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PREVALENCE OF OVERWEIGHT AND UNDERWEIGHT AMONG BLACK SOUTH AFRICAN CHILDREN FROM RURAL AREAS IN THE NORTH-WEST PROVINCE

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ABSTRACT

The aim of this study was to determine the prevalence of overweight and underweight according to body mass index (BMI) and percentage body fat, among Black South African children in rural areas from the North-West Province. The sample (N=168) consisted of 47 eleven-year-olds, 58 twelve-year-olds and 63 thirteen-year-old children of which 79 were boys, and 89 were girls. Anthropometric measurements (BMI and percentage body fat) were taken according to the standard ISAK methods. Descriptive statistics and the Independent t-tests were used. The majority of the boys were of normal weight (80%), with 19% underweight and 1% at risk of overweight. The majority girls were also of normal weight (78%), with 11% underweight, 4% at risk of overweight and 7% overweight and obese. Regarding percentage body fat, 47% of the boys were classified as optimal, 44% as low, 5% moderate high and 4% high. In girls, 58% were rated as optimal, 18% as low, 10% as moderate high, 7% as very high and 3% in the high and very low categories each. There were no significant differences in BMI and percentage body fat among the different age groups ($p<0.05$). It appears that teachers and school-based health professionals should promote changes in school education and screening programmes by designing health programmes that are sensitive to race and individual needs.

Key words: BMI; Percentage body fat; Body composition; Black South African children.

INTRODUCTION

The environment of children has drastically changed worldwide during the last decades as reflected in unhealthy dietary habits and sedentary behaviours (Ahrens *et al*., 2006). There is a growing concern that a lack of time and space, safety considerations, and competition with television, video games and computers are resulting in sedentary lifestyles (Pica, 1999; Tremblay & Willms, 2000; Salmon *et al*., 2005).

Numerous studies have reported that children are becoming more overweight and physically inactive (Cole *et al*., 2000; Sallis, 2000; Tremblay & Willms, 2000; WHO, 2000; WHO, 2003; Evers *et al*., 2007). The prevalence and aetiology of childhood obesity may vary

according to lifestyle and socio-economic status. Most of the reports with regard to childhood obesity are from studies conducted in urban areas (Abdenur *et al*., 1994; Taylor *et al*., 1997; Saraswathi *et al*., 2011). Black South African children in rural areas have different lifestyles when looking at the availability of televisions and computers (Stroebel *et al*., 2007). Also, Black children in rural areas generally live far from school and transportation is mainly on foot. The food intake for these children is usually unbalanced or inadequate and may lead to nutritional stunting or malnutrition (Monyeki *et al*., 2008; Kimani-Murage *et al*., 2010). Childhood nutritional stunting has been suggested as a possible factor contributing to the high prevalence of overweight in developing countries because of the observed association between stunting in childhood and obesity in adults (Popkin *et al*., 1996; Sawaya *et al*., 1998; Hoffman *et al*., 2000; Mantsena *et al*., 2004).

Over the past century, most nutrition research and policy concerning the developing world focused on poverty and under nutrition (Sawaya *et al*., 1998; Hoffman *et al*., 2000; Mantsena *et al*., 2004). Currently, there is growing evidence of a major shift toward overweight and obesity in these societies (Wang *et al*., 2002). A study by Marks *et al*. (2009) reported higher prevalence rates of obesity among children residing in rural areas compared to the general paediatric population.

In South Africa, a number of researchers have shifted their focus towards African children (Underhay *et al*., 2002; Monyeki *et al*., 2005; Armstrong *et al*; 2006; Stroebel *et al*., 2007; Jacobs *et al*., 2010). A few studies (Underhay *et al*., 2002; Monyeki *et al*., 2005; Armstrong *et al*., 2006) conducted in the North-West Province collected valuable data on the prevalence of overweight and stunting in 10- to 15-year-old rural children. According to Monyeki *et al*. (2005), body composition is an important indicator of the health status in children and adolescents. The aim of this study was to determine the prevalence of overweight and underweight according to body mass index (BMI) and percentage body fat, among Black South African children in rural areas of the North-West Province.

METHODOLOGY

Participants

The study made use of a convenient sample with a quantitative research design. Black South African children aged 11 to 13 years from three rural primary schools in the Potchefstroom area in the North-West Province participated in this study. The sample (N=168) consisted of 47 eleven-year-old, 58 twelve-year-old and 63 thirteen-year-old children. Of the total number examined, 79 were boys and 89 were girls. Parental consent was obtained from all subjects before participating in the study. Ethical approval was obtained from the Ethics Committee of the North-West University. In addition, permission from the Department of Education was acquired to conduct the tests at the schools.

