

*Full length Research Paper*

# Energy profile and Feeding Status of young adult Cameroonian university students

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**In Cameroon, malnutrition and micronutrient deficiencies are associated to emerging chronic diseases and are serious public health as reported on last nutritional surveys. The aim of this study was to evaluate the food and macronutrient intakes of 58 students comprising 39 male and 19 female, aged 21 to 31 years, in Douala, Cameroon. Average daily intakes of energy were then calculated from the protein, lipid and carbohydrate content of the food as reported on food composition tables. For males, the averages were 26 years, 22.43 Kg/m<sup>2</sup> and 2681 ± 1138 Kcal, for age, BMI and energy intakes respectively. For females, they were 25 years, 23.04 Kg/m<sup>2</sup> and 2266 ± 874 Kcal for age, BMI and energy intakes respectively. No case of underweight was observed. Education on food intakes of this group of Cameroonians is therefore needed along with further large scale studies.**

**Key words:** Foods, macronutrient, energy, intakes, young-adults, Cameroon.

## INTRODUCTION

Good nutrition is the cornerstone for survival, health and development for current and succeeding generations (Tontisirin and Yamborisut, 1995). In Cameroon, as in many developing countries the double burden of malnutrition is affecting the whole population's health. Its main roots are poverty and poor knowledge on food composition for optimal uses of available foods to maintain nutrition security. No study has addressed eating pattern of young adult and no national nutrition programme is available to the reduction of the malnutrition in the Country.

Overweight and obesity are among the most prevalent nutritional problems in developed and developing countries. They are risk factors of health problems such as cardiovascular diseases, diabetics, dislipidemia, some cancers... (Bener, 2006). Prevalences of these non communicable diseases linked to overfeeding and lack of physical activities, are increasing in developing countries at a very high rate at the same extend as undernutrition. 194 millions of people aged 20 to 79 years are diabetic

and 300 already obese percentage. If the parent is obese the children have 40% of chances to become obese and 80% if both parents are obese (Lefèbvre and Bouchard, 2004). In adolescents boy and girls aged 16 to 24 years, obesity has increased from 5.7 to 9.3% and from 7.7 to 11.6% respectively between 1995 and 2002 (Sproston and Premetesta, 2003).

Fulfilling the body requirements for energy and nutrients is essential for good health. This has been the concern of the WHO, whose recommendation for better nutrition was to make healthy and easy food choices (WHO, 1996). Intakes of energy and/or nutrients below or in excess of the body requirements for a prolonged period of time can adversely affect health through malnutrition. Malnutrition is a term used to describe many nutritional disorders ranging from under- to over-nutrition. It also includes macronutrient or micronutrient disorders. It is both a cause and consequence of poverty (ACC/SCN, 2000). Other underlying causes in many countries include the low financial status of women, poor prenatal care, low birth weights, high population densities, unfavourable child care practices, low levels of education and poor access to health services. The rapid population growth, conflicts and natural disasters in

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other countries have further exacerbated the situation.

Undernutrition is a major public health problem especially among young children and adolescents in some developing countries and some poor families in developed countries. The situation is now complicated by the HIV/AIDS pandemic which act in tandem (ACC/SCN, 2000). Controlling feeding practices of young adults could help to reduce the prevalence of chronic diseases during adulthood. Overnutrition (overweight and obesity) that was a nutritional disorder of great concern in industrialised countries and countries in transition is also becoming a call for concern now in developing countries like Cameroon because of its constantly increasing prevalence (Labadarios, 2005). The number of overweight individuals is similar to that of underweight individuals. Each of them is 1.1 billion (FAO, 2001). This situation is referred to as the double burden of malnutrition which involves the coexistence of both under and over nutrition.

In order to tackle this double burden of malnutrition, food consumption data are needed in any country to develop appropriate food-based dietary guidelines, for estimating nutrient intakes and monitoring changes in dietary behaviours and patterns (Burlingame, 2004). More and more over, data report nutritional status of adolescent boy and girls with increase prevalences ranging 40 and 16% for overweight and obesity respectively (Pourghassem et al., 2004; Bener, 2006). Many studies show that overweight and obesity in childhood and adolescence are highly predictive of adulthood weight and diseases (Serdula et al., 1993; Guo et al., 1994; Bakketeig, 1998). Despite the increasing rate of malnutrition in Cameroon, there is still very little research on food, nutrient consumption and nutrition security, especially on adolescents or young adults. The food and nutrient intakes of adult Cameroonians have been given very little interest. There is no data on the food consumption, nutrient and energy intakes of young adults of both sexes. Some researches have just focused on epidemiologic surveys, showing the poor nutritional situation (Lowe et al., 1993; République du Cameroun, 2001) and food composition. Due to the scarcity of studies on the energy intake of young adults, the objective of this study was therefore to assess the nutrient and energy intakes of young adults, who were Master's Degree students in the University of Douala. The work aimed at explaining how good nutrition and health status must be, based on well balanced diets, nutrients, non nutrients and some bioactive (functional) component (food) intakes.

