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Underweight, overweight and obesity among South African adolescents: results of the 2002 National Youth Risk Behaviour Survey

SP Reddy[1], K Resnicow[2], S James[1], N Kambaran[3], R Omardien[3,*] and AD MBewu[1]
[1]Medical Research Council, City of Cape Town, Western Cape, South Africa: [2]University of Michigan, Ann Arbor, MI, USA: [3]ARCH Actuarial Consulting, PO Box 12573, Mill Street, Cape Town 8010, South Africa

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Abstract

Objective: The present paper reports the prevalence of underweight, overweight and obesity by gender, ethnicity and grade, among participants in a 2002 national survey among South African school-going youth that included height and weight measurements.

Design: A stratified two-stage sample was used. Nationally representative rates of underweight, overweight and obesity were calculated using weighted survey data and compared using χ^2 analysis.

Setting: In all, 9224 grade 8 to grade 11 students, present at school in selected classes within selected South African government-funded schools in all nine provinces, participated in this study. Most of the students were between 13 and 19 years of age.

Results: Higher rates of underweight were observed for males than females as well as for black and 'coloured' than white students. Within each gender group, black and 'coloured' students had significantly higher rates of underweight than their white counterparts. Higher percentages of females than males were overweight and obese, overall and among black students. Furthermore, white male students had significantly higher rates of overweight than their black and 'coloured' counterparts. Among females, black and white students had significantly higher rates than 'coloured' students. Students in higher grades showed significantly lower rates of underweight and higher rates of overweight.

Discussion: These data confirm that South Africa, a developing nation in socio-economic transition, is experiencing both undernutrition and overnutrition. However, these problems are disproportionately distributed by gender, socio-economics and ethnicity. Continued surveillance of nutritional status may be one important component of a national strategy to prevent and control malnutrition.

Keywords
Youth
Underweight
Overweight
Obesity

In developing countries, public health professionals face, perhaps for the first time historically, the daunting task of addressing both extremes of malnutrition, undernutrition and overnutrition[1]. While undernutrition is defined as failure to consume adequate energy, protein and micro-nutrients to meet basic bodily requirements for growth and development and generally manifests as underweight (low weight-for-age), wasting (low weight-for-height) and stunting (low height-for-age), overnutrition is associated with overweight (excessive weight relative to height) and obesity (excessive body fat content). Both forms of malnutrition are associated with low-income countries, linked to poverty and unequally distributed throughout the world, with Asia and Africa being home to 60% and 28% of the world's total undernourished people, respectively[1].

A National Household Survey conducted in South Africa in 1995 reported that 2·3–2·5 million South Africans were undernourished, the majority of whom were children aged 0–15 years and of African descent[2,3]. In 1999 the National Food Consumption Survey (NFSC) reported, for children 1–9 years of age, an underweight prevalence of 10·3% with stunting being 21·6% and wasting 3·7%. These issues of undernutrition were highest in rural areas, commercial farms and informal settlements[4]. Underweight, and to a lesser extent obesity, is associated with higher rates of morbidity and mortality[5]. For adolescents in particular while there is evidence of higher rates of asthma, scoliosis, intestinal problems and emotional disorders, underweight may also result in low energy levels, fatigue and poor body image perceptions particularly in males who desire a muscular physique[5].

*Corresponding author: Email riyadh@archac.com

Conversely, until recently, obesity has largely been confined to more developed, industrialised countries. However, as a result of globalisation and improving economic conditions, dietary habits in developing countries have led to a rapid increase in obesity among historically lower socio-economic societies[6].

The International Obesity Task Force asserts that 'as poor countries become more prosperous, they acquire some of the benefits along with some of the problems of industrialised nations. These include obesity'[7].

This 'risk transition' will likely lead to a dramatic increase in chronic conditions such as cancer, diabetes and CVD in the developing world[8]. South Africa is a developing nation in the midst of such a public health transition. Monitoring obesity trends may help South African public health agencies prepare for the coming wave of chronic disease and attain the national nutrition goals established by the South African National Department of Health[9].