Measurement procedure

The first stage of the measurement procedure was conducted with the children separated into groups according to school grade and gender. The measurements and examinations were completed over a one-month period during scheduled appointment hours within a private

class setting. Measurement procedure was explained to children in detail to reduce any uncertainties and anxiety. With help from assistants, the participants completed a personal detail information sheet that included: age, gender, language and contact numbers. Thereafter, the anthropometric measurements were assessed. To ensure reliability of the study the researcher did all the anthropometric measurements.

Anthropometric Measurements

Measurements were taken according to the standard procedures of the International Society for the Advancement of Kinanthropometry (ISAK) methods (ISAK, 2001). The following measurements were taken:

Stature: Maximum stature was measured to the nearest 0.1cm with a stadiometer with the child standing upright and the head in the Frankfort plane.

Body mass: The children wore hospital gowns and underwear while their body mass was measured to the nearest 0.1kg on an electronic scale (Krupps). The scale was calibrated at the beginning of the study with a 20kg standard calibration weight. Using stature and body mass measurements, the BMI was calculated using the following equation (ACSM, 2006):

$$BMI = \frac{weight\,(kg)}{height\,(m)^2}$$

Skinfolds: The triceps and subscapular skinfolds were measured in duplicate to the nearest 0.2mm with a Harpenden® skinfold caliper with a constant pressure of 10g/mm^2 (Cambridge Scientific Intruments, Cambridge, MA) and the two values averaged. Sites on the right side of the body were measured and percentage body fat was determined using a 2-site skinfold measurement (triceps and subscapular) (Slaughter *et al*., 1988).

$$\Sigma SKF > 35mm: \%BF = 0.783(\Sigma SKF) + 1.6$$

$$\Sigma SKF < 35mm: \%BF = 1.21(\Sigma SKF) - 0.008(\Sigma SKF)^2 + I*$$

For Africans: $I*$ = -5.2

ΣSKF = Sum of skinfolds $\%BF$ = Percentage body fat

STATISTICAL ANALYSIS

Microsoft Excel Version 7.0 Analysis Tool and Statistica (Statsoft, 2006) were used for all quantitative data analyses. Descriptive statistics were used to report on means and standard deviations. Participants' weight status was classified by BMI percentile into underweight, normal weight, at risk of overweight, overweight and obese (Kuczmarski *et al*., 2000). Participants' percentage body fat was classified into very low, low, optimal range, moderate high, high and very high (Lohman, 1987). Independent t-tests were used to determine differences among age groups. Significance was accepted at $p<0.05$.

RESULTS

Table 1 shows descriptive information for the anthropometric characteristics, namely body mass index (BMI) and percentage body fat. The average BMI and percentage body fat for

boys were 16.5kg/m^2 and 10.5% respectively, whereas the averages for girls were 18.3kg/m^2 and 20% respectively. There were no significant differences in BMI and percentage body fat among the different age groups ($p<0.05$).

TABLE 1: **MEAN AND STANDARD DEVIATIONS OF ANTHROPOMETRIC CHARACTERISTICS (N=168)**

Age (yrs)	BMI (kg/m^2)		Percentage Body Fat (%)	
	Boys Mean±SD (n)	Girls Mean±SD (n)	Boys Mean±SD (n)	Girls Mean±SD (n)
11	15.7±1.64 (19)	17.8±3.85 (28)	10.1±5.16 (19)	19.3±7.93 (28)
12	16.8±1.60 (29)	18.8±4.76 (29)	10.3±2.98 (29)	20.9±9.29 (29)
13	16.6±2.29 (31)	18.3±3.10 (32)	10.9±5.33 (31)	19.6±6.27 (32)
Tot. Gr.	16.5±1.94 (79)	18.3±3.92 (89)	10.5±4.52 (79)	20.0±7.82 (89)

Figure 1 reports the prevalence of underweight, normal weight, at risk of overweight and overweight and obesity among boys and girls as defined by CDC BMI cut-off points (Kuczmarski *et al*., 2000). Healthy children have a BMI percentile ranging from between the 5th percentile to the 85th percentile. The children whose weight was more than the 85th percentile to less than the 95th percentile were considered as overweight and those who were equal to or greater than the 95th percentile as obese. The children, whose weight was equal to or lower than the 5th percentile, were considered underweight. In the case of the boys, the majority (80%) were of normal weight, with 19% underweight and 1% at risk of overweight. None of the boys (0%) were classified as overweight and obese. For the girls, the majority (78%) were also of normal weight, with 11% in the underweight category, 4% at risk of overweight and 7% overweight and obese.

