Clinical Nutrition xxx (2017) 1–8

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Original article

Nutritional status among adolescent girls in children's homes: Anthropometry and dietary patterns

Tone Berg [a], Christine Magala-Nyago [b], Per Ole Iversen [a, *]

[a] Department of Nutrition, Institute of Basic Medical Sciences, University of Oslo, Oslo, Norway
[b] Department of Food Technology & Nutrition, Makerere University, Kampala, Uganda

ARTICLE INFO

Article history:
Received 8 July 2016
Accepted 20 March 2017

Keywords:
Adolescent girls
Children's homes
Malnutrition
Micronutrients
Nutritional status

SUMMARY

Background & aims: Malnutrition is widespread among disadvantaged people in low-income countries like Uganda. Children and adolescents living in children's homes are considered an especially vulnerable group, and malnutrition among girls is of particular concern since it has intergenerational consequences. Virtually no information exists about the nutritional status of adolescent girls living in children's homes in Uganda. We therefore conducted a cross-sectional study to assess the nutritional status by evaluating anthropometric indicators, body composition and dietary patterns.

Methods: Forty-four girls aged 10–19 years living in five children's homes participated in addition to a reference group of 27 adolescent girls from three boarding schools; both in the Ugandan capital Kampala. Height and weight were measured to assess anthropometry. Body composition data was obtained by bioelectrical impedance analysis. Dietary intake was evaluated with a food frequency questionnaire, calculation of dietary diversity score, and a 24-h dietary recall.

Results: The adolescent girls living in children's homes suffered from stunting (18.6%), overweight or obesity (18.6%), and were at risk of insufficient intakes of multiple micronutrients, especially of vitamins A, B_{12}, C, D, E and calcium. They also had a low intake of essential fatty acids. Dietary diversity was low with a median score of 3 out of 9 food groups. Animal products were rarely consumed.

Conclusions: The majority of girls in children's homes consumed a less adequate diet compared to the reference group, thus being at risk of nutrient deficiency-related disorders.

1. Introduction

There has been an increased interest in adolescent girls' nutrition and health as an entry point to improve maternal and child nutrition pre-pregnancy, and in order to break the cycle of malnutrition and growth failure [1]. Undernourished and stunted mothers are at risk of restricted growth of the fetus and giving birth to undernourished offsprings. These children are then at risk of becoming stunted themselves [2]. Moreover, the nutritional status of the mother will not only affect the nutritional status of her child, but possibly also the health of her future grandchildren [3].

Uganda, a low-income country, is severely affected by stunting and micronutrient deficiencies, and is also increasingly experiencing the double burden of malnutrition, as the prevalence of overweight and obesity is growing, especially in urban areas. The Ugandan Demographic Health Survey (UDHS) estimated in 2011 that 14.3% of adolescent girls aged 15–19 years were thin with a body mass index (BMI) <18.5 kg/m^2, 3.9% were moderately to severely thin with a BMI <17 kg/m^2, and 11.5% were estimated to have a BMI >25 kg/m^2. In line with the latter, 10.5% were classified as overweight and 1.0% as obese [4]. Vitamin A deficiency is also a major concern, affecting an estimated 40.3% of girls; 29.6% were marginally deficient, 9.9% moderately and 0.8% severely deficient [4].

A particularly vulnerable group in Uganda is children and adolescents living in child care institutions such as children's homes. The number is estimated to exceed 57,000 children [5]. Orphanhood is a great challenge in Uganda where 14% of all children are orphaned. The high prevalence of HIV/AIDS has had a significant impact on the number of orphans, and is responsible for almost 50% of orphanhood in the country [5]. Other factors causing the high number of orphans include poverty, disease such as malaria and tuberculosis, as well as the legacy of the armed conflict in Northern Uganda.

* Corresponding author. Department of Nutrition, IMB, University of Oslo, P.O. Box 1046, 0317 Oslo, Norway. Fax: +47 22 85 13 41.
E-mail address: p.o.iversen@medisin.uio.no (P.O. Iversen).

http://dx.doi.org/10.1016/j.clnu.2017.03.020
0261-5614/

No previous, formal research has been conducted on the nutritional status of girls and female adolescents in children's homes in Uganda. Gathering such data is important given the particular concerns related to malnutrition among girls and the ensuing intergenerational consequences. The purpose of this study was thus to assess the nutritional status of adolescent girls in randomly selected children's homes in Kampala City, by evaluating anthropometry and body composition, dietary diversity, and their nutrient intake. Since little information about the nutritional status of Ugandan adolescents is available, a group of adolescent girls living in boarding schools in Kampala City was used as a reference group.

2. Subjects and methods

2.1. Study population

Adolescent girls aged 10–19 years from children's homes in Kampala City were invited to participate in the study. Only participants that had lived at the institution for at least one year were eligible. Participants that were pregnant or lactating, bedridden because of illness or disabled were excluded. For the sake of comparison, adolescent girls aged 10–19 years living and studying at boarding schools in Kampala City were invited to participate in the study as a reference group. All participants had to speak the local language Luganda or English.