No routine surveillance systems for obesity are in place for South Africa. However, a few cross-sectional studies have been conducted in adults and young children. In a 1998 nationally representative sample of adults, 57 % and 30 % were classified as overweight (BMI > 25 kg/m^2) and obese (BMI > 30 kg/m^2), respectively[10]. Among males, highest rates of overweight and obesity were found in whites and lowest rates in blacks. In females, there is little ethnic difference in overweight; however, for obesity, rates were highest in blacks. Among children in the 1999 National Household Food Consumption Survey (NHFSC), 17 % of those aged 1–9 years and living in urban areas were reported to be overweight, albeit defined by standards used in the US National Health and Nutrition Examination Survey[11]. In the NHFSC rates of overweight and obesity were higher for black children and children of mixed descent (i.e. 'coloured') than for white and children of Indian descent. Similarly, rates of overweight and obesity were higher for girls than for boys. To date, there has been no national study of obesity in South African adolescents. The 2002 South African National Youth Risk Behaviour Survey (SA YRBS) was a national study of South African school-going adolescents that included measurements of height and weight[8]. This paper reports the prevalence of underweight, overweight and obesity among participants from the 2002 SA YRBS and examines rates by gender and ethnicity.

Methods

Sample and design

The data were drawn from Umthente Uhlaba Usamila: the first SA YRBS conducted in 2002[8]. The SA YRBS used a two-stage sample first stratified by the country's nine provinces. Schools were the primary sampling units and were selected with a probability proportional to school student enrolment size in grades 8–11. This comprised 207 schools from nine provinces, selected without replacement. At the second stage of sampling, classes within each participating school were randomly selected. All students in the selected classes were eligible to participate. Self-administered questionnaires, covering a broad range of sociodemographic characteristics and risk behaviours, were obtained from 10 699 students in 188 schools. The survey instrument used was adapted from the US YRBS, conducted biennially since 1991. In addition, the anthropometric measures of height and weight were also taken. The school response rate was 91 % and the student response rate was 73 %, yielding an overall response rate of 66 %. Students identifying as Indian (1 % of the sample) or other (1 % of the sample), and students with incomplete height and weight data were due to their low numbers excluded from all analyses discussed herein, leaving a final sample of 9224. Additional details about the SA YRBS sampling design can be found elsewhere[8].

Anthropometric measures were taken by certified trained staff using a stadiometer to measure height and an electronic scale (A & D Weighing, Tokyo, Japan) for measuring weight according to the standard procedures suggested by the International Society for the Advancement of Kinanthropometry[12]. Where possible, nutritionists, dietitians and school nurses were allocated to measure heights and weights. Survey administrators practised measuring the heights and weights by taking the measurements of twenty students. In addition, the survey administrators' technical error of measurement (TEM), an indicator of the accuracy of height measurement, was established and monitored by a qualified kinanthropometrist, and only those survey administrators with a TEM percentage of 0·5 % or lower were allowed to take height measurements[12]. Each scale was calibrated daily with two 10 kg weights. Students were required to remove their socks, shoes, jacket, any heavy items and lower their hair, if necessary, before height and weight readings were taken. The survey administrator recorded the height and weight measurements on the students' answer sheets. Weight was recorded to the nearest 0·01 kg and height to the nearest 0·001 m. Two height readings were recorded for each student. The height readings had to be within 0·005 m of each other, failing which the measurements had to be repeated. Active parental consent and child assent were obtained from each participant.

Sociodemographic characteristics

The variables examined in this paper included gender, grade and race as defined by apartheid (black, white and 'coloured').

Classification of weight status

Measured height and weight were converted to rates of underweight, overweight and obesity. Prevalence of

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underweight was based on the WHO/National Center for Health Statistics (NCHS) recommendation of less than −2 *Z* scores below the NCHS median. The calculation of overweight and obesity was based on the International Obesity Task Force (IOTF) standards described by Cole *et al.*[13]. This approach uses age- and gender-specific cut-points in children aged 2 to 17 that predict a BMI of 25 kg/m^2 (overweight) and 30 kg/m^2 (obese), respectively, at age 18 years.

Throughout the paper, therefore, respondents classified as obese are by definition also classified as overweight.

Analysis

The sample was weighted to match the national population figures. Rates of underweight, overweight and obese are reported along with their 95 % confidence intervals. Differences between groups are reported using χ^2 analysis.

Table 1 Sample demographics (%) by gender, race and grade (*n* 9224)

Male	47·0
Female	53·0
Black	75·8
Coloured	15·4
White	8·8
Grade 8	27·2
Grade 9	33·8
Grade 10	22·5
Grade 11	16·5

Results

Sample description

The sample consisted of 53 % females and 47 % males (see Table 1). Approximately 75 % of the sample self-identified as black, 15 % as 'coloured', 9 % as white, 1 % as Indian and 1 % as other. Most of the students (80 %) were older than 13 and younger than 19 years of age.

