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ANTHROPOMETRIC PROFILE AND DIETARY HABITS OF STUDENTS OF NANGUI ABROGOUA UNIVERSITY IN CÔTE D'IVOIRE, A PILOT CROSS-SECTIONAL STUDY

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The nutritional status of the students was determined using a descriptive cross sectional survey during the first three weeks of December 2015. The population of the study consists of 156 students aged 18 to 34 from Nangui Abrogoua University of Côte d'Ivoire. Data collection concerned the anthropometric measures, the food habits and the frequencies of usual consumption of food estimated by means of questionnaire, as well as biochemical analysis of some food mainly eaten at lunch. The nutritional evaluation based on body mass index showed that 74.36% of students have a better nutritional status, 25.69% have a likely bad nutritional status with 17.95% in underweight and 7.74 in overweight including the obesity. Lunch (82.7%) and dinner (94.9%) represent both meals whose are more consumed by most of the subject. The energy contribution of the food mainly eaten at the university restaurant varies between 690 and 973 Kcal. These meals are unbalanced with the carbohydrate intake raised to more than 60% of the total energy intake and the low lipids contribution varying from 10.5% to 20.19%. As for proteins, their contribution which varies from 9.72% to 15.37% is good for all the menus.

Keywords: Nutritional status, Dietary habit, Student, Nangui Abrogoua University

INTRODUCTION

A healthy and well-balanced diet Is one that covers all the nutritional needs for the body, because it is a major element to maintain someone in good physical and intellectual condition. At the world level, the food constitutes a major stake and arouses diverse concerns.

It is well established that an inadequate diet, associated with low level of physical activity, is one determinant of the main causes of chronic diseases, such as cardiovascular diseases (Dargent-Pare, 2001; FAO/OMS, 2003; and Lichtenstein, 2006), some cancers Pan (SY, 2009), the type 2 diabetes (Parillo, 2004); or in them factors of risk (obesity, high blood pressure, dyslipidemic) (Herceberg, 2008).

A growing number of developing countries are faced with a "double burden of malnutrition": the persistence of undernutrition, especially among children and students, along with emerging problems of overweight and obesity, and diet-related chronic diseases (Vorster, 2005; and Sodjinou, 2008). Both conditions are often associated with problems of micronutrient deficiencies. Taken together, these problems are significant causes of disability and premature death worldwide.

In Africa, the co-existence of undernutrition and obesity is becoming more widespread and imposes an additional burden on already stretched social and health care services, especially in urban areas.

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Improving the nutritional status of school-age children and students is an effective investment for the future. Schools offer many opportunities to promote healthy dietary patterns, influence lifestyle choices for children or students and engage parents and community members in preventing children's malnutrition.

In Côte d'Ivoire, there are also nutritional problems according to several research works and reports of international organizations. Indeed, the proportion of population which is in state of malnutrition or undernutrition is estimated at 15% in 2013 (FAO, 2014). Notwithstanding, few studies have investigated the nutritional profile of university students and factors associated with such profile. Such data could be useful in guiding the planning and implementation of health interventions at the university - an institution considered to be important in forming students' habits.

The objective of this study is to determine students' eating habits, estimate their nutritional status and determine the nutritional composition of their lunch meals over a given period.

MATERIAL AND METHODS

Research Description

This study was carried out according to an interview-based descriptive research at Nangui Abrogoua University of Côte d'Ivoire in December 2015. One-hundred-fifty-six students aged 18-34 took part in the study. The study contains a descriptive aspect on students' behaviour and food habits, their nutritional status as well as the frequencies of usual consumption of food.

The sampling population was established with a 95% confidence interval and approximately 6% of error was made in a random way on voluntary students of both sexes.

The first step of the study consisted in a nutritional survey using the questionnaire. The working tool is an already existing questionnaire which was adapted so as to be able to collect a maximum of information on the dietary behaviour of the students.

Then the second part consisted in taking meals mainly consumed at the university canteen to determine their biochemical compositions and their energy values (Danel,1990; and Bencharif, 2011).

The Questionnaire

The questionnaire was in three parts:

- The first part concerns the information on the students: the sex, the age, the place of residence and the level of study.

The second part concerns:

- The dietary behaviour of students, that is to say the information on their food habits (number of meals a day, the regularity), and the perception of the individual concerning its own diet (in quantity and in quality).
- The third part is related to the frequency of food consumption. The majority of food (dishes, sauces and drinks) that may be eaten were used to identify their groups such as: The milk and their products, Cereal, starchy foods and their products, Meats, fishes and eggs; fruits; fats; drinks and sauces. The individuals quoted what they had consumed in the latest week and at what frequency.

