DIETARY INTAKE AND NUTRITIONAL STATUS OF ADOLESCENT GIRLS AND YOUNG WOMEN IN DURBAN, SOUTH AFRICA

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OPSOMMING

Die doelwit van hierdie studie was om die dieet inname en voeding status van tienermeisies (n=156) en jong vroue studente (n=367) in Durban, KwaZulu-Natal (KZN), Suid-Afrika te bepaal. Geen nasionale voorkoms syfers vir groeivertraging, "wasting" (spierverlies) en ondergewig kon gevind word vir tienermeisies in Suid-Afrika nie, en hierdie studie is belangrik want dit is een van die eerste studies wat die voedingstatus van tienermeisies as 'n groep in KZN rapporteer.

'n Ewekansige steekproef in drie informele nedersettings, wat in die stedelike eThekwini munisipale distrik geleë is, is in hierdie studie gebruik en die steekproef het bestaan uit 156 meisies, tussen die ouderdomme van 14 tot 18, wat ingestem het om deel te neem in die studie na die ouers toestemming gegee het. Drie honderd en sewe en sestig jong vroue met ouderdomme van 19 tot 28 uit drie verskillende naskoolse opleiding instellings in stedelike gebiede, het ook ingestem om deel te neem aan die studie. Al die meisies en vroue is geweeg en gemeet ten einde voedingstatus vas te stel vir die twee groepe. Die dieet inname is bepaal met behulp van drie 24-uur herroep vraelyste, ontleed met behulp van die Food Finder, uitgawe 3, sagteware en die resultate vergelyk met die dieet verwysing innames (DVI's) vir die spesifieke ouderdomsgroepe. Die voedsel groepe wat deur die twee groepe ingeneem is, is ingedeel volgens die meeste na die minste ingeneem as volg: styselryke voedsels (grane, brood, wortels, knolle), vette en olies, vleis voedsels (skaap, beesvleis, vark, vis, hoender), suiwelprodukte (melk, kaas, eiers, jogurt), peul groente, groente, vrugte, kruie en speserye, suikerryke voedsels (koek, lekkers, koeldrank), warm dranke (koffie en tee), en alkohol (wyn en bier).

In hierdie studie is 7,7% en 5,2% van die adolessente meisies en vroue was uitgeteer "wasted" (<-3SD) en ondergewig (<18.5 BMI) onderskeidelik, met 12,8% van die meisies (>+2SD) en 30,5% van die vroue (≥25BMI) wat oorgewig en 1,9% en 15% (>+3SD en >30BMI) onderskeidelik vetsugtig was. Die meerderheid van die meisies se dieet was laag in kalsium, vitamien A and vitamien C (27,6%, 70,9% en 46,7%) van die geraamde gemiddelde vereistes GGV's respektiewelik. 'n Soortgelyke tendens is in die vroue waargeneem met 'n dieet laag in kalsium, vitamien A en vitamien C (54,2%, 71,7% en 68,9%) van die GGV's, Hoewel die mediaan yster-inname voldoende was, het 42,3% van die meisies en 59,9% van die vroue minder as 100% van die GGV ingeneem. Beide die meisies en die vroue, het die styselryke voedselgroep die meeste ingeneem, gevolg deur die suikerryke, vleis en suiwel in die 2e, 3e en 4e plekke onderskeidelik. Meisies het 'n lae per kapita inname (48,8g)van die suiwelgroep getoon vergeleke met die 218g van die vroue. Die per kapita innames van groente en vrugte vir die meisies en vroue was baie laag - 57g en 169,1g respektiewelik.

Die hoë voorkoms van oorgewig en vetsug in die meisies en vroue en die sub-optimale nutrient innames, is moontlik die resultaat van swak voedsel innames, wat nie aan die SA Voedsel gebaseerde dieetriglyne vir gesondheid voldoen nie. Dit is belangrik om die oorsake van onvoldoende voedsel verbruik wat lei tot 'n swak voedingstatus in hierdie ouderdomsgroepe aan te spreek.

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INTRODUCTION

The World Health Organization (WHO) defines adolescents as children between the ages of 10 and 19 and young people between the ages of 10 and 24 (WHO, 2009). According to the United Nations Children's Fund (UNICEF), there is 1,2 billion adolescents in the world. Adolescents are stronger and healthier than their counterparts a couple of years ago as a result of immunisation and improved infant nutrition, as well as the completion of basic education. Mortality rates in adolescents are lower than in any other age group, with the rates for young people being only slightly higher (UNICEF, 2011). However, adolescence is characterised by vigorous growth, during which the total nutrient requirements are higher than in other phases in the life span. Although these increased dietary needs are seldom met by adolescents, overweight is an emerging problem among young people in both low- and high-income countries (WHO, 2010). In developing countries, 21-36% of adolescents have a body mass index (BMI) of over 25, placing them in the overweight or obese categories (UNICEF, 2011). In a South African study among women aged 15 to 29, the mean BMI was 23,7, indicating normal weight in most of the group; however, it was reported that 20% were overweight (25-29, BMI) and 9,6% obese (≥30 BMI) (Steyn & Nel, 2006). Adolescents who are obese are likely to remain so into adulthood as this is also a high-risk period for weight gain, skipping breakfast and consuming fast food (Niemeier *et al*, 2006). Obesity is also a well-known risk factor for cardiovascular disease (CVD) (Vinueza *et al*, 2010). CVD is one of the main causes of death in most developing countries (Yusuf *et al*. 2001), resulting in huge losses of disability-adjusted life years (Mozzafarian *et al*, 2013; Hermansen, 2005) and thus presenting a serious public health problem. Furthermore, women of reproductive age have an increased risk of anaemia due to iron losses during the menstrual cycle. In South Africa 22% of women older than 15 years are anaemic (Shisana *et al*, 2013: 160). Obesity may exacerbate this situation as recent research has shown that obesity is associated with chronic adiposity-related inflammation that may be a factor causing iron-deficiency anaemia in obese respondents (Cepeda-Lopez, 2011).

