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RESEARCH NOTE

Urban-rural disparities in the nutritional status of school adolescent girls in the Mizan district, south-western Ethiopia

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ABSTRACT

Introduction: Malnutrition that occurs during adolescence has important consequences for the future growth and development of the individual, particularly in girls in developing countries. Besides limiting growth, adolescent malnutrition has important consequences for society. Despite this, there is a lack of information on the nutritional status of adolescent girls in Ethiopia. This study was therefore performed to help redress this lack of data and to provide information for future improvements by health planners and policy makers.

Methods: A comparative cross-sectional study design was employed to determine the urban–rural disparity in nutritional status of adolescent school girls in the Mizan district in south-western Ethiopia. A two-stage sampling procedure was used to randomly select 622 adolescent girls, 311 each from urban and rural locations. Trained field workers used structured questionnaires to obtain the desired information from the respondents. Anthropometric measurements of height and weight were collected using standard procedures and appropriate quality control measures. Height-for-age Z-scores and body mass index (BMI)-for-age Z-scores were generated using AnthroPlus software. The independent sample *t*-test and χ^2 test were used to determine statistical significance.

Results: There were no significant differences in the ages or physical activities of the two populations of girls studied. Consumption of cereal, vegetables, sweets, sugars, fats, meat, and eggs was similar between the two groups, although slight

differences were found with regard to legumes, milk, and fruit consumption. No significant differences were found in the prevalence of mild underweight girls and overweight girls in the urban and rural groups (26.5% vs 22.3% and 7.5% vs 5.2%, respectively). Significant stunting was, however, present in the rural population (40.9% vs. 17.8% in the urban group). Although overall lower than the reference data provided by WHO, the mean BMI-for-age Z-scores and height-for-age Z-scores were significantly higher in the urban girls than in their rural counterparts, with mean differences of 0.18 (95% confidence interval (CI) 0.02–0.34) and 0.58 (95% CI 0.45–0.72), respectively.

Conclusions: Malnutrition was present in both urban and rural adolescent girls. The most obvious disparity between the two populations was significant stunting in the rural population. There is therefore an urgent need for strategies to address severe nutritional problems in rural adolescent girls and to improve the nutrition of adolescent girls within the urban environment.

Key words: adolescent girls, nutritional status, obesity, southwest Ethiopia, stunting, urban and rural disparity.

Introduction

Globally, there are more than 1.2 billion adolescents aged 10–19 years[1,2]. Adolescence is one of the most dynamic stages of development and is characterized by dramatic physical and psychosocial changes in the individual[3,4]. For example, approximately 20%, 50%, and 45% of the final adult height, weight, and bone mass, respectively, are attained during this period[1,5,6]. Such changes result in a peak in nutritional requirements[7,8] that exceeds that occurring during the remaining lifetime[3]. Deficits in nutrition during this period not only impair growth, but also the personal development of the individual[1-3], which will ultimately have a wider impact on society.

In Ethiopia, in contrast to boys, girls often face a reduction in freedom and opportunities during puberty[6,9,10]. These restrictions are frequently increased in rural parts of Ethiopia, where more than 85% of the girls live[8] and where work burdens for adolescent girls are especially heavy[11]. Puberty is also a time when girls' bodies prepare for the nutritional demands of pregnancy and lactation required in later life[12,13]. As a result, girls are more prone to nutritional difficulties than boys[2], and nutritional deficiencies experienced by a girl during this period can affect the future health of the individual and her offspring[13,14]. Improving the nutritional status of adolescent girls represents an important way of breaking the intergenerational cycle of malnutrition[5,14]. Furthermore, such an investment in increasing the opportunities of adolescent girls should have a positive impact on their individual development and also help long-term reductions in poverty[1,2].