Anthropometrical Measurements of Students and Chemical Analysis of Consumed Food

The anthropometric parameters included the measurement of body weight and height (SECA digital scale with an approximation of 0.5 cm and 0.1 kg respectively), was used for the calculation of Body Mass Index (BMI) of the students. This was assessed with the criteria recommended by the World Health Organization (WHO, 1998), which considers individuals with BMI < 18.5 kg/m^2 as underweight, between 18.5 kg/m^2 and < 25.0 kg/m^2 as eutrophic, between 25.0 kg/m^2 and 30.0 kg/m^2 as overweight, and $\geq$ 30.0 kg/m^2 as obese.

Then, some food usually eaten at noon at the university canteen was taken for the biochemical analysis. Every day and during a week, meals served at the restaurant were bought and transported in an icebox to the laboratory. Mixtures of food were weighed then crushed and dried at 80 °C during 48 hours. Flours obtained from the various meals were used for chemical analysis: crude proteins (Kjeldahl method) and fat (Soxhlet method) (AOAC, 1990) and total carbohydrates (Dubois *et al.*, 1956). The energy values of the food were estimated according to the method of Attwater and Rosa (1899).

Statistical Analysis

The questionnaire was developed from software Sphinx Plus^2. The data were treated there before being transformed into Excel file for the realization of figures. The results are

expressed in the form of average ± standard deviation and in percentage.

RESULTS

Characterization of the Subject

The studied subjects were composed to 83 boys (53.21%) and 73 girls (46.79%) (Table 1). The average age was 23.35±4.56 years with 24.13 for men and 22.49±3.40 for girls. The boys are significantly older than the girls ($p < 0.05$). 71.79% of the students live with their parents, 39.1% of them are women and 32.69% are men.

The percentage of boys who rent (7.05%) or who co-rent (7.05%) houses is higher than that of women (0.64% and 1.92%, respectively). Very few students, boys or girls (0.64-1.28%) live in student residences.

Food Consumption

In the sample of participants studied, approximately 47% of them take more than 3 meals per day and 51% take less than 3 meals (Table 2). There is no significant difference for daily intake meals among both sexes. 29.49% of the boys take 2 meals/day compared to the girls (19.87%). There is no difference between the percentage of boys and girls (20.51% and 21.79% respectively) who take 3 meals/day.

Frequency of the Food Intake

The results (Figure 1) indicated that they were very few students who have breakfast always, they were 14.74% against 59% in an irregular way and 25.6% have breakfast rarely.

Practically lunch and dinner are the meals favoured by more than three quarter of the students (that is 82.7% for lunch and 94.2% for dinner).

The analysis of the results shows that the frequency of students who have regularly breakfast is almost the same for men and women (9.62% vs 5.13%, $p>0.05$). 8.46% of the students never take breakfast (Figure 2). The main reason of the jump of the meal was the lack of time.

Anthropometric Assessment

The students' mean total Body Mass Index (BMI) was 20.88±2.95 Kg/m² (Figure 3) with the variation between 15.57 and 31.25 Kg/m². There was no significant difference between the mean BMI of boys (21.20±3.27 kg/m²) and the mean BMI of girls (20.61±2.62). 74.36% of the students were normal (18.5 < BMI< 24.9), 17.95% were underweight BMI < 18.5 kg/m²) and 7.74% (BMI < 24.9 kg/m²) were overweight and obese.

Composition of the Lunch

The composition of the lunch of the University canteen is giving the Table 3. The local meals semolina of cassava called *attiéké*, the rice and the paste of cassava called *placali* were the meals which were often eaten at the proportion of 66.67%, 54.49% and 52.62% respectively.

For milk and milk products, results shown that only 1.8% of students eat it in the form of yoghurt (1.28%) and *dèguê* (0.64%). The *dèguê* is the local yoghourt which contains granule of millet flour. High proportions of students never eat milk products, 39.74% for the yoghurt and 42.31% for

Table 1: Distribution of Students According of the Hosting Residence

Residence	Subject				Total (%)	n
	Boys (%)	n	Girls (%)	n		
In family	32.69	51	39.1	61	71.79	112
Student residence	1.28	2	0.64	1	1.92	3
Co-rent	7.05	11	0.64	1	7.69	12
On campus	1.92	3	2.56	4	4.49	7
Renting	7.05	11	1.92	3	8.97	14
Others	3.21	5	1.92	3	5.13	8
Total (%)	53.21	83	46.79	73		156

Note: n = number.