A randomized list of all 20 verified children's homes in Kampala was obtained from the Ministry of Gender, Labour and Social Development [6]. If a children's home did not fit the inclusion criteria, the subsequent home on the randomized list was selected. As there were no known socio-economic differences among the five divisions of Kampala, stratified random sampling for the different geographical areas of Kampala City was not considered necessary. A sample size of 10 adolescent girls suiting the inclusion criteria were then randomly selected from each children's home's register.

Kampala City Council provided a list of all boarding schools in Kampala City and we recruited randomly three boarding schools affordable by the middle class population, as no boarding school was present in low-income areas. The recruitment of the individual 10 girls at each of these reference schools was performed by convenience sampling.

Among the 50 children's home participants and the 30 reference school participants invited to the study, two girls from the children's homes were not included since they had been living in the homes for only a few months. Four participants from the children's homes and three participants from the reference schools were not included in the study since they were absent on the days of data collection. The final sample size thus consisted of 44 adolescents from children's homes and 27 girls from reference schools.

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Uganda National Council for Science and Technology (#SS3072), the Research Secretariat in the Office of the President (#ADM 154/212/01), the Ethical Committee of Makerere University, and the Regional Committee for Medical and Health Research Ethics in Norway (#2013/578). Written informed consent was obtained from all subjects.

2.2. Data collection procedure

A female assistant from Kampala was hired to assist in data collection, as well as helping with translation and interpretation. The main assessments conducted in this descriptive cross-sectional study were measurements of body composition, food frequency questionnaire (FFQ), collection of recipes for meals and an interactive 24-h dietary recall. Three days were allocated for assessments at each institution. The first day was spent observing the routines and becoming familiar with the setting of the institution. On the second day, the participants were informed in detail about the study, whereas we used the third day for data collection.

2.3. Measurements and analyses of anthropometry and body composition

Height (to the nearest cm) was measured standing using a stadiometer (SECA Model 213, Seca Gmbh & Co., Hamburg, Germany). Weight (to the nearest 100 g) and body composition were measured using a single-frequency bioimpedance analyser (BC-418 MA, Tanita Corp., Tokyo, Japan) operating at 50 kHz and with eight-point contact electrodes [7]. Total body water (TBW), fat free mass (FFM) and fat mass (FM) were calculated from the measured resistance values, height, body weight, gender, age, and standard body type (defined as less than 10 h of exercise per week). FFM index (FFMI) and fat mass index (FMI) were calculated as FFM and FM in kg/m^2. All measurements were performed with the subjects standing barefoot on the platform with arms slightly apart from the body. The body composition analysis also included assessment of basal metabolic rate (BMR) based on the bioimpedance analyzer. Assessments were conducted at least 2 h after a meal.

The WHO growth reference data for 5–19 years were used to assess BMI-for-age and height-for-age [8]. WHO's growth curves classify "thinness" in adolescents as a BMI-value below two standard deviations (SD) from the mean BMI. "Overweight" (1 SD above reference mean) and "obesity" (2 SD above reference mean) are equivalent to a BMI of 25 kg/m^2 and 29.7 kg/m^2 at age 19 years, respectively. Stunting, reflecting chronic malnutrition, is defined by WHO as <2 SD below mean height-for-age.

There were no adolescent body composition reference data available for Ugandans or for this region of Africa or for Africa as a whole. We therefore chose to use available body composition reference data of adolescents from the United Kingdom [9]. Since the reference percentiles from these data do not include TBW, NHANES III was used for TBW [10]. Cut-off values were set at above and below 2 SD. The age-specific FM% reference curves for children aged 5–18 years have set cut-offs to define "underfat", "overfat" and "obese" at the 2nd, 85th and 95th centiles, respectively. Cut-off values of "high" and "low" FM, FFM and FFM% were set at above and below 2 SD from the mean value, respectively.

Total energy expenditure (TEE) for each individual was calculated by multiplying the participant's individual BMR value, obtained by the bioelectrical impedance analysis, with the value for physical activity level (PAL): TEE = BMR × PAL. As estimating PAL among participants was outside the scope of this study, the calculation of TEE was based on three habitual PAL values for adolescents: a low activity level (PAL = 1.50), a medium activity level (PAL = 1.75), and a high activity level (PAL = 2.00) [11].

2.4. The food frequency questionnaire and diet diversity

The FFQ used to assess the diversity of the diet was developed by the United Nations Food and Agriculture Organization (FAO) [12]. FAO recommends assessing the consumption of nine nutritious food groups to best reflect micronutrient intake at an individual level thus reflecting the quality of the diet [13]: (1) starchy staples; (2) legumes; nuts and seeds; (3) vitamin A rich fruits and vegetables; (4) other fruits and vegetables; (5) milk and milk products; (6) dark green leafy vegetables; (7) meat and fish; (8) eggs; and (9) organ meats. The adolescents were asked how often they consumed the various food groups: "Never", "daily", "weekly",

Please cite this article in press as: Berg T, et al., Nutritional status among adolescent girls in children's homes: Anthropometry and dietary patterns, Clinical Nutrition (2017), http://dx.doi.org/10.1016/j.clnu.2017.03.020