## MATERIALS AND METHODS

The students enrolled in the study were highly selected according to their ability to know and distinguish the main foods. They followed training on nutritional survey and how to quantify and report their food intakes using a scale. Each student was taught how to record all the usual food items and the quantities eaten daily

for one week on 24 h recall basis. After a training seminar on the different classes of foods and the use of food composition tables, the students were assigned to record all the food items in different classes, which are usually eaten daily or available. They use the scale (to measure the amount of foods they consumed for the calculation of nutrient intakes and daily average energy intake. This served as a screening assessment for a study of the influence of zinc and iron supplementation on the bioavailability of natural sources of provitamin A carotenoids from papaya fresh fruit. The methods described by Haytowitz et al. (2002) and Harrison (2004) to identify the key foods for Food Composition Research were used as illustrated in table 1. Anthropometric measures (height and weight) were registered at the beginning and at the end of the study week.

The sample was representative of the whole country as the students were from all the ten regions (provinces) of Cameroon, because Douala has a cosmopolitan population that also influences the student foods habit and diversification. In Douala, inhabitants are from the whole country and each tribe group continue to eat some of the traditional meals which are usually share and adopted by neighbours. The data obtained from the analyses were statistically analyzed using SIGMASTAT 3.0. Comparisons between individual parameters and nutrients intakes, were done using analysis of variance (ANOVA) followed by Duncan's multiple range test with a significant probability of  $P < 0.05$ .

## RESULTS

The Master's degree students enrolled in the study were distributed in 64% of men and 36 % of women for a total of 58 students. From the student weekly food agenda, and 24 hour recall, it was noticed that most of the foodstuffs consumed were tubers (yams, cocoyams, Irish potatoes, sweet potatoes and many others), cereals (rice and maize), legumes (peanuts, soybeans and beans) very little fruits, vegetables and animal products. The choices of foods were not based on any particular knowledge, but on feeding habits according to the availability and affordability of meals. The average energy intake was  $2681 \pm 859$  Kcal for men, which lies between 1440 and 4706 Kcal, indicating a wide variability of energy intake in this group. For women, the average daily intake of energy was  $2266 \pm 960$  Kcal (Table 2). The average energy intake of women was lower than that of men, but with no significant difference between the two groups ( $P = 0.106$ ). However, few cases of overweight (20%) were observed in women. There was no significant difference between men and women energy intakes. The higher overweight percentage could be due to physical inactivity of the women. Table 2 shows that daily intakes of energy do not follow the recommended distribution.

The macronutrients contribution to energy (Table 3) intakes from proteins were respectively  $5.7 \pm 4.1$  and  $7.4 \pm 2.4\%$  for male and female. That of carbohydrates was  $64 \pm 12$  and  $63 \pm 7$  respectively for male and female and finally, the lipids contribute to  $32.34 \pm 11$  and  $28.43 \pm 8$  respectively for male and female to energy daily intakes. It is observed that the meals were very imbalanced by very low proteins intakes and high carbohydrates intakes.

