

## Protein-Energy Intakes and Nutritional Status of in-School Adolescents in Baham, Cameroon

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### Abstract

Poor nutritional status during adolescence is an important determinant of health outcomes at a later stage of life. Therefore, attention should be given to adolescent health and nutrition. The aim of the present study was to investigate the protein-energy intakes and nutritional status of in-school adolescents in Baham, Central sub-division of the upper plateau division of the western Region of Cameroon. A total of 770 in-school adolescents of Baham aged between 10 and 18 years were recruited for the study. Protein and energy intakes were estimated based on their food consumption recorded using a 7-days food diary. Protein and energy intakes obtained were compared with reference values. Anthropometric measurements included weight and height were analysed using the World Health Organizations' (WHO) AnthroPlus® version 1.0.2 statistical software. No significant differences were observed in the daily intakes in protein and energy ( $p > 0.05$ ) between male and female adolescents from 10 to 13 years. However, for adolescents aged 14 to 18, the daily intakes in proteins and energy were significantly higher for males compared to females ( $p < 0.05$ ). For all the subjects the protein intake was significantly higher than the needs while the energy intake was significantly lower than the needs ( $p < 0.05$ ). The prevalence of stunted and wasted was significantly higher in males than the females ( $p < 0.05$ ). In the contrary, the prevalence of overweight is significantly higher for females than for males ( $p < 0.05$ ). These results will be useful for nutritional advice and intervention in adolescent males and females in this community.

**Keywords:** Protein intake; Energy intake; Nutritional status; School adolescents; Baham; Cameroon

### Introduction

Malnutrition continues to be a major public health problem throughout the developing world, particularly in southern Asia and Sub-Saharan Africa [1,2]. The global prevalence of malnutrition is 13.6%, with the greatest proportion of the affected population found in the developing world [3]. Diets, in these populations are frequently deficient in macronutrients (protein, carbohydrates and fat), micronutrients (electrolytes, minerals and vitamins) or both [4,5]. Malnutrition is consequently the most important risk factor for the burden of disease in developing countries [6]. It is the direct cause of about 300,000 deaths per year and is indirectly responsible for about half of all deaths in young children [7]. The risk of death is directly correlated with the degree of malnutrition [8].

In Cameroon, approximately 45,000 children die each year due to malnutrition [9]. The prevalence of chronic malnutrition is 31.7% for children younger than 5 years old [10]. The latest nutrition survey conducted by the National Statistics Institute reported high rate and increasing prevalences of stunting (33%), underweight (15%) and wasting (6%) in children under 5 years [11]. The nutritional status of a population is an indicator of the level of development and future potential of the community. Determinants of child malnutrition should be periodically studied to monitor the situation and it is important to have appropriate interventions to prevent malnutrition [12].

Most studies of malnutrition in developing countries have focused on children under 5 year of age. There is relatively little nutritional informations available for adolescents, the age group with the highest growth velocity after infancy. According to the World Health Organization adolescence is a stage of development which corresponds roughly to the ages between 10 and 19 years [13]. In schooled adolescents, malnutrition and illness act as impediments to overall performance in school, as well as severely impairing psychomotor and intellectual development [14]. Adolescents have very special nutritional needs due to their rapid growth (lean body mass, fat mass, bone mineralization) and maturational changes associated with the onset of puberty.

According to nutritional surveys carried out mostly in developed world, many adolescents do not meet dietary requirements for their age group due to inadequate dietary intake of energy and proteins. Some adolescents have, however, problems with dietary excesses resulting in overweight and obesity as well as dietary inadequacies resulting in underweight [15]. Poor nutritional status during adolescence is an important determinant of health outcomes at a later stage of life. Therefore, attention should be given to adolescent health and nutrition. The aim of the present study was to investigate the protein-energy intakes and nutritional status of in-school adolescents in Baham, West Region of Cameroon.