Although Ethiopia is a country with an extremely young population, very little is known about the nutritional status of its adolescents[15]. Demographic and health surveys on adolescents aged 15 years and older are available, but relatively few studies have been performed on younger adolescents[16,17] in Ethiopia. Such studies also lack information obtained from both urban and rural environments. The present study was, therefore, carried out to help address this problem by obtaining information on the disparity in nutritional status between adolescent girls aged 11–19 years living within rural and urban communities in the Mizan district, south-western Ethiopia. The results obtained should provide important information for future planning to help prevent malnutrition and also improve the development of adolescent girls in Ethiopia.

Methods

Study setting and design

A cross-sectional comparative descriptive study design was employed to assess urban–rural disparities in the nutritional status of adolescent school girls in Mizan district. It is located in the Bench-Maji zone in the Southern Regional State of Ethiopia. This district has an estimated total population of 700 000; with 30% being urban residents. It is known for its

favorable agro-ecology, with year-round rainfall and one of the lowest risks of food insecurity in Ethiopia. The people in the rural parts are economically dependent on agricultural products while the urban residents are mainly engaged in market-oriented business activities and services[18]. The study area was selected purposively to fulfill the assumption homogeneity in population pattern, in regards to culture, ethnicity and agro-economy in the urban and rural setting. It contains 29 schools, with female enrolment reaching 98% in both the urban and rural setting during 2012. The present survey was conducted in February 2012, corresponding to the Ethiopian post-harvest season.

Sample size and sampling

A sample size calculation was performed using the STATCALC program of EPI INFO v6.2 (Centers for Disease Control and Prevention; http://wwwn.cdc.gov/epiinfo). A total of 622 subjects (311 in each rural and urban study group) were required to detect the previously identified 16% urban–rural stunting prevalence disparity[10] with a 95% level of confidence, 90% power, a design effect of two, and with 10% allowance. Fifteen schools with grades 5 to 10 were stratified into urban (seven schools) and rural (eight schools) groups based on the governmental administrative structure. Three schools were selected from each group using the 'probability proportional to size' method, and female adolescents were selected randomly from the two settings. Computer-generated random numbers were used to identify study participants from the two sampling frames.

Data collection and measurement

Twelve female diploma nurses fluent in the local dialect interviewed the adolescent girls using a pre-tested structured questionnaire. The questionnaire included questions about demographic characteristics, income, puberty, food security, dietary practice, physical activity, and health-related practices. The nurses received 5 days of intensive training both in the classroom and as field practice. Due to its sensitive nature in the study area, data on ethic background of the children were not sought.

A four-item individual food security scale, developed and tested in another study[19], was used to assess food security status. The questions in the scale asked whether girls within the last month had (1) ever worried about having enough food, (2) ever had to reduce food intake because of shortage of food or lack of money to buy food, (3) ever had to go without eating because of shortage of food or money to buy food or (4) ever had to ask outside the home for food. Food security status was determined as follows: girls were 'food secure' only when the responses for all the four items were 'no'; otherwise, the girls were labeled as 'food insecure'. The dietary practice of subjects was assessed by asking about their usual number of meals per day, the frequency of missed meals within the last 2 weeks, and, finally, the usual frequency of consumption for different food groups (cereals, legumes, fruits and vegetables, milk and milk products, and meat and eggs).

Physical activity was assessed using the Adolescent Physical Activity Recall Questionnaire (APARQ)[20] but adapted to include a list of common activities performed by adolescents in Mizan. Girls were asked to estimate the frequency and time spent doing the listed activities in a typical week. The weight and height of each girl was taken by one of the researchers using standard techniques and calibrated equipment[21], with the subjects wearing school uniform and no shoes. Weight was measured using a digital scale (SECA 876) to the nearest 100 g and height to the nearest 1 mm using a statometer (SECA 225). The age of the girls was confirmed from the school registers.

The socio-demographic information was collected to provide a logical overview of the study population to link with the results and interpretation of the data. This is because the information was obtained from face-to-face interviews with school children, which is not reliable for multivariate analysis.