Lipids daily intakes are acceptable. It was observed

**Table 1.** Illustration of one week daily record of food and energy intakes.

Days	Meal	Food and drinks	Quantity (g and ml)	Classes of food	Proteins (g)	Carbohydrates (g)	Lipids (g)	Ashes (g)	Fibre (g)	Energy (Kcal)
1	Breakfast	Tea	300	Drink	0.3	0	0	/	0	1.4
		Skimmed milk	50	Dairy products	1.8	2.5	0.1	/	/	18.0
		Lemon Juice	5	Fruit	/	1.0	/	/	/	5
		Butter	5	Fat	/	/	4.2	/	/	37.1
		Bread	30	Cereal	1.2	11.3	0.3	/	2.6	56.4
	Break	Cooked Eggs	50	Animal products	6.2	0.3	5.4	/	/	74.3
		Apple fresh	75	Fruits	0.3	8.6	0.3	/	1.5	38.9
		Irish potatoes	150	Tubers	2.9	21.4	0.2	/	/	102.9
		Carrot	125	Vegetable	1.2	4.5	0.2	/	4.6	26.3
		Oil	5	Fat	0.0	0.0	5.0	/	/	44.1
	Diner	Tea	300	Drink	0.3	0.0	0.0	/	/	1.4
		Lettue fresh	50	Vegetale	0.6	0.5	0.1	/	0.8	5.9
		Soya bean	10	0.0	0.0	/	9.9	/	/	87.2
		Bread	30	Cereal	1.2	11.5	0.3	/	2.6	56.4
Between	Apple fresh	75	Fruits	0.3	8.6	0.3	/	1.5	38.9	
2*										
3*										
4*										
5*										
6*										
7*										

\* Days 2, 3, 4, 5, 6, 7 are filled exactly like day 1 at breakfast, break launch, diner and between meals.

that Student consumed very little fruits and vegetables.

Figures 1 and 2 show the parameters (age, weight, height and BMI) for men and women respectively. For the men, the average age was  $25.8 \pm 2.4$  years, ranging from 22 to 31 years. The average BMI was  $22.4 \pm 1.9$  Kg/m<sup>2</sup> for men and  $23.0 \pm 2.3$  Kg/m<sup>2</sup> for women.

The average weight was  $66.38 \pm 6.55$  Kg for men and  $64.21 \pm 10.37$  Kg for women, with no significant difference between the two groups ( $p = 0.344$ ). The difference is linked to the heights. For young adult women, the average age was  $25.11 \pm 2.47$  years, ranging from 21 to 28 years, average BMI was  $23.04 \pm 2.37$  Kg/m<sup>2</sup> with 4 of them between 25 and 27 Kg/m<sup>2</sup>, indicating grade

1 overweight. There was no significant difference between the mean BMI values of the two groups ( $p = 0.306$ ). The study was carried out during academic year, meaning that during holidays, in absence of physical and intellectual activities the percentage of overweight could be higher. There was a significant difference ( $p = 0.006$ ) between the average height of the two groups, which was

**Table 2.** Average energy consumption for 7 days by men and women.

Identification number	Man	Women
1	1578.21 ±67.34	2266.85±123.34
2	3362.43±152.02	775.8± 129.21
3	2247.3±123.33	2065.55±201.22
4	1033.54±112.21	2131.17±145.33
5	2279.48±213.42	3916.16±233.76
6	3993.75±267.11	2573.9±213.42
7	2584.54±132.34	1477.92±113.12
8	1440.88±211.02	2390.81± 251.41
9	2781.31±135.54	2161.26±262.44
10	3876.9±322.32	1350.28±231.11
11	2883.5±244.42	2781.32±213.42
12	4706.7±256.35	3064.19±267.11
13	2781.31±138.94	645.98±78.32
14	2228.29±211.45	3496.67±265.45
15	2739.38±169.38	2515.07±213.47
16	1732.01±122.43	724.46±234.12
17	3503.04±322.49	2781.31±237.62
18	1602.34±152.5	3774.13±225.13
19	3658.61±245.39	2389.23±138.94
20	4038.83±324.54	Average 2266.16
21	2595.92±231.32	±960.71
22	2365.61±341.87	
23	3435.65±322.12	
24	1304.75±98.21	
25	2591.22±213.22	
26	2523.4±211.78	
27	3689.62±298.64	
28	2074.3±198.78	
29	2218.29±187.29	
30	2141.21±112.97	
31	3204.44±289.34	
32	1664.27±119.31	
33	2781.72±178.92	
34	2871.49±211.45	
35	1992.62±132.3	
36	3454.45±322.12	
37	3241.03±297.45	
38	2781.31±168.94	
	Average 2681.14	
	± 859.	

1.72 ± 0.06 m for men and 1.67 ± 0.08 m for women, respectively, However men are taller than women.