The detection of health problems and adequate advice with regard to food intake and micronutrient supplementation at this stage of life are the foundation of good health in adulthood (WHO, 2010). The lack of accurate data and up-to-date information in these age groups is making it difficult for countries to develop policies and programmes to address nutritional problems (WHO, 2010; UNICEF, 2011). The evaluation of anthropometric growth, supplemented with dietary data and information on risk factors related to changes in dietary intake, is commonly used for the assessment of children and youth (Wenhold *et al*, 2008:444).

The main aim of this study was thus to determine the actual food intake and nutritional status of apparently healthy adolescent girls (14-18 years old) and post-school women (19-28 years old) in Durban, a coastal city on the East coast of South Africa. The girls and women all attended school and training institutions respectively on a full-time basis.

MATERIALS AND METHODS

Permission and consent

The Durban University of Technology (DUT) approved the study as part of Masters' research projects. The proposal was submitted in accordance with the South African Medical Research Council's guidelines for research on human beings as well as the Helsinki Agreement Guidelines. Consent from the caregivers of the girls was obtained and the girls agreed to participate in the study; informed consent was also obtained from the women.

Study population and sampling

This study was undertaken in three randomly selected informal settlements in a low-income community in the urban eThekwini municipal district during 2010. According to the KZN Department of Health, approximately 10% of the urban population lives in informal settlements which are often under-developed as a result of the non-availability of economic and infrastructure resources needed for general health and well-being (KwaZulu Natal Department of Health (KZN DoH), 2010). The household profile of the children who participated in this study reflected that the girls came from low socio-economic households with insufficient resources based in an informal settlement. Overcrowding was evident in the households with an average of six members per households. In some households, the girls were raised by grandparents who were the only breadwinners surviving on old age government grants. Food procurement was problematic due

to financial constraints which, therefore, lead to food scarcity (Silangwe, 2012: 110).

All the girls in a secondary school (n=406) in one of the informal settlements in Durban were approached in the classroom to participate in the study. Of all the girls approached in the school, 156 girls, aged between 14 and 18, and their caregivers gave consent to participate in the study. Women students from three different urban post-school training institutions, servicing low-income communities, were approached in the classroom to participate in the study, and 87, 194 and 86 women from each institution respectively signed informed consent to participate. Three hundred and sixty seven women, aged 19 to 28 years, with a socio-demographic profile similar to that of the schoolgirls, thus formed part of the sample. This study thus had a convenience sample of 523, comprised of young girls (n=156) and women (n=367).

DATA COLLECTION AND ANALYSIS

Data enumerators

Six trained data enumerators assisted in the completion of the questionnaires and the taking of anthropometric measurements. Students responsible for anthropometric measurements measured all the respondents and the questionnaires were completed in a one-on-one interview by the same data enumerators in order to ensure uniformity of the measurements. The first author was present at the data collection points to ensure correct measurements. All questionnaires were checked for completeness every day after the fieldwork was completed and if any data were outstanding the fieldworkers made contact with the respondents to obtain the missing information.

Data collection

The data was collected during August to October 2010.

Anthropometric indices Anthropometric measurements included body weight and height, measured according to standard procedures (WHO, 1976). Body weight, in light clothing with no shoes, was determined to the nearest 0,1kg on a new calibrated portable electronic Physician scale (PPS – Scales 2000 [SA]). The scale was calibrated three times during the study, each time before a new group was weighed. Each group was weighed and measured by the same fieldworker to ensure consistency in the measuring method. Height was measured to the nearest 0,5cm with a portable stadiometer (Scales 2000 - SA). All measurements were taken twice and the average of the two measurements was recorded if a difference was observed.

Dietary assessment A structured 24-hour recall questionnaire, (Oldewage-Theron *et al*, 2005) was administered to the children during an interview at the school with the caregiver present. The young women were interviewed at the tertiary institutions on three consecutive days, one day at a time, on one weekend day and two weekdays, by the trained fieldworkers in order to obtain quantitative, descriptive information about actual food intake. A limitation of the 24-hour recall questionnaire is that it does not provide a reliable estimate of an individual's intake, owing to day-to-day variation (Margetts & Nelson, 2000:139). This method was used, however, because of the advantages of speed and ease of administration. Food models with portion size indicators were used for quantifying portion sizes and describing the food items to the subjects. The average intake of the three days was used to calculate the various nutrients.

Data analyses

Anthropometric data for the girls were analysed using the WHO AnthroPlus version 1.0.2 statistical software (WHO, 2005). Stunting was defined as height-for-age z score <-2SD (severe stunting, <-3SD), wasting/thinness as BMI-for-age z score <-2SD (severe wasting /thinness, <-3SD) and overweight as >+2 SD (obesity, >+3SD) (WHO, 2007). BMI (kg/m^2) was calculated and compared with WHO cut-off points for the women (WHO, 2009). Underweight was defined as <18,5, normal range 19,5-24,99, overweight $\geq$25, obese class I 30-34,99, obese class II 35-39,99 and obese class III $\geq$40 (WHO, 2009).

Dietary intake data were analysed by a nutrition expert using the FoodFinder® version 3 software program, based on the South African food composition tables (Wolmarans *et al*, 2009) and developed by the South African Medical Research Council. The median nutrient intake of the three days was calculated per group for each of the nutrients. The EAR values were used as the recommended standard for estimating the prevalence of inadequate intakes within a group and the adequate intake (AI)

levels used for those nutrients without an EAR (Institute of Medicine, (IoM) 2003). To determine the nutrient adequacy of the dietary intakes, the 24-hour recall data were used to calculate the nutrient adequacy ratio (NAR) for energy, protein, carbohydrate, dietary fibre and the 21 micronutrients for which analyses as well as EAR and AI were available. The NAR was calculated by dividing the actual median daily intake of each of the girls and women for a specific nutrient by the DRI of that nutrient and a median was calculated from the NAR of all the respondents for the specific nutrient (Guthrie & Scheer, 1981). The median adequacy ratio (MAR) was calculated by the sum of nutrient adequacy ratio for all nutrients divided by the number of nutrients (n=25). A value of 1 for both NAR and MAR indicates that intake equals requirement (Guthrie & Scheer, 1981), thus serving as a measure of the adequacy of the overall diet.