Underweight

Overall, 9·0 % of the sample was underweight (see Table 2). A significantly higher percentage of males than females were underweight ($\chi^2_1 = 147{\cdot}3$; $P < 0{\cdot}01$). Gender differences were observed among black ($\chi^2_1 = 126{\cdot}6$, $P < 0{\cdot}01$) and 'coloured' students ($\chi^2_1 = 18{\cdot}7$, $P < 0{\cdot}01$), but not among white students. For males, it was found that a significantly greater percentage of black and 'coloured' students were underweight compared with white students ($\chi^2_1 = 19{\cdot}4$, $P < 0{\cdot}011$; $\chi^2_1 = 26{\cdot}5$, $P < 0{\cdot}01$). For females, a significantly greater percentage of black and 'coloured' students were underweight compared with their white counterparts ($\chi^2_1 = 4{\cdot}9$, $P < 0{\cdot}05$; $\chi^2_1 = 8{\cdot}2$, $P < 0{\cdot}01$). Grade 8 students had a significantly higher rate of being underweight than grade 11 students ($\chi^2_1 = 6{\cdot}2$, $P < 0{\cdot}05$).

Table 2 Prevalence of underweight, overweight and obesity, by race and grade, in total and for males and females separately

	Total			Male			Female		
	%	LCL %	UCL %	%	LCL %	UCL %	%	LCL %	UCL %
Underweight									
Total	9·0	7·9	10·2	15·6	13·7	17·6	3·9	3·2	4·7
Black	9·5	8·3	10·9	17·0	15·0	19·2	3·9	3·2	4·9
Coloured	10·6	8·4	13·2	15·5	12·5	19·2	6·2	4·2	9·1
White	1·9	1·0	3·4	2·6	1·5	4·5	1·3	0·4	4·5
Grade 8	11·0	9·2	13·1	17·7	14·9	21·2	5·0	3·8	6·4
Grade 9	10·5	8·6	12·8	17·5	14·4	21·2	4·4	3·1	6·3
Grade 10	5·6	4·1	7·6	11·4	8·5	15·1	2·4	1·5	4·0
Grade 11	7·6	5·9	9·7	12·4	9·2	16·5	3·9	2·3	6·3
Overweight									
Total	16·9	14·7	19·3	6·9	5·5	8·5	24·5	20·9	28·5
Black	16·6	14·0	19·6	5·2	4·1	6·5	25·1	20·9	29·7
Coloured	13·0	10·7	15·8	8·5	5·5	13·0	16·9	13·2	21·5
White	23·4	19·4	27·9	20·2	14·7	27·1	26·0	20·9	31·9
Grade 8	12·9	10·8	15·4	6·9	5·1	9·4	18·3	14·5	22·8
Grade 9	13·5	11·4	16·0	4·8	3·5	6·7	21·0	17·8	24·7
Grade 10	24·0	17·9	31·5	8·9	6·3	12·7	32·2	23·1	43·0
Grade 11	18·7	16·1	21·7	7·6	5·2	11·0	27·1	22·7	31·9
Obese									
Total	4·0	3·3	4·8	2·2	1·6	3·1	5·3	4·3	6·6
Black	3·8	3·1	4·7	1·9	1·3	3·7	5·3	4·1	6·7
Coloured	3·3	2·0	5·6	2·8	1·1	6·7	3·8	2·4	6·1
White	6·4	3·8	10·5	4·8	2·2	10·1	7·7	4·8	12·2
Grade 8	3·3	2·2	4·9	2·3	1·4	3·8	4·2	2·5	7·2
Grade 9	3·5	2·8	4·5	1·5	0·8	2·8	5·3	4·0	7·0
Grade 10	5·0	3·5	6·9	2·4	1·2	4·7	6·4	4·4	9·1
Grade 11	4·6	3·3	6·3	3·2	1·8	5·5	5·6	3·7	8·4

LCL %, 95 % lower confidence limit; UCL %, 95 % upper confidence limit.

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Overweight

Of the total sample 16·9% were overweight based on the IOTF cut-offs corresponding to a BMI of 25 kg/m^2 at age 18 years (see Table 2). A significantly greater proportion of females than males were overweight ($\chi_1^2 = 52{\cdot}4$, $P < 0{\cdot}01$). Gender differences again were observed among black ($\chi_1^2 = 47{\cdot}5$, $P < 0{\cdot}01$) and 'coloured' students ($\chi_1^2 = 7{\cdot}3$, $P < 0{\cdot}01$), but not among white students.

Among males, a significantly greater proportion of white students were overweight compared with 'coloured' and black students ($\chi_1^2 = 11{\cdot}2$, $P < 0{\cdot}01$; $\chi_1^2 = 7{\cdot}7$, $P < 0{\cdot}01$). Among females, 'coloured' students were significantly less likely to be overweight than black and white students ($\chi_1^2 = 6{\cdot}0$, $P < 0{\cdot}05$; $\chi_1^2 = 6{\cdot}0$, $P < 0{\cdot}05$).