## Materials and Methods

### Study area

The study was carried out in Baham, situated in the West Region of Cameroon. It is the Central sub-division of the upper plateau division of the western Region. It lies between latitudes 5°15'N and 5°21'N to the North of the equator, and between longitudes 10°21'E and 10°27'E. It has a subtropical climate. Its population is estimated at about 51,567 inhabitants [16]. In Baham, farming is the main occupation. The dishes consumed in Baham are prepared mostly from sweet potatoes, yams, cassava, unripe bananas, maize, soybeans, beans, peanuts, egusi seeds and green leafy vegetables [17].

### Sample population and sampling procedure

Schooled adolescents of Baham aged between 10 and 18 years were recruited. A total of 770 subjects (345 adolescents aged 10-13 years and 425 adolescents aged 14-18 years) participated in the study. The Schooled adolescents were divided into two groups (10-13 years and 14-18 years) according to their nutrient needs established by the Food and Nutrition Board of the Institute of Medicine (IOM) [18]. To be selected for the study, the Schooled adolescents had to be a permanent resident of Baham. Individuals were selected according to the ethnic homogeneity, allowing to limit the influence of the genetic factor on the variability of measurements, phenomenon which generally occurs at school age children and teenagers [19]. Moreover this homogeneity limits interethnic variability in food consumption. Screening questionnaires were completed to ensure that children were healthy. Adolescents were excluded from the study if they had been hospitalized within the past 3 months or were suffering from a medical condition that affected dietary intake.

### Dietary assessment

Protein and energy intakes were estimated from a 7-day measured inventory of food and drink. This method has been successfully used and validated with young people aged 4-18 years [20]. During a survey of the cooking methods and the consumption of the dishes in families chosen randomly in Baham, a scale (precision  $\pm 1$  g; Philips HR-2393, Hungary) was used to determine the exact quantity of each dish contained in one standard household measures (such as cups, tablespoons, etc.). All adolescents were issued a food record diary and standard household measures. Verbal instructions were given on how to complete the diaries. Protein and energy intakes were calculated from the dietary record of schoolchildren using data of literature and the Baham food composition table established by Fokou et al. [17]. Protein and energy intakes obtained were compared with reference values.

### Anthropometric indices

Anthropometric measurements included body weight and height, measured according to standard procedures described by Cogill [21]. Body weight, in light clothing with no shoes, was determined to the nearest 0.1 kg on a calibrated portable physician's scale. Height was measured to the nearest 0.5 cm with a Scales® 2000 portable stadiometer. All measurements were taken twice. The average of the two measurements was recorded. Anthropometric data for the adolescents were analyzed using the WorldHealth Organizations' (WHO) AnthroPlus® version 1.0.2 statistical software. Stunting was defined as a height-for-age z score  $< -2$  standard deviations (SD),

wasting as a BMI-for-age z score  $< -2$  SD and overweight as a BMI-for-age z score  $> +1$  SD [22]. Approval was obtained from the schools authorities prior to the commencement of the research. The teachers, students, and parents were well-informed of the scope and extent of the survey. Parents and adolescents signed a written informed consent.

### Statistical analysis

After adequately verifying the data distribution by the Kolmogorov-Smirnov test, the values for protein and energy intakes were compared with the reference values, using the Student t-test. The other results were analyzed using the Mann-Whitney U test. All statistical analyses were done with SPSS package (version 10.07) and the significant level was set at  $p < 0.05$ .

## Results

### Population Distribution

Table 1 shows the distribution of subjects in relation to their age group. Adolescents from 10 to 13 years represented 44.8% of the population with 20.4% of males and 24.4% of females. Adolescents from 14 to 18 years represented more than one-half of the population (55.2%) with 26.1% of males and 29.1% of females.

Age group	Males	Females	Total
10-13 years	157 (20.4)	188 (24.4)	345 (44.8)
14-18 years	201 (26.1)	224 (29.1)	425 (55.2)

Data presented as n (%)

Table 1: Distribution of subjects in relation to the age group (n=770).