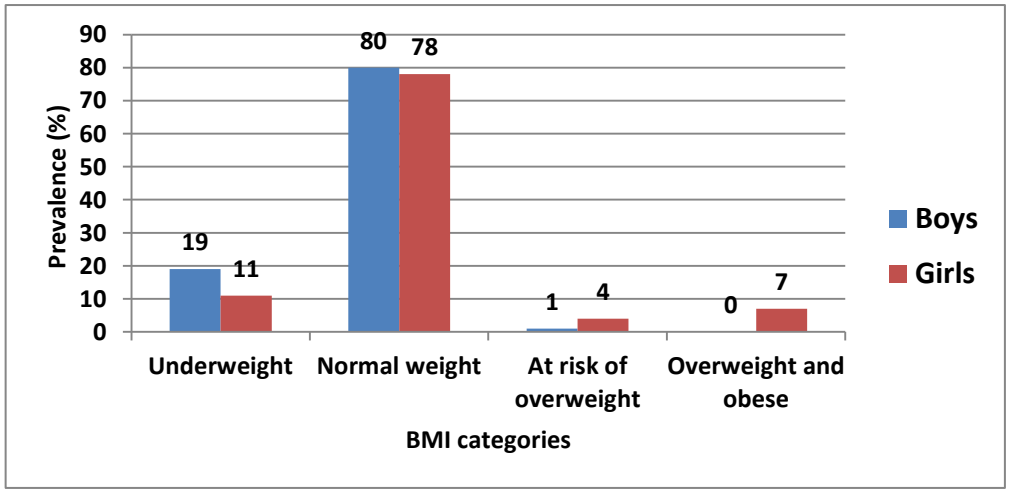

FIGURE 1: **PREVALENCE WITHIN WEIGHT CATEGORIES FOR BOYS AND GIRLS (N=168)** (Kuczmarski *et al*., 2000)

Figure 2 illustrates the percentage body fat ranges for boys and girls respectively, as classified according to percent-fat charts by Lohman (1987). Body fat is regarded as being too high when it exceeds 25% for boys and 35% for girls and is considered low in children when it ranges between 6 and 10% in boys and 12 and 15% in girls (Lohman, 1999).

Regarding percentage body fat, 47% of the boys were classified as optimal, 44% as low, 5% as moderate high and 4% as high. Of the girls, 58% had an optimal range percentage body fat, followed by 18% classified as low, 10% as moderate high, 7% as very high and 3% each in the high and very low category.

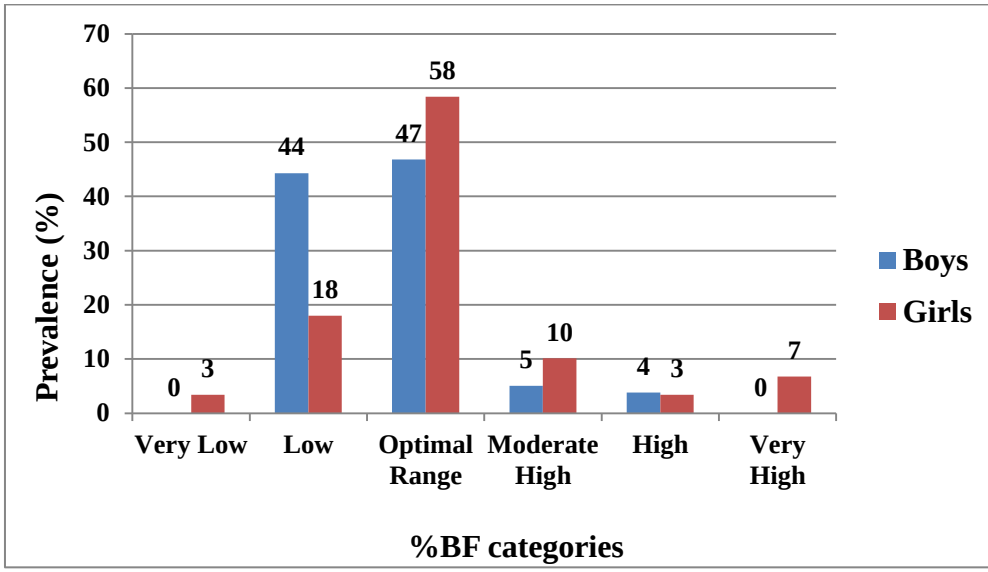

FIGURE 2: **PERCENTAGE BODY FAT RANGES FOR BOYS AND GIRLS (N = 168) (Lohman, 1987)**

DISCUSSION

The concern for the health of South African children has arisen from an awareness of international trends in paediatric overweight and obesity coupled with the results of the National Food Consumption Survey and some factors identified by the Birth to Twenty Study (Armstrong *et al*., 2006).

