.3–14.6		
Fat (%E)					
Mean (SD)	29.6 (6.9)	28.9 (7.3)	30.1 (6.8)	0.37	36.6
Q_1–Q_3	25.0–34.0	23.8–33.6	26.7–34.4		
Carbohydrate (%E)					
Mean (SD)	62.5 (9.0)	63.4 (9.8)	62.0 (8.6)	0.4	47.1
Q_1–Q_3	56.0–68.3	55.5–70.5	56.3–66.6		
Sugar (%E)					
Mean (SD)	9.5 (5.1)	10.4 (5.4)	8.9 (4.9)	0.12	NA
Q_1–Q_3	6.1–11.8	6.4–12.9	6 1–10.7		

Q_1, 25th percentile; Q_3, 75th percentile; *first year female students at the University of Stellenbosch;[13] †Student's *t*-test; NA, not available.

Table 2. Mean (SD) micronutrient intakes of black female students

Nutrients	All students (n = 115)	Area of residence: Urban students (n = 45)	Area of residence: Rural students (n = 70)	P-value†
Calcium (mg)				
Mean (SD)	659* (362)	690* (380)	639* (652)	0.47
Q_1–Q_3	395–836	360–839	396–832	
Iron (mg)				
Mean (SD)	13.2 (4.8)	13.6 (5.7)	13.0 (5.9)	0.6
Q_1–Q_3	9.7–16.4	9.0–17.8	9.0–16.7	
Zinc (mg)				
Mean (SD)	10.5 (3.9)	11.0 (4.6)	10.1 (3.4)	0.24
Q_1–Q_3	7.9–12.6	8.2–13.5	7.5–12.3	
Vitamin A (RE)				
Mean (SD)	1831 (1617)	2105 (1769)	1655 (1498)	0.02‡
Q_1–Q_3	695–2431	704–3112	641–2282	
Thiamin (mg)				
Mean (SD)	1.4 (0.6)	1.4 (0.5)	1.4 (0.6)	0.79
Q_1–Q_3	0.9–1.7	0.9–1.8	0.9–1.7	
Riboflavin (mg)				
Mean (SD)	2.1 (1.2)	2.2 (1.3)	2.0 (1.0)	0.4
Q_1–Q_3	1.2–2.6	1.2–2.8	1.3–2.6	
Niacin (mg)				
Mean (SD)	17.8 (6.9)	18.1 (7.4)	17.6 (6.6)	0.66
Q_1–Q_3	12.7–22.2	12.7–23.1	12.9–21.5	
Vitamin B_6 (mg)				
Mean (SD)	1.9 (0.9)	2.0 (1.0)	1.8 (0.8)	0.16
Q_1–Q_3	1.2–2.5	1.3–2.6	1.2–2.3	
Fo!ate (µg)				
Mean (SD)	286 (149)	269 (128)	296 (161)	0.34
Q_1–Q_3	184–366	184–350	190–376	
Vitamin C (mg)				
Mean (SD)	207 (210)	217 (204)	200 (215)	0.67
Q_1–Q_3	77–258	70–268	80–253	
Vitamin B_{12} (µg)				
Mean (SD)	7.9 (11.6)	7.0 (9.3)	8.4 (12.8)	0.54
Q_1–Q_3	3.0–7.8	3.0–7.5	2.8–8.0	

Q_1, 25th percentiie; Q_3, 75th percentile; †Student's t–test; ‡$P < 0.05$; *mean value is less than 67% RDA.

(687.1 g *vs* 539.4 g), although these results were not significant.

Table 4 presents anthropometric data of black students in the current study and white students in the Stellenbosch study.[13] There were no significant differences between the urban and rural groups with respect to anthropometric variables; however, rural students had a significantly greater WHR than did urban students (0.76 *vs* 0.73). This is reflected by the greater percentage of rural students having a WHR ≥ 0.80 (18.57% *vs* 4.44%). However, the mean WHR values of both groups were less than 0.80. There were large anthropometric differences between the black students and Stellenbosch students. The white students were considerably taller and consequently had a lower mean BMI value. Only 7.6% of white students had a BMI ≥ 25, compared with 22.9% of black students. A large percentage of urban (22.7%) and rural (22.9%) students were found to have BMI values ≥ 25. Mean WHR values were similar for white and black students.

Nutrition knowledge scores of women in the present study were generally poor, with a mean value of 25.23 (40.7%) (Table 5). Handling of food aspects scored the lowest, while nutrients in the life cycle scored the highest. The Student's t-test indicated no significant differences in nutrition knowledge scores between urban and rural participants. Stellenbosch students had a mean value of 35.5 (58.9%), which is considerably higher than that of the black students in the present study. Table 6 indicates that NKT scores were positively related to numerous dietary variables, including energy, protein, carbohydrate, fibre, calcium, zinc, niacin, thiamin and folate intakes. There was also a correlation between sugar intake and WHR.