The food intakes were grouped as follows: starchy foods (cereals, bread, roots, tubers, including potatoes and sweet potatoes), fats and oils, flesh foods (meat, fish, chicken), dairy (milk, cheese, eggs, yoghurt), legumes and nuts (soy, nuts, peanut butter, dried peas and beans), vegetables, fruit, sauces and condiments, sugary foods (cake, sweets, cold drinks), beverages (coffee and tea), and alcohol (wine, beer, spirits). The per capita intake in grams per day was calculated separately for each food group for the girls and women.

Statistical analyses

All the data were analysed on *SPSS*, version 22,0. All the variables were tested for normality (skewness). The mean and standard deviation were calculated for age as the age data were normally distributed. None of the dietary intake variables were normally distributed, therefore, medians as well as interquartile ranges (IRQs), were determined for the nutrient intakes and NAR and MAR for both groups, as well as for the dietary intake variables for the different nutritional status categories. Frequencies were used to determine the prevalence of inadequate intakes, specifically, the estimated average requirement (EAR) values. The estimated energy requirement (EER) was used for energy and adequate intake (AI) where EARs were not available (Institute of Medicine (IoM) (1997, 1998, 2000, 2001, 2002/2005 & 2011). Furthermore, one-way analysis of variance

TABLE 1: NUTRITIONAL STATUS OF THE GIRLS AND WOMEN

Nutritional status categories	Classification	%(n)
Adolescent girls (n=156)		
Stunting (Height-for-age)		
Severely stunted	<-3SD	0
Stunted	<-2SD	7,7 (12)
Normal height-for-age	>-1SD to +3SD	92,3 (144)
Wasting/Thinness (BMI-for-age) (n=367)		
Severely wasted	<-3SD	0
Wasted	<-2SD	1,3 (2)
Normal	>-1SD to <+1SD	41 (64)
Possible risk of overweight	>+1SD	43 (67)
Overweight	>+2SD	12,8 (20)
Obese	>+3SD	1,9 (3)
Women (n=367)		
BMI category	**Classification**	**%(n)**
Underweight	<18.50 kg/m^2	5,2 (19)
Normal range	18.50-24.99 kg/m^2	49,3 (181)
Overweight	≥25.00 kg/m^2	30,5 (112)
Obese class I	30.00-34.99 kg/m^2	10,4 (38)
Obese class II	35.00-39.99 kg/m^2	2,2 (8)
Obese class III	≥40.00 kg/m^2	2,5 (9)

(ANOVA) was used to determine the statistically significant differences in medians of dietary intake variables, NAR and MAR among the different categories of nutritional status of the girls (wasted, normal, overweight and obese) and the women (underweight, normal, overweight and obese) respectively. Two-tailed bivariate Pearson correlations were conducted to determine statistically significant ($p<0,05$) associations between the dietary intake variables with BMIA and BMI for the girls and women respectively.

The anthropometric data were also analysed, using *SPSS*, version 22,0. Case summaries were used to determine the frequency (percentage) of respondents within each of the BMI or BMI-for-age (BMIA) categories for women and girls respectively.

RESULTS

Nutritional status of girls and women according to BMI-for age and BMI

The mean age of the girls was 15,59 years and of the women, 20,74 years. Table 1 presents the anthropometric results of the two groups. The results in Table 1 indicate that 7,7% of the girls were stunted (low height-for-age, <-2SD) according to the WHO growth standards (WHO, 2007),indicative of chronic insufficient food and nutrient intake and/or frequent infections.

The BMI-for-age (thinness/wasting) results in Table 1 indicated that none of the girls were severely wasted and only two were wasted (<-2SD). However, 43% of the girls were at risk of being overweight (>+1SD), with 12,8% already overweight (>+2SD), while 41% were of normal BMI-for-age (WHO, 2003).Table 1 also presents the percentage of women in the different nutritional status categories. In the sample, 5,2% were underweight (BMI <18,5) according to the WHO BMI (kg/m^2) classification for adult underweight, overweight and obesity. However, 30,5% and 15% were overweight and obese respectively. Half of the women (49,3%) were in the normal range, according to the BMI cut-off points (WHO, 2009).

Dietary intake of girls and women

In Table 2, the dietary intake results for the girls and women are presented. Although the median energy intake was low in both groups, the median macronutrient intakes were sufficient except for total dietary fibre when compared with the RDAs for girls (14-18 years) and women (19-20 years). Although the median macronutrient intakes were sufficient for both the girls and the women, the majority of the girls (89,1%) and women (93,7%) had inadequate energy intakes. The prevalence of inadequate median intakes of protein and total dietary fibre was 25% and 93,6%, and 33,5% and 95,1% for the girls and women respectively. The contribution of the macronutrients to the total energy intake of the girls (Table 3) indicated a balanced meal, with 58,6% carbohydrates (including dietary fibre), 13,2% protein and 28,2% dietary fat, as compared with the guidelines of 45-65% carbohydrates, 10-30% protein and 25-35% fat for children and adolescents (IoM, 2002/2005). The contribution of the macronutrients to the total energy intake of the women (Table 5) showed a slightly higher contribution by fat and protein to the women's energy intake than that of the girls, and are within the recommended guidelines of 45-65% carbohydrates, 10-35% protein and 20-35% fat (IoM, 2002/2005).

As a result of accelerated growth during adolescence, an increased need exists for energy and certain nutrients, specifically protein, iron, zinc, calcium, and iodine (Wenhold *et al*, 2008:448). In this group of girls, the median dietary intakes reflected inadequate intakes for all these nutrients except protein and zinc – although 25% of the girls did not meet the EAR for protein and 46,2% the EAR for zinc. Almost 90% (89,1%) of the sample did not meet 100% of the EER for total energy. The median calcium intake was extremely low at 304,12mg/day and almost all the girls took in less than the recommended amount of 1300mg/day. The median intakes were deficient for all the vitamins, except for the, niacin, riboflavin, and vitamins B6 and B12. The prevalence rate for inadequate intakes by the girls was 36,5% for riboflavin, 34% for niacin, 39,7% for vitamin B6 and 50% for vitamin B12 respectively (Table 2).