Ethics approval

Ethics approval of the study protocol was obtained from the ethics review board of Jimma University (RpGc/448/2012). Consent was obtained from representatives of parents and teachers in a group meeting where the purpose and nature of

the study was explained prior to the start of data collection. Verbal assent from the selected adolescents was obtained.

The data were analyzed using the Statistical Package for the Social Sciences v16 (SPSS Inc., http://www.spss.com). Height-for-age Z-scores (HAZ) and body mass index (BMI)-for-age Z-scores (BAZ) were calculated using the WHO growth reference data for adolescents (AnthroPlus v1.0.3; http://www.who.int/growthref/tools/en). The prevalences of stunting and the underweight category were calculated from the mean HAZ and BAZ, respectively, using the cutoff point <–2 standard deviations (SD). Overweight was considered as BAZ >+1SD[22]. The mean HAZ, BAZ, age at menarche, and gynecological age (age since menarche) was also calculated. The urban–rural disparity in nutritional status was tested using the Pearson χ^2 test for categorical data (stunting and BMI categories) and the independent student *t*-test for continuous (mean HAZ, BAZ, and age at menarche) data.

Results

Socio-demographic characteristics

The baseline characteristics of the adolescent girls studied are shown in Table 1. Overall, 98.7% (614/622) of the adolescent girls enrolled were included in the analysis, of which 99% and 98.4% girls were from the urban and the rural groups, respectively. The mean age of the girls was 14.4 (±2.0 SD) years, with approximately 49.5% (304/614) aged 14–16 years. In the urban group, 34.4%, 50.3%, and 15.9% of the girls were aged 11–13, 14–16, and 17–19 years, respectively. Similar results of 36.6%, 49.7%, and 13.7% were found for the same age ranges in the rural group. These results showed that there was no significant difference in the mean age (14.5±2.0 vs 14.3±2.0, p=0.25) of the girls from the urban and rural study groups, respectively.

Fifty-nine percent of the girls were Orthodox Christian, 28% were Protestant, and 12% were Muslim. There were no statistically significant differences in distribution of religion between urban and rural. There was no statistically significant difference between girls living in the urban (72%; 224/311) and rural (75.9%; 236/311) groups, respectively, living with both of their biological parents (χ^2 test p>0.05). Of the remaining girls, 11.8% were living with one of their parents while the remaining 13.3% were not living with any parent. The overall mean family size was 5.7±1.8 with no statistically significant difference between the urban and rural groups (5.6±1.8 vs 5.8±1.8); p=0.6). Of their mothers, 17% were illiterate and only 54.2% had attended any level of formal education.

Health and health-related practices of the participants

The majority, 87.8% (273/311) and 81.3% (253/311) of the urban and rural groups of girls, respectively, obtained their water within a 30-minute walk, while 76.1% (n=467) of all the girls reported using a covered pit latrine. Only 3.9% (n=24) of the two groups of girls used open-field defecation. No significant differences were observed between the urban and rural girls with respect to latrine facilities. Similarities between the urban and rural groups were also found with respect to episodes of illness, using mosquito nets, and wearing shoes (χ^2 urban vs rural; p>0.05).

In the week preceding this study, 58.7% (n=355), 23.2% (n=141), and 17% (n=102) of girls washed their hands with soap always, usually, or rarely, respectively, 30 minutes before eating. Following toilet use, 26.2% (n=158), 55.9% (n=339), and 16.7% (n=101) of all surveyed girls always, usually, and rarely washed their hands after toilet use, respectively. There was, however, a significant difference between the two groups with respect to hand washing after using the toilet. Only 20.8% (n=64) of the urban girls washed their hands, compared to 31.7% (n=97) of the rural group (χ^2 test p=0.01). Other significant differences were the proportion of households reported to fetch water within 30 minutes walking distance (89.8% (n=273) urban vs 83.0% (n=253) rural; p=0.02) and the proportion of respondents in contact with health extension workers (64.7% (n=152) urban vs. 49.2% (n=121) rural; χ^2 test p=0.02).