Discussion

Maize meal porridge is the main staple food in the traditional African diet of the Northern Province. It is either eaten in a soft form (*motepa*) or in a stiff/crumbly form (*bogope*/*phutu*). Sorghum and millet porridge are also popular alternatives. A tomato and onion sauce is often eaten with the porridge. Wild

Table 3. Mean (SD) daily food consumption (g) of black female students in terms of food groups

Food groups	All students (n = 115)	Area of residence: Urban students (n = 47)	Area of residence: Rural students (n = 74)	P-value†
Milk	172.4 (163.4)	187.3 (187.8)	162.9 (146.2)	0.43
Eggs	62.2 (76.2)	73.6 (107.8)	54.8 (45.3)	0.19
Meat	114.3 (102.7)	124.0 (131.8)	108.1 (79.0)	0.42
Fish	23.5 (27.2)	22.6 (27.5)	24.0 (27.2)	0.79
Legumes	13.9 (28.6)	6.3 (19.9)	18.9 (32.2)	0.01*
Nuts	0.4 (2.0)	0.2 (0.9)	0.6 (2.4)	0.25
Cereals	539.5 (266.0)	493.4 (212.2)	569.1 (293.1)	0.11
Rice	49.5 (43.3)	48.1 (38.1)	50.2 (46.1)	0.81
Maize meal	265.1 (227.5)	206.7 (148.6)	297.7 (256.9)	0.03*
Whole maize	51.9 (39.7)	55.9 (37.7)	49.2 (41.2)	0.51
Wheat products	258.1 (126.8)	275.5 (146.1)	246.9 (112.3)	0.23
Fats/oil	36.3 (37.4)	40.1 (43.0)	33.8 (33.3)	0.38
Confectionery/sweets	225.5 (251.4)	290.4 (319.1)	183.7 (186.9)	0.02*
Fruit	597.2 (524.7)	687.1 (542.1)	539.4 (508.7)	0.14
Vegetables	151.6 (97.2)	143.4 (97.6)	156.8 (97.3)	0.47
Sauces	42.2 (46.0)	38.5 (43.2)	44.6 (47.9)	0.49
Beverages	269.9 (519.7)	339.6 (787.7)	225.2 (213.1)	0.25

†Student's t-test; *$P < 0.05$.

Table 4. Mean (SD) anthropometric measurements of first year female students

Measures	All students (n = 115)	Urban students (n = 45)	Rural students (n = 70)	P-value†	White urban* (n = 316)
Height (cm)	159.08 (6.21)	160.30 (6.83)	158.29 (5.69)	0.09	167.00 (6.00)
Weight (kg)	56.77 (10.70)	57.24 (10.83)	56.47 (10.68)	0.71	59.80 (8.00)
Waist (cm)	69.22 (7.86)	68.31 (7.42)	69.80 (8.13)	0.32	69.00 (5.90)
Hip (cm)	92.36 (8.54)	93.48 (9.60)	91.66 (7.79)	0.27	93.00 (6.10)
BMI (kg/m^2)	22.42 (3.85)	22.35 (4.38)	22.46 (3.51)	0.87	21.50 (2.70)
% BMI ≥ 25	22.9	22.73	22.86	–	7.65
WHR	0.75 (0.04)	0.73 (0.04)	0.76 (0.04)	0.0003‡	0.74 (0.04)
% WHR ≥ 0.8	13.04	4.44	18.57	–	–

*First year female students at the University of Stellenbosch;[13] †Student's t-test; ‡$P < 0.001$; BMI, body mass index; WHR, waist-to-hip ratio.

Table 5. Mean (SD) nutrition knowledge scores of black female students tested with the nutrition knowledge test (NKT)*

Knowledge concepts**	All students (n = 115)	Urban students (n = 45)	Rural students (n = 70)	P-value†
Concept 1				
Mean (SD)	9.67 (3.08)	9.67 (3.33)	9.67 (2.93)	0.99
Q_1–Q_3	7–12	7–12	8–12	
Concept 2				
Mean (SD)	8.21 (2.62)	8.21 (2.75)	8.20 (2.57)	0.98
Q_1–Q_3	6–10	7–10	6–10	
Concept 3				
Mean (SD)	3.29 (1.10)	3.38 (1.03)	3.23 (1.14)	0.49
Q_1–Q_3	3–4	3–4	3–4	
Concept 4				
Mean (SD)	4.06 (1.51)	4.26 (1.53)	3.92 (1.49)	0.26
Q_1–Q_3	3–5	3–5	3–5	
Total				
Mean (SD)	25.23 (6.10)	25.52 (6.57)	25.03 (5.81)	0.69
Q_1–Q_3	21–29	21–29	22–29	
Stellenbosch students	35.53 (8.43)			