The median micronutrient intakes of the women showed a pattern similar to those of the girls. Although the median intakes for the majority of the micronutrients were low, median adequate intakes were found for phosphorus, riboflavin, niacin, and vitamins B6 and B12 while 35,4% of the women did not meet the EAR for phosphorus. Although adequate median intakes were reported, 49,6%, 38,7%, 49,6% and 37,9% did not meet the EAR for riboflavin, niacin, and vitamins B6 and B12 respectively.

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TABLE 2: ANALYSIS OF 24-HOUR RECALL: MEDIAN DAILY INTAKE OF THE GIRLS (N=156) AND WOMEN (N=367)

Nutrients	Girls				Women			
	Daily intake Median (25th, 75th percentile)	Prevalence of inadequate intakes %	DRIs for girls 14-18 years old	NAR Median (25th, 75th percentile)	Daily intake Median (25th, 75th percentile)	Prevalence of inadequate intakes %	DRIs for women 19-30 years old	NAR Median (25th, 75th percentile)
Energy kJ	7618 (6400; 8927)	89,1	9946 (EER*)	0.7 (0.56; 0.84)	6629 (5342; 8129)	93,7	10 093 (EER)	0,66 (0,53; 0,81)
Carbohydrate g	198 (201; 301)	0	130 (RDA)	1,98 (2,01; 3,01)	198 (152; 250)	4,6	130 (RDA)	1,98 (1,52; 2,50)
Total fat g	54 (43; 72)				54 (42; 68)			
Total protein g	58 (46; 72)	25	46 (RDA)	2,32 a (1,82; 2,86)	56 (38; 67)	33,5	46(RDA)	1,16 a (0,92; 1,45)
Calcium mg	304,12 (213,36; 441,82)	98,7	1100.00 (EAR)	0.23 ba (0,23; 0,34)	481,84 (284,81; 774,37)	76,7	800 (EAR)	0,48 a (0,28; 0,77)
Iron mg	7,82 (6,2; 10,36)	52,6	7,90 (EAR)	0,99 (0,78; 1,31)	7,68 (5,55; 10,97)	59,9	8,1 (EAR)	0,95 (0,69; 1,35)
Magnesium g	224,32 (188,15; 261,89)	88,5	300 (EAR)	0,75 (0,75; 0,87)	188,69 (139,67; 239,51)	79,6	255 (EAR)	0,74 (0,55; 0,94)
Zinc mg	30,46 (9,76; 44,93)	46,2	7,3 (EAR)	4,06 a (1,30; 6,00)	6,31 (4,83; 8,42)	55,9	6,80 (EAR)	0,93 a (0,71; 1,24)
Chromium µg	41,93 (1; 2,5),	25,3	24 (AI)	1,75 a (0,99; 2,5)	23,24 (15,15; 36,93)	54,2	25 (AI)	0,93 a, (0,61; 1,48)
Phosphorus mg	827,07 (649,15; 974,65)	79,5	1055 (EAR)	0,78 a (0,78; 0,92)	690,1 (444,75; 922,98)	35,4	580 (EAR)	1,19 a (0,77; 1,59)
Selenium µg	33,68 (20; 51,13)	66	45 (EAR)	0,75 a (0,75; 1,14)	28,97 (19,54; 39,69)	81,7	45 (EAR)	0,64 a (0,43; 0,88)
Iodine µg	20,3 (13,6; 32,93)	97,4	95 (EAR)	0,21 a (0,21; 0,35)	25,94 (17,36; 44,55)	98,6	95 (EAR)	0,27 a (0,18; 0,47)
Vitamin A RE µg	243,96 (140,20; 390,12)	83,3	485 (EAR)	0,5 (0,5; 0,8)	247,75 (166,5; 400,77)	90,7	500 (EAR)	0,5 (0,33; 0,8)
Thiamine mg	0,82 (0,63; 1,07)	60,9	0,9 (EAR)	0,91 (0,91; 1,18)	0,78 (0,6; 1,1)	62,9	0,9 (EAR)	0,87 (0,66; 1,22)
Riboflavin mg	1,23 (0,66; 2,03)	36,5	0,9 (EAR)	1,36 (0,73; 2,25)	0,9 (0,45; 1,66)	49,6	0,9 (EAR)	1 (0,5; 1,84)

TABLE 2: ANALYSIS OF 24-HOUR RECALL: MEDIAN DAILY INTAKE OF THE GIRLS (N=156) AND WOMEN (N=367) (Continued)