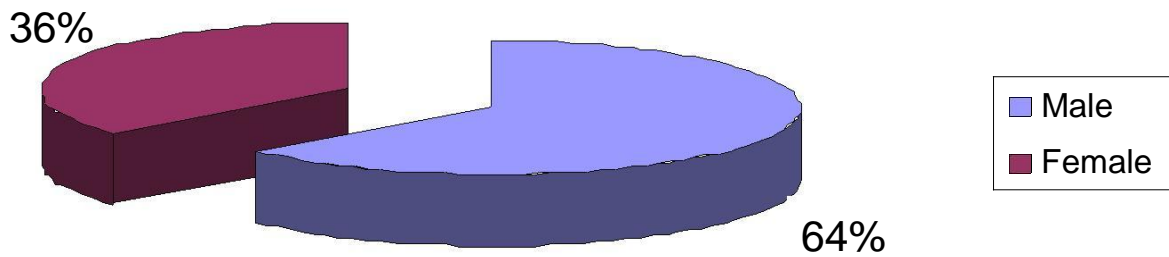
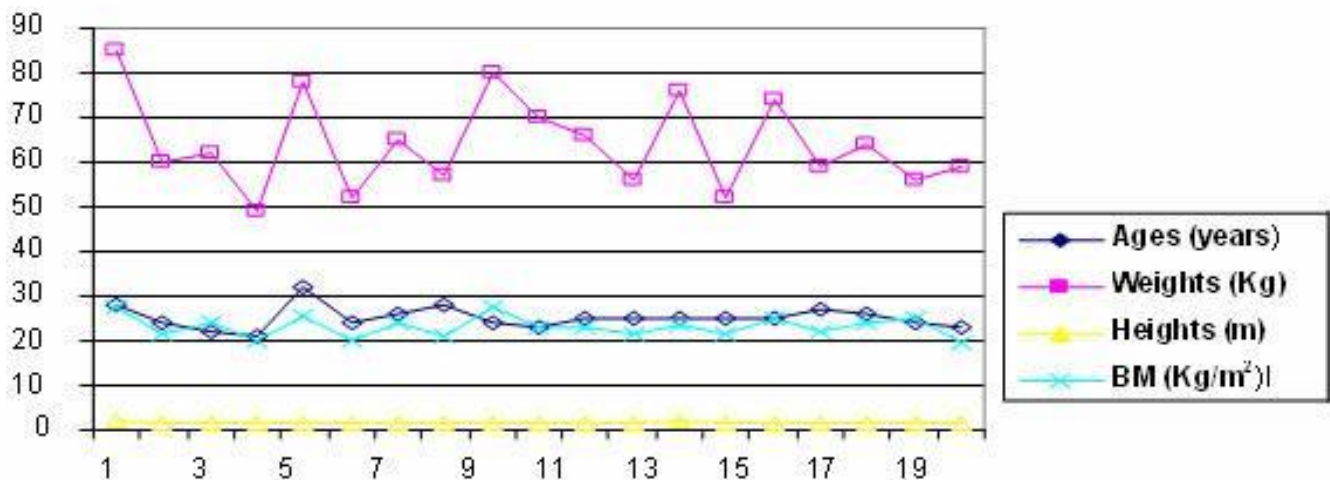
## DISCUSSION

The choice of meals was not based on any notion of nutrition security that is necessary for optimal feeding.

The meals were imbalanced in terms of contribution to daily energy intakes. For proteins, carbohydrates and lipids, we obtained respectively for male and females values ranged from 5.7 ± 4.1 to 7.4 ± 2.4%; 64 ± 12 to 63 ± 7 and 32.34 ± 11 to 28.43 ± 8. Acceptable Macronutrient Distribution Ranges (AMDRs) have been estimated. AMDRs was defined as a range of intake for a particular energy source that is associated with reduced

**Table 3.** Contribution of macronutrients to energy coverage.

Subjects	Proteins (%)	Recommended energy from protein (%)	Lipids (%)	Recommended energy from lipid (%)	Carbohydrates (%)	Recommended energy from carbohydrates (%)
Men (n = 38)	5.7 ± 4.1	12 - 15	32.34 ± 11	30 - 35	64 ± 12	50 - 65
Women (n = 19)	7.4 ± 2.4	12 - 15	28.43 ± 8	30 - 35	63 ± 7	50 - 65

**Figure 1.** Percentage of sex distribution of students. Men represented 64% and Women 36% of a total of 57 Master's degree students involved.**Figure 2.** Female parameters.

risk of chronic disease while providing adequate intakes of essential nutrients. The AMDR for fat and carbohydrate was estimated to be 20 to 35% and 45 to 65% of energy, respectively for all adults. The AMDR for protein is 10 to 35%, 5 to 20% and 10 to 30% of energy for adults, young and older children, respectively by WHO/FAO in 2003. The poor nutritional balance observed from different diets no data as summarised above could expose the students to chronic diseases, if these young people do not use the extra energy in intellectual work and do more physical activity.