### Protein and energy intakes and coverage rate of subjects' needs

Table 2 presents the average daily protein and energy intakes of subjects. No significant differences were observed in the daily intakes in protein and energy ( $p > 0.05$ ) between male and female adolescents from 10 to 13 years. On the other hand, the daily intakes in proteins and energy were significantly higher in male than the female adolescents from 14 to 18 years ( $p < 0.05$ ).

Parameters	Males	Females	Total
10-13 years	n=157	n=188	n=345
Protein (g/day)	42.13 $\pm$ 12.36	42.34 $\pm$ 11.70	42.24 $\pm$ 12.03
Energy (Kcal/day)	1835.58 $\pm$ 496.32	1820.93 $\pm$ 440.17	1828.26 $\pm$ 468.25
14-18 years	n=201	n=224	n=425
Protein (g/day)	54.48 $\pm$ 19.87*	48.82 $\pm$ 13.76	51.65 $\pm$ 16.82
Energy (Kcal/day)	2401.19 $\pm$ 748.14*	2072.92 $\pm$ 511.47	2237.06 $\pm$ 629.80

\* = significant difference at the threshold  $p < 0.05$  between sex. Comparison by Mann-whitney U test

Table 2: Average daily protein and energy intakes of subjects.

Table 3 compares intake and need (reference value) in protein and energy and determination of the coverage rate in subjects. In both groups, the intake in proteins was significantly higher than the needs for males and females, while their energy intake was significantly lower than the needs ( $p < 0.05$ ).

	Males			Females		
	Intake	Need**	Coverage rate (%)	Intake	Need**	Coverage rate (%)
<b>10-13 years</b>						
Protein (g/day)	42.13*	34	123.91	42.34*	34	124.53
Energy (Kcal/day)	1835.58*	2279	80.54	1820.93*	2071	87.93
<b>14-18 years</b>						
Protein (g/day)	54.48*	52	104.77	48.82*	46	106.13
Energy (Kcal/day)	2401.19*	3152	76.18	2072.92	2368	87.54

\* = significant difference at the threshold  $p < 0.05$  between intake and need. Comparison by student's t-test for sigle sample. \*\*= need established by the Institute of Medicine [18]

**Table 3:** Comparison between protein and energy intakes and need (reference values) and determination of coverage rate in subjects.

### Distribution of the subjects according to the nutritional status

Parameters	Males	Females	Total
10-13 years	n=157	n=188	n=345
Normal (%)	76.50*	75	75.75
Stunted (%)	11.50*	8.4	9.95
Wasted (%)	0.4*	0	0.2
Overweight (%)	11.6*	16.6	14.1
14-18 years	201	224	425
Normal (%)	62.8*	67.1	64.95
Stunted (%)	28.3*	6.2	17.25
Wasted (%)	0.5*	0	0.25
Overweight (%)	8.4*	26.7	17.55

\* = significant difference at the threshold  $p < 0.05$  between sex. Comparison by Mann-whitney U test

**Table 4:** Distribution of subjects according to the nutritional status.

Table 4 presents the distribution of the subjects according to the nutritional status. In adolescents aged 10-13 years, the prevalence of stunted and wasted were significantly higher ( $p < 0.05$ ) for males (11.50% and 0.4%, respectively) than for females (8.4% and 0.0% respectively). In the contrary, the prevalence of overweight was significantly higher ( $p < 0.05$ ) for females (16.6%) than for males

(11.6%). In adolescents aged 14-18 years, the prevalence of stunted and wasted were also significantly higher ( $p < 0.05$ ) for males (28.3% and 0.5% respectively) than for females (6.2% and 0.0%, respectively). In this age group, the prevalence of overweight was also significantly higher ( $p < 0.05$ ) for females (26.7%) than for males (8.4%).