Nutrients	Girls				Women			
	Daily intake Median (25th, 75th percentile)	Prevalence of inadequate intakes %	DRIs for girls 14-18 years old	NAR Median (25th, 75th percentile)	Daily intake Median (25th, 75th percentile)	Prevalence of inadequate intakes %	DRIs for women 19-30 years old	NAR Median (25th, 75th percentile)
Niacin mg	13,12 (9,68; 16,81)	34	11 (EAR)	1,19 (0,88; 1,53)	12,37 (9,27; 18,08)	38,7	11 (EAR)	1,12 (0,84; 1,64)
Folic acid µg	204,44 (145,99; 291,05)	70,3	330 (EAR)	0,62 (0,44; 0,88)	215,54 (140,39; 327,02)	72,7	320 (EAR)	0,67 (0,44; 1,02)
Vitamin B6 mg	1,13 (0,8; 1,51)	39,7	1(EAR)	1,13 (0,8; 1,51)	1,11 (0,78; 1,6)	49,6	1,1 (EAR)	1,01 (0,71; 1,45)
Vitamin B12 µg	2 (0,95; 3,69)	50	2 (EAR)	1 (0,48; 1,85)	3,88 (1,50; 4,02)	37,9	2 (EAR)	1,18 0,75; 2,01)
Pantothenate mg	4,72 (2,88; 6,31)	55,1	5 (AI)	0,94 (0,58; 1,26)	4,39 (2,97; 5,84)	62,4	5 (AI)	0,88 (0,59; 1,17)
Biotin µg	17,59 (13,36; 23,58)	77,6	25 (AI)	0,7 (0,53; 0,94)	21,36 (14,82; 28,84)	78,7	30 (AI)	0,71 (0,49; 0,96)
Vitamin C mg	20,08 (11,9; 34,36)	89,1	56 (EAR)	0,36 [a] (0,21; 0,61)	33,77 (15,28; 58,58)	75,8	60 (EAR)	0,56 [a] (0,25; 0,98)
Vitamin D µg	2,37 (1,14; 4,38)	80,1	10 (EAR)	0,47 (0,23; 0,88)	2,94 (1,51; 5,01)	76	10 (EAR)	0,59 (0,3; 1)
Vitamin E mg	7,04 (4,49; 10,95)	82,1	12 (EAR)	0,59 [a] (0,37; 0,91)	5,78 (3,92; 8,9)	90,5	12 (EAR)	0,48 [a] (0,33; 0,74)
Vitamin K µg	26,1 (11,78; 73,87)	77,6	75 (AI)	0,35 [a] (0,35; 9,98)	21,15 (10,95; 43,01)	95,4	90 (AI)	0,24 [a] (0,12; 0,48)
MAR				1,05 [a] (0,81; 1,28)				0,82, [a] (0,69; 1,06)

a, b statistically significant differences at $p<0.05$ between variables in the same row
*EER = Estimated Energy Requirements (IoM 2003) for healthy moderately active Americans

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TABLE 3: ENERGY % DISTRIBUTION, SODIUM, FIBRE AND FRUIT AND VEGETABLE INTAKE OF THE TWO GROUPS COMPARED WITH THE WHO POPULATION NUTRIENT INTAKE GOALS

Nutrient	Goal	Girls n=156	Women n=367
Total fat % E	25-35% (g) / 20-35% (w) (IoM, 2002/2005)	28,2	31
Total protein% E	10-30% (g)/ 10-35% (w) (IoM, 2002/2005)	13,2	14,1
Total carbohydrates	45-65% (IoM, 2002/2005)	58,6	54,9
Mean sodium mg/day	<2000 (WHO, 2003)	1713,2	1487,6
Dietary fibre (g)	>25 (WHO, 2003)	16,4	13,8
Fruit and vegetable intake (g)	>400 (WHO, 2003)	101,7	76,8

A statistically significant difference ($p<0,05$) was observed between the MAR of the girls (1,05) and of the women (0,82). The median MAR (0,82) of the women show that the overall nutrient intake of the diet is inadequate. The median MAR of 1,05 for the girls indicate an adequate nutrient intake, however, this is not true as 17 of the 25 nutrients measured, showed inadequate intakes. Unfortunately, the high NAR (>2) for total protein and zinc intakes compensated for those nutrients with the low NAR, thus resulting in a skewed picture. The girls had a statistically significant lower NAR than women for calcium, phosphorus, iodine and vitamin C, while the women had a statistically significant lower NAR than the girls for total protein, chromium, selenium, vitamin E and vitamin K.

No significantly different dietary intakes as measured by one-way ANOVA, were observed between the wasted, normal weight, overweight and obese children. The same was observed for the women. This was confirmed by the MAR not being significantly different for the wasted/ underweight, normal weight, overweight and obese children and women respectively (Table 4).

Furthermore, no significant correlations were found between the BMIA and nutrient intakes of the children. The same trend was observed in the women except for only two significant weak positive relationships between BMI and selenium ($r=0,138$, $p=0,009$) and vitamin A ($r=0,142$, $p=0,007$) respectively.

The quantities consumed per food group showed similarities. In both the girls and the women, the per capita intake of cereal, sugary, meat (including fish, chicken, beef, mutton and pork) and dairy food groups was ranked 1, 2, 3 and 4 respectively. The girls had low per capita intakes for the dairy and legume groups – 48,8g and 21,7g respectively compared to higher dairy (218g) and even lower legume (18,2g) per capita intakes respectively for the women. Three portions of dairy (250 ml of milk or cheese and yoghurt equivalent) are recommended for adequate calcium and magnesium intake per day (SA DoH, 2012). Vegetable and fruit per capita intakes were very low – 57g and 169,1g for the girls and the women when compared to the WHO recommended intake of >400g per day (WHO 2005). The same trend was observed for the fats and oil group. These results confirmed the low micronutrient intakes in both the girls and the women (refer table 5).

DISCUSSION

This study examined the dietary intake and nutritional status of adolescents and young adult women resident in low-income communities and attending schools and training institutions in Durban respectively. The motivation for the study was the emerging levels of high overweight and obesity in girls and women in this age bracket in SA, despite poor dietary intake (Steyn & Nel, 2006:23; South African Department of Health, 2004:26; Shisana *et al*, 2013:171). Furthermore, adolescence has not yet been studied on a national level and adolescents and the youth are on the brink of

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TABLE 4: ANALYSIS OF 24-HOUR RECALL: MEDIAN DAILY INTAKE OF THE GIRLS (N=156) AND WOMEN (N=367) ACCORDING TO NUTRITIONAL STATUS (BMIA AND BMI RESPECTIVELY)