The lack of knowledge on good feeding habits and balanced diets leads to very a poor nutritional status of

our student population (Haytowitz, 2002). Also, nothing is taken into account concerning the characteristics (structural and objective data) and performances (functional and subjective quality) of foods that are necessary to ensure the food and nutrition security of the population as described by (Janghorbani and Parvin, 1998). These are some of the reasons for the increasingly poor nutrition as double burden in Cameroon. It is clearly reported that strategic for promoting health must be based on scientific evidence on the ways in which peoples dietary and physical activity patterns have positive or adverse effects on health (Burlingame, 2004).

The average daily energy intake of men was greater than that of women (Figure 1). The difference in the mean values of the two groups can be due to the variability in random sampling. Most of the male students were also physically active and this could raise their daily energy intakes.

Twenty percent of students, and mostly women were overweight. This could lead to chronic diseases (obesity, cardiovascular diseases, hypertension some cancers) if no interventions for diet improvement and physical activities are carried out. Obesity is a problem with complex causes linked to energy intake and output, and also to the accumulation of large amounts of body fats (ACC/SCN, 2000). Many studies have shown that obesity in childhood continues to adulthood with emerging chronic diseases. Overweight in adolescent girls has been reported in many countries, 13.3% in Iran (Pourgasseem et al., 2004). In other studies, 14% of adolescent girls were overweight in Iran (Gargari, 2004), 10 to 20% and 39.3% of overweight/obesity were reported on American adolescent girls in US (Pawson et al., 1991; Troiano, 1995).

There was no significant difference between men and women that could be due to physical inactivity of the women. Men were more physically active in addition to their intellectual activities. It has been reported that some benefits from physical activity can be achieved within a minimum of 30 min of moderate activity for most days of the week. The distribution of BMI was within the normal range for male. and 21% grade 1 overweight for women, according to the WHO Expert Committee on Physical Growth based on the following classifications: Mild underweight (BMI = 17.00 to 18.49 kg/m<sup>2</sup>), moderate underweight (BMI = 16.00 to 16.99 kg/m<sup>2</sup>) and severe underweight (BMI < 16.00 kg/m<sup>2</sup>). These three groups are considered to be chronically energy deficient (CED). For overweight, the categories are as follows: Grade 1 (BMI = 25.00 to 29.99 kg/m<sup>2</sup>), Grade 2 (BMI = 30.00 to 39.99 kg/m<sup>2</sup>) and Grade 3 (BMI > 40.00 kg/m<sup>2</sup>). No cases of underweight, grade 2 and grade 3 overweight were reported. Mortality in both men and women is high in individuals with a high BMI and underweight is common in women in developing countries. However, 30 min of regular daily activity is insufficient to maintain body weight in adults in the recommended BMI range (18.5 to 25 kg/m<sup>2</sup>) and fully derive all the identified health benefits.

Hence, to prevent weight gain and to accrue additional weight-independent health benefits of physical activity, 60 min of daily moderate activity (e.g. walking/jogging at 6 to 8 km/h) was recommended in addition to the activities required by a sedentary lifestyle (WHO, 1996; WHO/FAO, 2003).

## Conclusion

This study has revealed that knowledge of dietary guidelines that give advice on consumption or food

components which can be used to achieve optimal nutrition is not vulgarised. Students consume very little fruits and vegetable which are sources of most of vitamins. Ensuring maximum well-being, health and quality lifespan is very much based on infectious health in our system. Bearing in mind that malnutrition contributes in all its forms directly or indirectly to over 56 to 60 % of illnesses, nutritional education is necessary for any health intervention. The root of the problem is the lack of Food Science and Nutrition related disciplines in Primary, Secondary, High Schools and in the Universities. If nothing is done in terms of food and nutrition trainings and nutritional education. The cases of overweight observed could lead to obesity. Due to the increasing prevalence of chronic diseases related to obesity, education and information must focus on school children and adults of both sexes. The efforts to eliminate or eradicate nutritional deficiencies must continue. Nutrition and healthy lifestyles should be addressed in the school curriculum. Physical activity should be promoted for children in schools during school hours and in the general population. Sugar and fat intakes should also be reduced.