The mean BMI for both boys and girls reported similar results than those measured in rural children from KwaZulu-Natal (Jinabhai *et al*., 2001) and the greater Johannesburg area (McVeigh *et al*., 2004). However, the THUSA BANA study on 10- to 15-year-old children from five different regions in the North-West Province found the BMI and percentage body fat to be higher than the results reported in this study (Underhay *et al*., 2002). In contrast, a study conducted on rural primary school children in the Ellisras region, found lower BMI values (Monyeki *et al*., 2005). Moreover, Monyeki *et al*. (2005) reported lower percentage body fat measurements in girls, but higher percentage body fat measurements in boys.

In comparison with other countries, the BMI for boys in the present study showed significantly lower values than those reported in countries such as Australia, Canada, Mexico, Portugal and the Midwestern part of the United States of America (Pitetti *et al*., 2002; Pena Reyes *et al*., 2003; Olds & Dollman, 2004; Tremblay *et al*., 2005; Ribeiro *et al*., 2006). In contrast, the girls' BMI in the present study reported similar results to these countries.

Taylor *et al.* (1997) reported higher percentage body fat than that found in the present study. In accordance with this finding, the children in this study had a percentage body fat lower than the values reported in the study by Abdenur *et al*. (1994). Furthermore, the percentage body fat for boys in the present study was significantly lower than values reported for Australia, China and the United Kingdom (Rowlands *et al*., 2002; Murdey *et al*., 2005; Wickramasinghe *et al*., 2005). However, the girls from the present study reported similar results to studies in the United Kingdom and United States of America (Philadelphia), whereas Australia, Denmark and France reported significantly higher percentage body fat values (Ekelund *et al*., 2001; Gavarry *et al*., 2003; Murdey *et al*., 2005; Wickramasinghe *et al*., 2005; Ittenbach *et al*., 2006).

Compared to the findings reported by Monyeki *et al*. (1999), Monyeki *et al*. (2005) and Goon *et al*. (2006), none of the boys were overweight and obese. Furthermore, girls demonstrated a prevalence rate for overweight of 7%, which is higher than that reported by Monyeki *et al*. (1999). The prevalence rate of this study is lower than those reported by Armstrong *et al.* (2006) who reported overweight rates of 8.3 to 11.4% for boys and 12.6 to 14.2% for girls. The weights of most children were within the normal range (80% and 78% for boys and girls respectively), which is in accordance with Kruger *et al*. (2006) who investigated 10- to 15-year-old children from the North-West Province.

Body fat measurements revealed that 47% of boys and 58% of girls were in the optimal range category, which is in agreement with Kruger *et al*. (2006). However, it should be noted that a large percentage (44%) of boys were in the low percentage body fat category, which can explain the significantly higher prevalence rate for underweight (19%) compared to 11% for girls. According to a report by the United Nations Children's Emergency Fund (UNICEF, 2011), the prevalence rate for underweight children in developing countries measured in 2006 was 32%. In comparison, the present study reported a much lower rate for underweight children. The UNICEF reported that children in rural areas were twice as likely to be underweight than children in urban areas. In contrast, a study by Hanson and Chen (2007) reported that children from lower socio-economic backgrounds and rural areas had a significantly higher BMI. According to Rebato *et al*. (1998), this trend also appeared in samples in Guatemala and India.

The study suggests that although the majority of children were classified as normal weight, a high prevalence rate for boys was found in the underweight category with a mean percentage body fat below the prescribed limit. This suggests that the children in rural areas are undernourished and might be more prone to several deficiencies and disorders. Therefore, the nutritional status of the children should be investigated to ascertain whether this phenomenon is linked to malnutrition. Future studies examining the maturational status, as well as the environmental conditions that affect the health of children are needed.

There are several limitations of the current study that should be taken into account. Since, the present study did not reveal strong evidence of overweight and obesity among the Black South African children who participated, the prevalence estimates of overweight and obesity in the present study are not comparable to many other global studies, because of variation in the criteria used (BMI cut-off points), age and socio-economic status. The children selected were limited to a small geographic location, and as a result of time constraints, children were selected purposely and not randomly, which could have influenced the outcomes of the study. In addition, future studies should endeavour to include children from urban schools.

CONCLUSION

The prevalence of overweight among Black South African rural children was low, and this may reflect the fact that the children came from low socio-economic backgrounds. The relatively high prevalence of underweight found in this study has implications for the children's growth and development. It is suggested that the nutritional status of the children should be investigated to ascertain whether this phenomenon is linked to malnutrition. In developing countries, environmental constraints such as malnutrition or under nutrition, infectious diseases, poor living conditions and lack of educational facilities must be taken into consideration when discussing growth and development in children (Parizkova & Hills, 1998).

In conclusion, the majority of children were classified as normal weight. However, a high prevalence rate for boys was found in the underweight category with a mean percentage body fat below the prescribed limit. In the light of these findings, teachers and school-based health professionals should promote changes in school education and screening programmes by designing health programmes that are sensitive to race and individual needs.

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