	Girls (n=156)				Women (n=367)			
	BMIA Classification				BMI Classification			
	Wasting n=2, 1,2%)	Normal weight (n=131, 84%)	Overweight (n=20, 12,8%)	Obese (n=3, 1,9%)	Underweight (n=19, 5,2%)	Normal weight (n=181, 49,3%)	Overweight (n=112, 30,5%)	Obese (n=55, 15%)
Nutrients	**Intake Median 25th: 75th**	**IntakeMedian 25th: 75th**	**Intake Median 25th: 75th**	**Intake Median 25th: 75th**	**Intake Median 25th: 75th**	**Intake Median 25th: 75th**	**Intake Median 25th: 75th**	**Intake Median 25th: 75th**
Energy kJ (EER*)	7286 (6011; 8235)	7835 (6543; 9182)	7203 (6457; 8841)	7337 (6199; 9608)	7608 (5557; 9511)	6629 (5201; 8055)	6388 (5328; 8078)	6641 (5447; 7310)
Carbohydrate g	234 (186; 251)	258 (204; 303)	237 (197; 297)	242 (195; 315)	205 (153; 244)	197 (147; 258)	190 (150; 235)	199 (173; 250)
Total fat g	57 (44; 68)	57 (43; 73)	55 (43; 72)	58 (42; 75)	63 (44; 91)	51 (36; 63)	55 (41; 75)	56 (40; 72)
Total protein g	52 (43; 70)	60 (49; 74)	53 (41; 62)	49 (40; 81)	66 (53; 72)	52 (42; 65)	55 (43; 67)	50 (43; 60)
Total Dietary Fiber g/day	14 (11; 18)	15 (12; 20)	15 (11; 18)	17 (14; 22)	14 (11; 16)	13 (9; 18)	13 (9; 18)	13 (9; 16)
Calcium mg	273,8 (205,49; 430,32)	316,98 (221,75; 429,86)	324,49 (200,01; 520,88)	300,42 (171,65; 558,77)	638,24 (286,85; 990,45)	488,47 (277,02; 731,10)	499,98 (297,26; 846,70)	365,51 (277,12; 621,35)
Iron mg	7,94 (6,74; 9,5)	8,18 (6,30; 10,37)	7,31 (6,06; 10,26)	7,31 (5,38; 12,35)	9,24 (4,33; 10,63)	7,68 (5,53; 11,97)	7,29 (5,50; 9,34)	8,12 (5,86; 11,41)
Magnesium g	207,91 (193,13; 241, 12)	226,53 (186,51; 263,25)	228,82 (190,46; 266,43)	222,99 (153,39; 252,53)	222,02 (155,36; 239,5)	187,13 (137; 239,86)	188,67 (130,9; 242,99)	181,7 (141,5; 227,3)
Phosphorus mg	699,32 (655,68; 966, 41)	862,33 (673,91; 985,31)	747,99 (627,43; 937, 32)	711,9 (567,31; 1179,56)	599,18 (353,73; 1047,55)	712,53 (439,93; 934,8)	622,51 (381,24; 853,12)	764,73 (631,03; 1041,45)
Zinc mg	25,27 (7,48; 39,56)	31,16 (8,93; 46,42)	31,14 (10,54; 42,59)	24,91 (9,9; 35,77)	7,3 (3,74; 9,69)	6,31 (4,76; 8,33)	5,73 (4,19; 8,25)	7,23 (5,42; 9,13)
Chromium µg	48,29 (15,78; 64,96)	42,8 (28,91; 58,83)	29,94 (12,95; 54,3)	52,19 (14,22; 82,55)	17,84 (11,96; 47.77)	22,07 (14,73; 35,7)	22,55 (14,81; 33,58)	29,32 (17,55; 47,25)
Selenium µg	36,39 (17,64; 48,71)	34 (20,61; 51,07)	30,36 (13,78; 50,6)	34 (18,94; 69,84)	33,25 (19,39; 45,85)	28,69 (18,3; 37,87)	28,15 (19,16; 38,46)	33,05 (23,05; 53,29)
Iodine µg	20,58 (15,16; 32,62)	22,83 (16,11; 34,23)	17,3 (12,15; 28,8)	18,48 (11,1; 46,5)	44,07 (19,49; 68)	23,66 (15,81; 39,03)	31,13 (18; 50,12)	27,78 (19,67; 39,81)
Vitamin A RE µg	276,69 (145,52; 344,86)	229,29 (117,16; 387,7)	247,60 (145,98; 392, 01)	298,94 (131,21; 667,34)	286,9 (213,26; 449,80)	238,36 (142,67; 397,09)	278,93 (173,91; 440,89)	228,95 (171,05; 358,18)

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TABLE 4: ANALYSIS OF 24-HOUR RECALL: MEDIAN DAILY INTAKE OF THE GIRLS (N=156) AND WOMEN (N=367) ACCORDING TO NUTRITIONAL STATUS (BMIA AND BMI RESPECTIVELY) (Continued)