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## REFERENCES

- Pourgasseem B, Garga, Hamed M, Saeideh HB Ghassab Pour G, Ayat A (2004). Prevalence of overweight and obesity among high-school girls in Tabriz, Iran, in 2001. *Food Nutr. Bull.*, 25 (3): 288-291.
- Bener AB (2006). Prevalence of obesity, overweight and underweight in Qatari adolescents. *Food Nutr. Bull.*, 27(1): 39-45
- Bakketeig LS (1998). Current growth standards, definitions, diagnosis and classification of fetal growth retardation. *Euro. J. Clin. Nutri.*, 52(S1): 1-4.
- Burlingame B (2004). Fostering quality data in food composition databases. *Visions for the future*, 17: 251-258.
- FAO (2001). *The State of food insecurity in the world*. Ed. FAO, Rome, pp. 10-36.
- Gargari BP, Behzad MH, Ghassabpour S, Ayat A (2004). Prevalence of obesity among high-school girls in Tabriz, Iran, in 2001. *Food Nutr. Bull.*, 25 (3): 288-291.
- Guo SS, Roche AF, Chumlea WC, Gardner JD, Siervogel RM (1994). The predictive value of childhood body mass index values for overweight at age 35. *Am. J. Clin. Nutr.*, 59: 810-25.
- Harrison GG (2004). Fostering data quality in food composition databases: applications and implications for public health. *Am. J. Nutr.*, 17: 259-265.
- Haytowitz DB, Pehrsson PR, Holden JM (2002). The identification of key foods for food composition research. *J. Food Comp.*, 15: 183-194.
- Janghorbani M, Parvin L (1998). Prevalence of overweight and thinness in high-school girls in Kerman Iran. *Int. J. Obesity Relat. Metab. Disord.*, 2: 629-33.
- Labadarios D (2005). Presentation highlights : Vitamin A and the common agenda for micronutrients. XXII IVAG meeting held 15-17 November 2004 in Lima, Peru. *Sight and Life newsl.*, 1: 9-17.
- Lefebvre B, Bouchard V (2004). *Diabetes and Obesity: Time to Act*. Roche, pp. 1-57.

- Lowe JC, Nestel P, Rustein PO (1993). Santé au Cameroun en 1991. Lowe JC, Nestel P, Rustein PO (1993). Nutrition and health of young cameroonians. Results of Health and Demographic Survey in Cameroon in 1991. Macro International Inc. Collumbia, Maryland USA, pp. 13-25.
- Pawson IG, Martorell R, Mendoza SA (1991). Prevalence of overweight and obesity in US Hispanic populations. *Am. J. Clin. Nutr.*, 1991; 53(6 suppl): 1522S-1524S.
- Republic of Cameroon (RC) (2001). National Survey on Vitamin A Deficiency and Anaemia in Cameroon, pp 23-37.
- Serdula MK, Ivery D, Coates RJ, Freedman DS, Williamson DF, Byers T (1993). Do obese children become adults? A review of the literature. *Prev Med.*, 22: 167-177
- Sproston K, Primetesta P (2003). Health survey of England 2002. The health of children and young people. The stationery office, 1: 27-35
- Sub-Committee on Nutrition (ACC/SCN) (2000). 4<sup>TH</sup> Report on the World Nutrition Situation: Nutrition throughout the lifecycle, Technical Report Series, 1(82): 452.
- Tontisirin K, Yamborisut U (1995). Appropriate weaning practices and foods to prevent protein-energy malnutrition: An Asian review. *Food Nutr. Bull.*, 16(1): 82-100.
- Troiano RP, Flegal KM, Kuczmarski RJ, Campbell SM, Johnson CL (1995). Overweight prevalence and trends for children and adolescents. The National Health and Nutrition Examination Surveys, 1963 to 1991. *Arch. pediatr. Adolesc. Med.*, 149: 1085-1091.
- WHO (1996). Low Birth-Weight: A Tabulation of Available Information. Maternal Health and Safe Motherhood Programme, Geneva, WHO/MCH/92.2, updated version of September, 1996. Geneva: WHO, pp. 1-6.
- WHO/FAO (2003). Diet, Nutrition and the prevention of Chronic Diseases, p. 149.