## Discussion

### Protein and energy intakes and coverage rate of subjects' needs

The daily intakes in proteins and energy (Table 2) were higher for male (54.48 g/day; 2401.19 Kcal/day, respectively) than for female (48.82 g/day; 2072.92 Kcal/day, respectively) adolescents from 14 to 18 years. The difference observed was due to the difference in the quantity of food consumed by each sex. The protein intake of adolescents aged 10-13 years (Table 2) was low compared with the 45.2 g /day obtained by Priyanka Gupta et al. [23] among adolescent girls residing in an Urban Slum of Delhi (India). On the other hand the protein intake of adolescents 14-18 years (Table 2) was high compared with the 28.30, 45.2 and 50.4 g/day obtained by Ponka et al. [24] in adolescents cameroonian school children of Ngali II, Priyanka Gupta et al. [23] among adolescent girls residing in an Urban Slum of Delhi and Charukatare and Madhubala [25] among adolescent Girls Pursuing Undergraduate Studies at Orai (India), respectively. But the protein intake of adolescents 14-18 years (Table 2) was low compared with 62.7 g/day obtained by Doustmohammadian et al. [26] among adolescent girls in Tehran (Iran) and 59 g/day obtained by Gibson [27] in adolescents in Great Britain.

The energy intake of adolescents 10-13 years (1828.26 kcal/day) (Table 2) was high compared with the 1654 kcal/day obtained by Priyanka Gupta et al. [23] among adolescent girls residing in An Urban Slum of Delhi. The energy intake of adolescents 10-13 years was also high compared with the 1793 kcal/day obtained by Tornaritis et al. [28] in Cypriot adolescents. The energy intake of adolescents 14-18 years (2237.06 kcal/day) (Table 2) was high compared with 1649 kcal/day obtained by Charukatare and Madhubala et al. [25] among adolescent girls residing in an Urban Slum of Delhi. It was also high compared with the 1957.4 kcal /day obtained by Doustmohammadian et al. [26] among adolescent girls in Tehran (Iran).

The protein intake (Table 3) in all subjects was sufficient to cover the nutritional need established by the IOM [18]. In the contrary, the energy intake (Table 3) in all subjects was insufficient to cover the nutritional need. Protein plays a lot of important functions in the human body and in fact the human body is about 45% protein. They are essential macromolecules without which our bodies would be unable to repair, regulate, or protect itself. Essential body processes such as water balancing; nutrient transport and muscle contractions require protein to function [29]. Protein deficiency causes growth retardation, muscle wasting, edema, abnormal swelling of the belly and collection of fluids in the body [30] (Mounts, 2000). Previous studies like those of Tanner et al. (1987) in Tanzania, Pereira et al. [31,32] (1995) and Razanamparany et al. [33] in Madagascar, Man et al. [34] in Gambia, and Tonglet et al. [35] in Central Africa showed that protein-calorie malnutrition favors the evolution of malaria.

### Distribution of the subjects according to the nutritional status

The low prevalence of stunted (9.95-17.25%) and wasted (0.2-0.25%) in the population (Table 4) may be due to the appropriate protein intake. The high prevalence of stunted (11.50-28.3%) and wasted (0.4-0.5%) in males compared to females (6.2-8.4%) stunted and (0%) wasted would be related to relative low energy intake which could divert amino acid for energy production. The high prevalence of stunting and wasting in males may also be explained by the physical activity which is usually important in males compare to females. The high prevalence of overweight in females would be due to the fact that the coverage of energy was better in females (87%) and may be boys of this age were more active than girls. Moreover during the period of adolescence, females attend the puberty with the increase on their weight.

### Conclusion

From this study, no significant difference was observed in the daily intakes in protein and energy between male and female adolescents from 10 to 13 years. On the other hand, the daily intakes in protein and energy was significantly higher in male than the female adolescents from 14 to 18 years. In all subjects, the intake in protein was significantly higher than the needs while their energy intake was significantly lower than the needs. In adolescents, the prevalence of stunted and wasted was significantly higher in male than the female. In the contrary, the prevalence of overweight was significantly higher in females than the males. These results will be useful for nutritional advice and intervention in adolescent males and females in this community.

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