Table 1: Mean characteristics of adolescent girls in public schools of Mizan district, by residence February 2012 (urban *n*=308 and rural *n*=306)

Characteristic	Mean (SD)		Total (*n*=614)	*t*-test *p* value
	Urban (*n*=308)	Rural (*n*=306)		
Age (years)	14.5 (2.0)	14.3 (2.0)	14.4 (2.0)	0.063
Height (cm)	157.1 (7.1)	152.7 (7.6)	154.9 (7.0)	0.001
Weight (kg)	47.8 (9.1)	44.0 (8.6)	45.9 (9.05)	0.001
BMI-for-age Z-score	–0.32 (1.0)	–0.50 (0.90)	–0.41 (0.99)	0.026
Height-for-age Z-score	–0.26 (.88)	–0.84 (0.82)	–0.55 (0.89)	0.001
BMI (kg/m^2)[†]	19.3 (2.9)	18.7 (2.8)	19.01 (2.9)	0.015
Age at menarche (*n*=378)[†]	13.2 (1.1)	13.8 (1.0)	13.5 (1.0)	0.001
Gynecological age (*n*=378)[†]	2.3 (1.5)	1.8 (1.4)	2.1 (1.5)	0.002

[†] Independent sample *t*-test; *p* value is two-tailed.
BMI, body mass index. SD, standard deviation

Table 2: Distribution of physical activity and household chores of adolescent girls in public schools of Mizan district, by residence February 2012 (urban *n*=308 and rural *n*=306)

Characteristic	Mean (SD)		Total (*n*=614)	*t*-test *p* value
	Urban (*n*=308)	Rural (*n*=306)		
Time spent on physical activity per week (min)	430.3 (359.0)	555.2(613.6)	492 (502.0)	0.002
Time taken to school on foot in minutes	24.1 (10.4)	27.4 (15.2)	24.58 (13.2)	0.002
Sleeping (hours/day) (*n*=613)	7.8 (1.5)	8.0 (1.6)	7.89 (1.6)	0.025
TV watching (hours/day)	4.2 (1.43)	1.4 (1.4)	1.96 (2.0)	0.001
Sedentary life (hours/day)	10.4 (2.1)	9.4 (2.1)	9.9 (2.1)	0.005
Household chores (hours/week)	6.8 (4.75)	7.7 (5.4)	7.3 (5.1)	0.041

SD, standard deviation

In the month preceding the study, 99.2% (*n*=609) of the two groups of girls ate meals at least twice a day, with 69.4% (*n*=212) of the rural and 61.8% (*n*=190) of the urban study groups eating three meals a day. The food consumption patterns of participants in the two populations were similar with respect to cereals, vegetables, sweets and sugars, fats, meat, and eggs ($p>0.05$). Differences were, however, reported in the consumption of legumes (27.7% (*n*=85) urban vs 33% (*n*=100) rural; $p=0.01$), milk and milk products (13.2% (*n*=41) urban vs 20.2% (*n*=62) rural; χ^2 test $p=0.01$) and fruits (59.8% (*n*=183) urban vs 49.5% (*n*=151) rural; $p=0.01$).

Physical activity

The various physical activities of the two groups of girls are summarized in Table 2. The majority (79.3, *n*=487)) of total participants engaged in at least 40 minutes of physical activity per day in five or more days during the week preceding the interview. More household chores were performed in rural settings. Eighty-eight percent (*n*=268) of the urban group walked to school, compared to 93.5% (*n*=283) of the rural group ($\chi^2=5.5$, $p=0.02$). A minority of the urban and rural girls, 15% (*n*=46) and 18% (*n*=55), respectively, were engaged in paid work after school.