Grade 11 students had a significantly higher rate of overweight than grade 8 students ($\chi_1^2 = 9{\cdot}3$, $P < 0{\cdot}01$).

Obesity

The rate of obesity according to the age- and gender-adjusted value corresponding to a BMI of 30 kg/m^2 at age 18 was 4·0% in the total sample, with a significantly greater proportion of females than males being obese (see Table 2; $\chi_1^2 = 24{\cdot}1$, $P < 0{\cdot}01$). This gender effect was observed among black students ($\chi_1^2 = 21{\cdot}0$, $P < 0{\cdot}01$), but not among 'coloured' and white students.

Similar to rates of overweight, the highest rates among males were found in whites and the lowest rates in blacks. And for females, the lowest rates were observed among 'coloured', the highest rates among whites, with black students intermediate.

Similar to findings with regard to rates of being overweight, students in higher grades had higher rates of obesity, but this difference by grade was not statistically significant.

Discussion

Our findings regarding underweight confirm those of previous studies that reported a greater prevalence among males than females. Our finding of a 9% prevalence of underweight in an adolescent population is similar to that found among 1–9-year-olds in an earlier study[3].

Regular and comprehensive growth assessment is needed in South Africa to better inform any necessary intervention to address the issue of underweight in early childhood and adolescence. Such data will also complement the WHO Global Database on Child Growth for the Southern African region, which is not being carried out currently. Additional research regarding the determinants of eating and nutrition behaviour among this age group is also imperative if we are to gain a better understanding of the nutritional needs of adolescence.

The rates of overweight (6·9% for boys and 24·5% for girls) and obesity (2·2% for boys and 5·3% for girls) in South African adolescents appear to be among the highest in all of Africa[7], and are comparable to those of many industrialised nations.

In the USA, recent data among adolescents aged 12–19 years show an 18% prevalence of overweight in boys and 16% in girls, with the prevalence rate being highest, 25% in black girls[14]. In Europe, obesity has increased over the past 10 years with England experiencing the highest increase in prevalence. The most recent individual national studies indicate obesity prevalence among 14–17-year-olds of as high as 9% in boys (Spain) and 7% in girls (England)[7,15].

Together with the previously reported adult data in South Africa, our data indicate an expanding 'epidemic' in obesity and its related chronic diseases. Given lack of time trend data it is difficult to determine if the rates observed here represent an increase in prevalence. However, consistent with data from other countries in transition it is highly likely that the rates today are higher than those 10 or 20 years ago.

In general, rates of overweight and obesity were highest among white adolescents. Among males, black youth had the lowest rates of overweight and obesity. However, among females, 'coloured' youth had the lowest rates, and black girls were slightly lower than white girls. These findings differ markedly from the results of a USA survey that found similar rates of overweight among black and white boys, but significantly higher rates for black girls compared with white girls[14].

There could be several reasons for the differences between the gender–race distributions of nutritional status in South Africa and the USA. In South Africa, where black and 'coloured' adolescents have higher rates of underweight and lower rates of overweight than white adolescents, race is a more potent indicator of socio-economic status; evidence also seems to support the anecdotal, publicly held views that there is social pressure causing white girls to be thin, while there is positive social value to being larger for black South African girls (the n'guni concept of s'duhlza) – this cultural effect appears to be counteracting the socio-economic effect among South African girls.

Students in higher grades have higher rates of overweight, and lower rates of underweight, than those in lower grades. This is perhaps a result of early dropout from the schooling system by students with a higher propensity to be underweight, such as students from poorer socio-economic backgrounds.

Further studies targeted at assessing the effect on nutritional status of these socio-economic and cultural factors are required.

These data confirm that, as in many other developing nations in transition, South Africa is experiencing both undernutrition and overnutrition. However, these

problems are disproportionately distributed by socio-economic and cultural factors, with black and 'coloured' having the greatest rates of undernutrition, and whites having the highest rates of overnutrition. With increasing economic opportunity, it is highly likely that overnutrition will become an even greater problem among South African blacks and 'coloureds', which will require a shift in how public health nutrition and medical resources are allocated. Continued surveillance of nutritional status may be one important component of a national strategy to prevent obesity and associated chronic diseases.

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Authors' contribution: S.P.R. was the Principal Investigator for the SA YRBS survey and led the conception of this manuscript. R.G.O. and N.S.K. assisted with the SA YRBS and completed the analyses. K.R. guided the analyses and the led the writing-up of findings. All authors were involved in generating ideas, interpreting findings and reviewing the manuscript.

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