	Girls (n=156)				Women (n=367)			
	BMIA Classification				BMI Classification			
	Wasting (n=2, 1,2%)	Normal weight (n=131, 84%)	Overweight (n=20, 12,8%)	Obese (n=3, 1,9%)	Underweight (n=19, 5,2%)	Normal weight (n=181, 49,3%)	Overweight (n=112, 30,5%)	Obese (n=55, 15%)
Nutrients	**Intake Median 25th: 75th**	**IntakeMedian 25th: 75th**	**Intake Median 25th: 75th**	**Intake Median 25th: 75th**	**Intake Median 25th: 75th**	**IntakeMedian 25th: 75th**	**Intake Median 25th: 75th**	**Intake Median 25th: 75th**
Thiamine mg	0,78 (0,57; 0,91)	0,83 (0,66; 1,07)	0,81 (0,6; 1,07)	0,88 (0,58; 1,5)	0,8 (0,6; 0,98)	0,77 (0,56; 1,27)	0,76 (0,59; 0,96)	0,8 (0,64; 1,22)
Riboflavin mg	1,21 (0,72; 1,77)	1,25 (0,67; 2,08)	1,23 (0,63; 2)	1,19 (0,56; 2,62)	0,98 (0,6; 1,66)	0,95 (0,41; 1,99)	0,81 (0,48; 1,44)	0,94 (0,57; 1,55)
Niacin mg	12,53 (10,8; 15,46)	13,57 (9,76; 18,27)	12,81 (9,24; 15,7)	12,32 (8,92; 20,76)	11,49 (7,34; 18,84)	13,41 (9,4; 21,84)	11,64 (9,1; 16,36)	13,45 (9,94; 17,01)
Folic acid µg	185,63 (147,97; 303,84)	210,63 (132,36; 299,48)	209,7 (135,94; 270,78)	247,68 (191; 332,27)	188,57 (159,45; 248,86)	222,27 (131,27; 338,4)	220,42 (143,49; 327,52)	193,71 (154,61; 286,83)
Vitamin B6 mg	1,09 (0,79; 1,42)	1,2 (0,87; 1,61)	0,98 (0,74; 1,33)	1,04 (0,78; 2,1)	1,13 (0,87; 1,41)	1,12 (0,8; 1,82)	1,09 (0,75; 1,42)	1,1 (0,71; 1,48)
Vitamin B12 µg	2,48 (0,79; 5,68)	2,4 (0,97; 3,82)	1,75 (0,94; 3,2)	1,62 (0,55; 2,91)	2,53 (1,31; 4,06)	2,56 (1,54; 4,18)	2,04 (1,48; 4)	2,4 (1,56; 3,74)
Pantothenate mg	3,91 (2,34; 5,65)	5,05 (3,14; 6,7)	4,49 (3,33; 5,65)	4,59 (2,72; 7,08)	5,11 (3,36; 5,94)	4,3 (2,84; 5,64)	4,49 (2,92; 5,83)	4,28 (3,38; 5,49)
Biotin µg	15,13 (12,24; 17,96)	18,05 (14,09; 24,63)	17,74 (13,19; 22,15)	21,6 (12,43; 30,26)	24,49 (16,87; 28,76)	20,74 (13,79; 28,53)	22,56 (15,96; 30,88)	18,74 (14,48; 24,9)
Vitamin C mg	16,16 (10,72; 30,9)	24,69 (12,72; 38,79)	15,26 (11,69; 24,9)	26,45 (20,08; 44,36)	34,16 (21,3; 62,56)	29,74 (13,79; 28,53)	38,67 (17,22; 62,19)	31,53 (13,35; 70,03)
Vitamin D µg	2,98 (1,59; 5,33)	2,34 (1,04; 4,59)	1,89 (1,07; 3,7)	2,98 (1,99; 4,33)	3,6 (1,52; 6,15)	2,93 (1,21; 5)	3,54 (2; 5,23)	2,36 (1,32; 3,9)
Vitamin E mg	7,63 (5,95; 9,81)	7,28 (4,53; 11,34)	5,65 (3,87; 10,16)	8,35 (5,59; 15,81)	6,31 (3,78; 9,84)	5,38 (3,51; 8,06)	5,93 (4,25; 9,13)	6,18 (4,26; 9,2)
Vitamin K µg	25,53 (16,52; 73,38)	25,12 (11,75; 64,97)	23,54 (10,5; 128,08)	49,19 (13,1; 72,1)	25,02 (14,68; 52,44)	19,08 (10,15; 36,99)	28,49 (13,16; 55,9)	18,02 (8,95; 29,12)
MAR	1,08 (0,76; 1,16)	1,09 (0,81; 1,29)	0,92 (0,79; 1,26)	1,12 (0,72; 1,45)	0,85 (0,73; 1,08)	0,81 (0,68; 1,14)	0,82 (0,67; 0,95)	0,92 (0,72; 1,07)

TABLE 5: DAILY PER CAPITA INTAKE OF FOOD GROUPS BY THE GIRLS (N=156) AND WOMEN (N=387 E

Food group	Per capita intake (g) of the girls (n=156)	Per capita intake (g) of the women (n=367)
Cereal group	489,5	484,4
Sugary foods	158,9	349,9
Meat, fish and chicken (Animal source)	128,6	274,9
Dairy products & eggs	48,8	218
Legumes	21,7	18,2
Vegetables	29,3	67,2
Fruit	27,7	101,9
Fats & oils	10,7	23,7
Tea & coffee beverages	92,3	92,5
Sauces & condiments	4,5	12,2
Alcohol	0	9,6

adulthood, when diseases of lifestyle may present as a result of poor food and dietary intake patterns, specifically high intake of fat and saturated fat, poor dietary fatty acid composition and poor vegetable and fruit intakes (Labadarios *et al*, 2008a:147), combined with inactivity. The results of this study indicated that the prevalence of stunting and thinness/wasting in the girls and underweight in the women is less prevalent than overweight and obesity in both groups.

In this study, 7,7% and 5,2% of the adolescent girls and women were wasted/underweight respectively. This is lower than the national prevalence of 12,8% in women aged 15 years and older (Shisana *et al*, 2013:135). In the present study, 12,8% of the girls and 30,5% of the women were overweight and 1,9% and 15% obese, respectively, in comparison with the national prevalence rates of 24,8% overweight and 39,2% obesity for women aged 15 years and older as reported by Shisana *et al* (2012) in the South African Health and Nutrition Examination Survey (SANHANES). Furthermore, according to SANHANES (2012), 20,3% of girls aged 2-14 in KZN are overweight and 8,5% obese. It is also indicated that 25,2% of women 16 years and older in KZN are overweight and 44% obese, which is higher than in the present study (Shisana *et al*, 2013:140, 205). The prevalence rates of overweight and obesity in women of KZN increased when compared to the SADHS (SA DoH, 2004:26) report from 2003 when 24,5% and 32,9% of women in KZN were obese and overweight respectively. This is consistent with the findings in the USA, where the prevalence of obesity in adolescents and adults has increased significantly during the last decade (Niemeier *et al*, 2006).

Although the prevalence of stunting and wasting in the girls was low, this was consistent with the low energy intake as reflected by the median NAR of 0,7 for energy. The same trend was observed in the women with a prevalence of only 5,2% underweight, however, the median NAR for the group of women was 0,66 and 93,7% reported low total energy intakes. The transition from adolescence into adulthood is a high-risk period for weight gain (Niemeier, 2006; Bauer *et al*, 2003). International data have indicated that adolescents, as a group, have a tendency to develop poor eating habits which do not meet dietary recommendations (Wenhold *et al*, 2008:450; Bauer *et al*, 2003). A number of studies have shown that the adolescent consumes high amounts of fat and non-nutritious energy-dense foods, which are very popular in this group (Venter & Winterbach, 2010). In this study, the fat consumption of 28,2% and 31% of the total energy intake of the girls and women respectively were within and slightly higher than the WHO goal of 15-30% (WHO/FAO 2003). Furthermore, the per capita intakes of respectively 10,7 and 23,7 grams of fat by the girls and women confirmed that this group did not consume large amounts of fat. At least four and a maximum of six fat and oil servings, equivalent to 5 grams or ml each, should be consumed per day (SA DoH 2012). The girls only consumed two servings compared to six by the women.