Growth and nutritional status of the study participants

The age, height, weight, BAZ, and HAZ of all the adolescent girls are shown in Table 1. On average, a gain of 23 kg in weight and 18 cm in height was observed as the age of the girls increased from 11 to 19 years. The mean BAZ and HAZ were significantly higher for the urban than for the rural girls, with a mean difference of 0.18 (95% confidence interval (CI) 0.02–0.34) and 0.58 (95% CI 0.45–0.72) respectively. Urban girls were also taller and heavier than their rural counterparts by an average of 4.38 cm (95% CI 3.21–5.55) and 3.86 kg (95% CI 2.47–5.28), respectively (Table 1).

An age-wise comparison showed that the mean BAZ for urban girls were higher than those for the rural group of girls at every age except for ages between 16 and 17 years (Fig1). After this time, although the mean BAZ for the rural population remained below the reference group, the scores for the urban group aged 18–19 years rose above the WHO 2007 reference line (Fig1). The mean HAZ of both the urban and rural groups were below the reference group for all girls aged 11–18 years (Fig2). A greater difference from the reference data was observed in the rural group of girls (Fig2).

The overall prevalences of mild stunting, thinness, and being overweight in the two groups of girls were 29.3%, 24.4%, and 6.4% respectively (Fig3). The prevalences of mild thinness, mild stunting, and being overweight in the urban and rural settings were 22.3% versus 26.5%, 17.8% versus 40.9%, and 7.5% versus 5.2%, respectively. While an overall comparison of nutritional status based on residence eand stunted in rural schools compared to those in urban schools, the difference in the proportion of thinness and being overweight was not statistically significant. In contrast, the prevalence of mild stunting was significantly higher in the rural group (40.9%) than in the urban group (17.8%; p=0.0001). The proportion of stunting (HAZ<–2) was 1.9% in the urban group compared to 6.9% in the rural group. The prevalences of moderate and severe thinness were 5.2% versus 8.2% and 0.3% versus 1.3% in the urban and rural groups, respectively (Table 3). No case of severe stunting was observed in the urban group, whereas the incidence was 0.7% in the rural group.

The majority (61.6%; n=378)) of the girls were post-menarche. Of these, 66.9% (n=206) were from the urban and 56.2% (n=172) were from the rural groups. The mean age at menarche for menstruating girls (n=378) was 13.5±1.0 years, with the urban girls reaching menarche at an earlier age than their rural counterparts (13.2±1.1 urban vs 13.8±1.0 rural; p=0.001) (Table 1).

Discussion

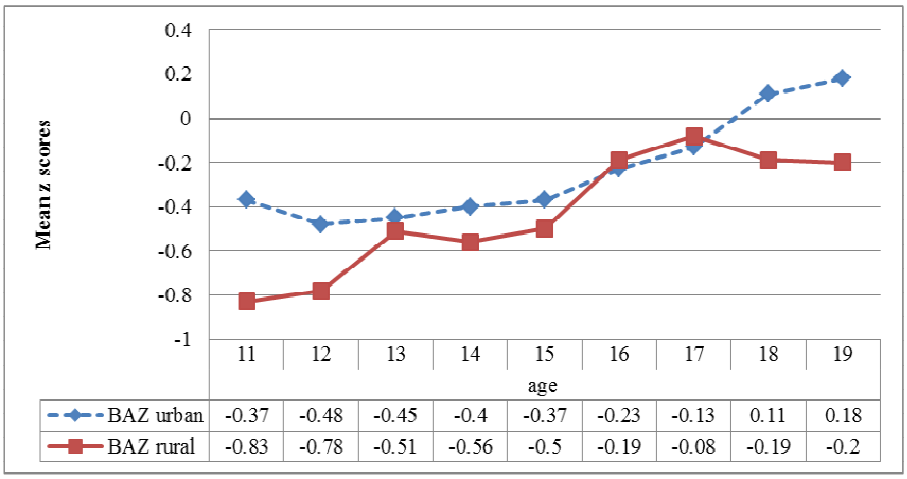
Relatively few studies have been undertaken to study the nutrition of adolescent girls in Ethiopia. The present study aimed to study disparities in the nutritional status of adolescent girls from rural and urban communities, in order to help redress this situation. Mizan, a zone of south-western Ethiopia that has a low level of food insecurity, was chosen as the study area. The provision of information on nutritional status is important because although anthropometric parameters, such as height and weight, are considered highly heritable traits[9], they are also influenced by environmental factors such as nutrition[17,23].