*Maximum score = 62; **concept 1: use of food by the body (maximum = 24); concept 2: relationship between nutrients and health (maximum = 20); concept 3: nutrients and the life cycle (maximum = 7); concept 4: handling of food, for example, hygiene (maximum = 11). †Student's t-test.

spinach (*marogo*) and pumpkin are the most common vegetables eaten as well as numerous indigenous green leafy vegetables. Bananas are the most common fruit consumed. Legumes are popular as a side-dish and peanuts are frequently added to vegetables. Sour maize gruel (*motogo*), tea and sorghum beer are the most common local drinks. Chicken is very popular and is consumed at least twice a week by the majority of families. Due to its high cost, red meat is used less frequently.[26,27] In urban areas there has been a tendency to use more processed foods, red meat and fresh fruit. This has also been reported in earlier studies and is thought to be due to increased availability and affordability of these food items in the urban areas.[28,29]

The rural diet presented in this study still reflects many traditional aspects. It is high in cereals and legumes and low in meat and fat. The urban diet is significantly lower in legumes and significantly higher in processed, sugar-based items. In addition, there is a greater consumption of animal protein and beverages, and a lower consumption of vegetables. A positive aspect regarding the urban diet is the high consumption of fruit, which is also reflected in the significantly higher vitamin A intake of this group.

The diet of the white urban students makes for an interesting comparison. Although mean energy intake is similar, there are large differences in the intakes of macronutrients, with carbohydrate intake being considerably lower and fat intake higher. The diet of the black urban students is still in effect more similar to that of the rural students than to the diet of white urban students. Unfortunately, no data is available on the intake of fibre and micronutrients of the Stellenbosch students.

The mean energy and macronutrient intakes found in this study are similar to those for black South African women, reported in a meta-analysis using the food frequency method.[30]

Mean intakes for urban and rural women, respectively, were as follows: energy, 9.5 and 9.0 MJ; protein, 71 and 70 g; carbohydrate, 298 and 297 g; and fat, 85 and 61 g. Three micronutrients which appear to be most deficient in the diet of the students, particularly rural students, are calcium, iron and zinc. Mean values for these micronutrients are less than the RDA and in the case of calcium, less than 67% of RDA. The low calcium intakes are in agreement with numerous reports on the low dairy intake of the African population. Possible reasons for this include cultural habits, lactose intolerance as well as price.[30]

Although both the present study and the Stellenbosch study used a quantified food frequency method, the results should be interpreted cautiously, particularly when taking the disadvantage of the frequency method into consideration, namely overestimation.[31] It should also be kept in mind that the students were required to recall a time prior to entering the university, at a time when they were being exposed to a totally different environment (i.e. the change from school to university and from a home environment to a hostel environment) in many instances.

Anthropometric results of the study population indicate that 22.9% of students were overweight (BMI ≥ 25). One of the most striking differences between the black and white students relates to the prevalence of those who were overweight. Approximately four times the number of African students had a BMI ≥ 25 compared with white students at Stellenbosch University. In the USA a similar scenario applies. The prevalence of obesity in Afro-American women

Table 6. Correlation matrices[a] for body mass index (BMI), waist-to-hip ratio (WHR) and nutrition knowledge test (NKT) with dietary intake variables

	BMI	WHR	Energy intake	Total protein	Plant protein	Total fat	Chol-esterol	Carbo-hydrate	Fibre	Sugar	Calcium	Iron	Zinc	Vit A	Ribo-flavin	Niacin	Vit B_6	Folate	Vit C	Vit B_{12}	Thiamin
BMI																					
r	1.00	0.26	0.01	0.10	0.09	−0.06	−0.06	0.03	0.06	−0.08	−0.07	0.10	0.14	0.21	0.16	0.15	0.21	0.01	−0.06	0.15	0.05
P	0.00	0.006†	0.92	0.27	0.33	0.48	0.51	0.76	0.50	0.39	0.44	0.26	0.11	0.02*	0.08	0.08	0.02*	0.89	0.52	0.10	0.59
WHR																					
r	0.26	1.00	0.13	−0.04	−0.11	0.18	−0.04	−0.16	−0.04	−0.27	−0.18	0.06	0.06	−0.09	−0.05	0.04	−0.06	−0.05	−0.13	0.14	0.06
P	0.006*	0.00	0.16	0.69	0.22	0.05	0.64	0.08	0.66	0 002†	0.04	0.49	0.51	0.92	0.59	0.66	0.49	0.59	0.14	0.11	0.52
NKT																					
r	0.04	−0.08	0.21	0.25	0.34	0.11	0.10	0.21	0.22	−0.06	0.21	0.11	0.24	−0.08	0.11	0.21	0.13	0.26	0.02	0.03	0.25
P	0.69	0.42	0.03*	0.01*	0.0001‡	0.24	0.29	0.03*	0.02*	0.94	0.02*	0.26	0.01*	0.39	0.23	0.03*	0.18	0 008†	0.83	0.74	0.009†