The diet of adolescents and youth is further characterised by low intakes of milk, fruit and vegetables (Wenhold *et al*, 2008:450). Fruit and vegetable intakes in both the women and the girls in this study were much lower than the recommended intake of 400g per day (WHO/ FAO 2003). Furthermore, although the dairy product and egg group ranked fourth on the list

of food groups consumed, the per capita intake was low. It is recommended in the South African Food-Based Dietary Guidelines that at least one to two servings, equivalent to 200-400 ml milk, should be consumed per day (SA DoH 2012). The girls did not even meet a quarter of the minimum dairy intake recommendation whereas the women just met the minimum requirement. These results confirmed similar findings by Larson *et al* (2008) in a study among adolescents in the USA. Low milk, vegetable and fruit intakes are furthermore associated with low calcium, iron and vitamins A and C intakes (Wenhold *et al*, 2008:450) and the low intakes of these foods may have contributed to the inadequate micronutrient intakes in this study. The majority of the girls consumed a diet low in calcium (98,7%), vitamin A (83,3%) and vitamin C (89,1%). A similar trend was observed in the women, who also consumed a diet low in calcium (76,7%), vitamin A (90,7%) and vitamin C (75,8%). Although the median iron intake was adequate, 52,6% of the girls and 59,9% of the women did not meet 100% of the EAR. Micronutrient intakes were thus low and a high risk for micronutrient deficiencies may be prevalent in this group of girls and women, which is consistent with the findings of the

The 2012 SANHANES (Shisana *et al*, 2012) found a national prevalence rate of vitamin A deficiency (VAD) in 11,6% and 13,3% of young women (16-25 years) and women of productive age respectively. Furthermore, the prevalence of VAD in women living in KZN is 16,4% one of the highest VAD prevalence rates in the country (Shisana *et al*, 2013:157). Although the NFCS reported that folic acid is not a deficiency of concern in the general South African population, neither the girls nor the women showed adequate median folic acid intakes, and in both groups a large majority did not meet 100% of the EAR for folic acid. The B-vitamins are very important for cognitive development and behavioural outcomes in children and adolescents (Wenhold *et al*, 2008:449). In this study, most of the B-vitamins also showed inadequate median intakes except for riboflavin, niacin and vitamin B6 in the girls and women as well as vitamin B12 in the women. Furthermore, large percentages of both groups did not meet 100% of the EAR for these vitamins. Interestingly, no significant differences were observed between the dietary intakes of the wasted/underweight, normal weight, overweight and obese adolescent girls and women respectively and no significant correlations were observed between the dietary intake variables and BMIA for the girls. Significantly weak positive correlations were found between the BMI of the women with only selenium and vitamin A respectively. This was consistent with findings that indicated very weak correlations between dietary intake and BMI from South Africa (Kruger *et al*, 2005) and elsewhere (Jeon *et al*, 2011).

It is estimated that 61% of the KZN population live in poverty and 28,2% are at risk of hunger, which could explain the poor diet quality of the girls and women in this study (KZN DoH, 2010:21). The cereals and sugary food groups ranked highest and the girls and women also had the largest per capita intakes of the cereal food group in this study; it can thus be concluded that carbohydrate-rich foods are the main foods consumed by both groups. Low quantities of milk, legumes, vegetables and fruit were consumed. This trend is also reflected by Kruger *et al* (2005) for South Africa and also for young women in the USA (Larson *et al*, 2008). Although the fat and salt intakes were within the recommendations, salt added at the table was not reflected in the data.

CONCLUSIONS

It can be concluded that overweight and obesity are the most outstanding nutritional status feature of the girls and women in this study. This could be the result of poor food consumption patterns which do not meet the SA FBDG goals for health, thus compromising optimal nutrient intakes. Adolescence is characterised by nutritional vulnerability due to growth and the associated high nutrient requirements, as well as poor eating habits and risk-taking behaviours (Wenhold *et al*, 2008:449). Adolescents are the adults of the future and it is likely that their dietary habits will continue into adulthood (Steyn, 2010). Likewise, the nutritional status and health of women of child-bearing age are important for healthy birth outcomes. Furthermore, during adulthood, progressive functional changes in cells and organs occur as a result of catabolic changes taking precedence over anabolic processes (Senekal *et al*, 2008:481). South Africa has a high burden of chronic diseases of lifestyle among adults. Research has shown that diet is an important factor in the prevention of chronic diseases and obesity and nutrition is one of the important modifiable determinants of chronic diseases (Labadarios *et al*, 2008b).

RECOMMENDATIONS

It is important to address the underlying causes of poor food intakes and the resulting poor nutrient intakes which lead to a poor nutritional status. The availability and accessibility of healthy foods, the frequency of family meals, parental food consumption patterns and parenting practices are important factors that assist adolescents in making healthy choices. Household food availability and accessibility play a major role in the young adult's food intake (Labadarios *et al*, 2008a).

Research efforts can be concentrated at the level of school, educational institution or workplace in order to change intake habits in specific settings, since up to eight hours a day are spent at school and work (Story *et al*, 2008). UNICEF (2011) makes the following statement: "Late adolescence is a time of opportunity, idealism and promise. It is in these years that adolescents make their way into the world of work or further education, settle on their own identity and world view and start to engage actively in shaping the world around them". Policy makers and nutritionists should therefore educate young girls and women through nutrition education programmes about healthy food options that can be made up at home for consumption while away from home. The FBDGs can be used as a basis for these nutrition education programmes (NEPs). Furthermore, the management at schools, post-school training institutions and the workplace should be encouraged to provide healthier options in tuck shops, dining rooms and canteens so that young people will be able to make the correct choices.

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