The results obtained in the present study demonstrated a disparity in nutritional status between urban and rural adolescent girls. This was shown by comparison of the current results with the WHO 2007 growth reference data, which shows the prevalence of under-nutrition in terms of height for age and BMI for age for girls from both urban and rural groups. While both urban and rural girls were shorter and thinner than heights and weights of the reference curve, the rural group of girls was also shorter and thinner than their urban counterparts. This significantly lower mean nutritional index of rural compared to urban girls is consistent with previous studies performed in adolescents in Ethiopia[16-18] and other developing countries[24,25]. One possible reason for such a disparity might be the socio-economic status of the household. The present results were, however, in contrast to a previous rural northern Ethiopian study, in which the mean height for age was below the –1.5 SD of the WHO 2007 reference data[26]. This difference might be attributable to variability in livelihoods or the fact that Mizan is a relatively productive region[18] compared to northern Ethiopia, where 75% of the girls studied were from food-insecure households at some points in a year[16].

Table 3: Nutritional status of adolescent girls in public schools of Mizan district, by residence 2012 (urban *n*=308, rural *n*=306)

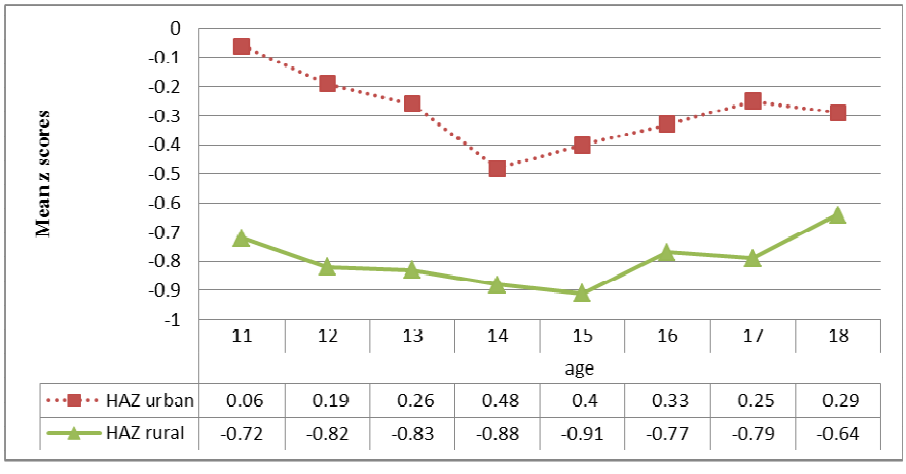
Age (years)	BMI-for-age Z-score								Height-for-age Z-score			
	<–3SD (%)		<–2SD (%)		<+1SD (%)		<+2SD (%)		<–3SD (%)		<–2SD (%)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
11–19 (*n*=614)	0.3	1.3	5.2	8.2	7.5	5.2	1.0	0.3	0.0	0.7	1.9	6.9
11–14 (*n*=313)	0.7	1.9	7.9	11.9	7.9	4.4	2.0	0.6	0.0	1.3	2.0	6.9
15–19 (*n*=303)	0.0	0.7	2.5	4.1	7	6.2	0.0	0.0	0.0	0.0	1.9	6.8