*$P < 0.05$; †$P < 0.01$; ‡$P < 0\ 001$; [a]Pearson's product moment correlation coefficients.

is nearly twice that found among white women,[32] and has been found to be 25% among black girls aged 12–17 years.[33] One possible explanation for this relates to poor socio-economic status, as those at greater risk of obesity in the USA are reported to be poor black women.[34]

In the present study most of the black students at the University come from the Northern Province, which has a low per capita income and a high unemployment rate.[15] Another factor to consider is the finding that stunting is prevalent among children and adults in this province.[35] African women in the present study were nearly 10 cm shorter than Stellenbosch women. Low socioeconomic status and poor diet coupled with early stunting are all factors that may have contributed to the high prevalence of black students who were overweight. Additionally, mean kilojoule intakes of the students were found to be high and could also explain the high prevalence of overweight. Ellis and co-workers had similar findings in a study of 15–18-year-old American women. The white women were taller and lighter than the Afro-American and Hispanic women.[36]

Mean WHR of Stellenbosch students compare well with those of black urban students; however, mean WHR was significantly greater in rural women. Waist-to-hip ratio is generally used to assess central obesity, which is an important predictor of cardiovascular death and non-insulin dependent diabetes mellitus (NIDDM).[37] The prevalence of NIDDM in South Africa varies between 4.8 and 8.0% in semirural and urban blacks, respectively.[38,39] Omar *et al.* found a high prevalence (5.2%) of NIDDM in Zulu women in Durbart.[40] It is speculated that the rising BMI and obesity in urban black women constituted important risk factors in the emergence of NIDDM in this population.[41] Urbanized Zulus had a high prevalence of hypertension (25%) compared with only 2–8% in rural areas.[42] The greater mean WHR of the rural students and the greater percentage having a WHR ≥ 0.80 should be interpreted cautiously. It is possible that many rural women still have not adopted the 'Western' concept of beauty, which encompasses a very slim (waist) figure. The urban students, however, were comparable to their white counterparts at Stellenbosch University.

Nutrition knowledge scores of black women were very poor, particularly with respect to the concept that deals with the safety aspects of food. However, when interpreting these results it is important to bear in mind the fact that the NKT was originally designed using a predominantly white population aged 17–20 years.[23] There is a possibility that the low scores can be partially attributed to an inability of the students to understand all of the questions because of a lower level of education due to the inequalities of the previous education system. On the other hand, the low scores could reflect an actual lack of adequate nutrition education, due to the approach of the previous education system and/or a general lack of focus on nutrition in the education syllabus. The finding that there were no urban–rural differences implies that the education inequalities apply in all areas and need to be addressed by policy-makers.

The positive correlation (although weak) between NKT scores and dietary variables such as energy, carbohydrate, protein, fibre, calcium, zinc, thiamin, niacin and folate is of specific interest as the implication is that an increased nutrition knowledge results in consumption of a diet with

improved nutrient quality. Low intakes of calcium, zinc, niacin and folate have been reported in a study undertaken in adolescents in the Northern Province and thus it is a positive finding that these intakes were higher in students with better nutrition knowledge.[27]

Conclusions

Rural students followed a more traditional African diet compared with urban students, consuming more cereals (maize meal) and legumes, and less confectionery and beverages. Macronutrient and micronutrient intakes were similar in both groups with calcium, iron and zinc intakes being least optimal.

There is a high prevalence of black females with a BMI ≥ 25 in both urban and rural areas compared with white urban females. This is a cause for concern in both urban and rural areas and indicates that no definite effect on possible change due to urban origins is as yet evident. Dietary intervention would thus be recommended in both areas.

Nutrition knowledge was generally poor, but the positive correlation between knowledge and certain nutrients is encouraging and emphasizes the importance of nutrition education as part of intervention strategies.

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