BMI, body mass index. SD, standard deviation



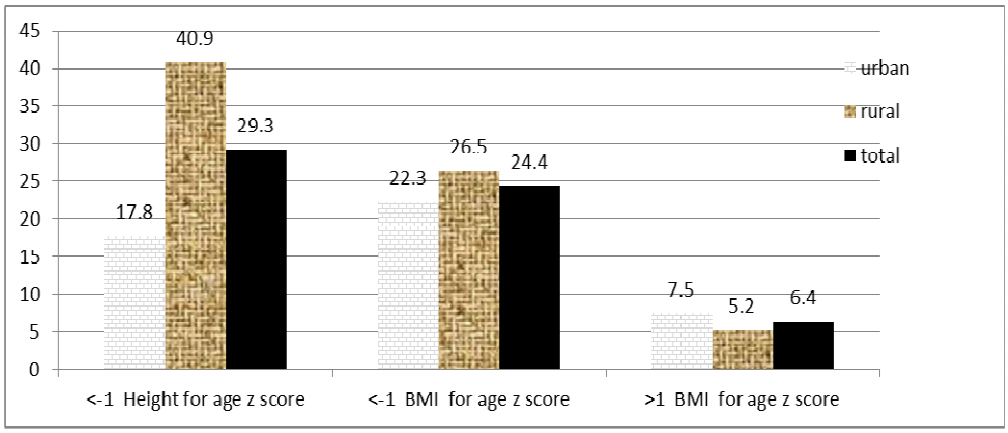
BAZ, BMI-for-age Z-score

Figure 1: Age-wise comparison of mean body mass index for age Z-scores of study population by residence relative to WHO 2007 reference data (where '0' represents the median of the reference data), Mizan district February 2012 (urban *n*=308, rural *n*=306).



HAZ, height-for-age Z-score

Figure 2: Age-wise comparison of mean height for age Z-scores of study population by residence relative to WHO 2007 reference data (where '0' represents the median of the reference data), Mizan district February 2012 (urban *n*=308, rural *n*=306).



BMI, body mass index

Figure 3: Prevalence of mild under-nutrition and overweight of adolescent girls, by residence Mizan district 2012 (urban *n*=308, rural *n*=306).

The nutritional status of the girls, based on the BAZ, indicated that there were no significant differences between the urban and rural study groups. This result is at odds with other reports from Ethiopia[10,11]. Mild stunting was observed in 29.3% of all the girls studied, but was more common in the rural group, where it was found in 40.9% subjects compared to just 17.8% in the urban group of girls. This result is consistent with other reports[4,25] and is supported by evidence that rural girls are more likely to suffer from under-nutrition when compared to urban girls in developing countries[10,11,26]. Of interest, a difference in moderate to severe stunting in the urban and rural groups was lower than other similar studies in different countries[16,24,25]. Possible reasons for this include socio-economic differences, not only between the various countries, but also between the urban and rural communities[6,27]. Such differences might affect the quality and quantity of food consumption. Another important factor for consideration is that malnutrition occurring during childhood might delay growth during childhood as well as in adolescence[2].

The onset of menstruation is considered the most obvious sign of puberty in girls[28,29]. The mean age at menarche was significantly higher in the rural group than in the urban group in the present study. This was despite the absence of any significant difference in biological ages between the two populations. Instead, this result suggests an effect of different living conditions on the onset of puberty. Indeed, under-nutrition has been linked to a delayed age at menarche, whereas a moderate degree of overweight has been associated with early menarche[29]. There is increasing evidence that the age of onset of puberty is decreasing in the developed world[28]. In keeping with this, the mean age of menarche in the present study is later than in girls from Michigan in the USA (12.3±5 years[30]), Alexandria in Egypt (11.98±0.96 years), and in African-American girls[28].

Conclusions

Differences in nutritional status were found between urban and rural girls. These took the form of decreased height, weight, and BMI compared to 2007 WHO reference data from other developing countries. Stunting was also significantly increased in the rural group of girls compared to those from an urban environment. These results demonstrate the urgent need to develop strategies to improve the growth and nutritional status of adolescent girls, with a special emphasis on rural girls. Since the huge urban and rural differences in nutritional status in terms of stunting might be

attributed to social and/or economic disparities, future community-based longitudinal studies should be instigated as soon as possible to further investigate the reasons for this.

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