Table 2: Distribution of Students (in % of the Investigated Population) According to the Number of Meals and by the Sex

Number of Meal/Day		Subject		Total (%)
		Boys (%)	Girls (%)	
Less than 3 meals	1	0.64	0.64	1.28
		(n=1)	(n=1)	(n=2)
	2	29.49	19.87	49.36
		(n=46)	(n=31)	(n=77)
3 meals	3	20.51	21.79	42.3
		(n=32)	(n=34)	(n=66)
More than 3 meals	4	1.92	3.2	5.13
		(n=3)	(n=5)	(n=8)
	4 and more	0,64	1,28	1,92
		(n=1)	(n=2)	(n=3)
	Mean ± SD (meal/day)	2.49 ± 0.69	2.67 ± 0.75	2.57 ± 0.72

Note: (n) is the number of the subjects (male and female).

dèguê. These proportions were higher to for those who often eat it (19-23%) and rarely (35-37%).

As regards meats and fishes, half of the studied subject often eat them in the respective proportions of 53.21% and 49.36%. It indicates a regular consumption of meats and fishes at lunch.

For Fruits, results indicate that more than 50% of the investigated eat fruits to the lunch. As for fats, only 20% of the subjects declare to consume it often against 34.62% rarely and 35.90% which never take it.

The consumption of beverage shown that 41.67% of students prefer the local juice.

Results indicated that the students prefer sauces based of vegetables (mixture of tomatoes, courgettes, aubergines, cabbages, carrot, etc.) at 71.79% and 75.56%.

Biochemical Composition and Food Balance of the Lunch

Tables 4 and 5 show restaurant menus and macronutrients (carbohydrates, proteins and lipids) intake, the energy intake and the dietary balance of diets.

As documented in Table 5, the energy contribution of various restaurant menus varied from 690 to 973 kcal. menu 1 (973.05 kcal) gave higher energy value. menus 2, 3, 4 and 6 have practically the same energy values. They are superior or equal to 846 kcal. Only menu 5 has the smallest energy value (690.31 kcal).

Carbohydrates contribute to the energy value more than 60% for most part of the menus, among which the strongest part is 74.59% for menu 5.

Figure 1: Distribution of the Students According to Meal Frequency Rate

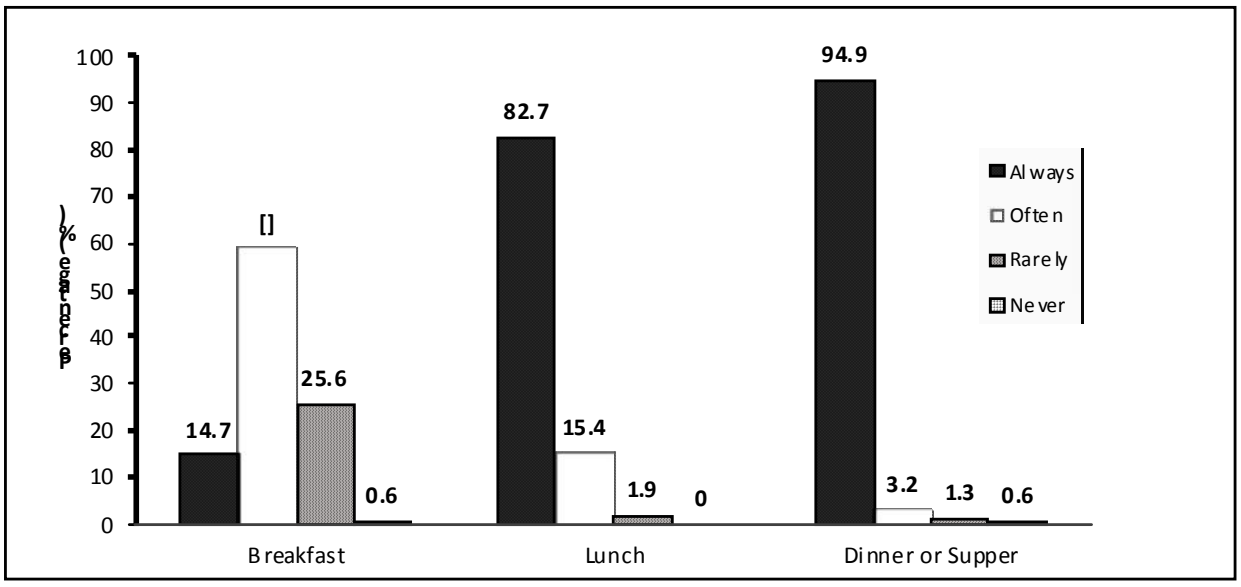


Figure 2: Distribution of the Students According to Meal Skipping Rate

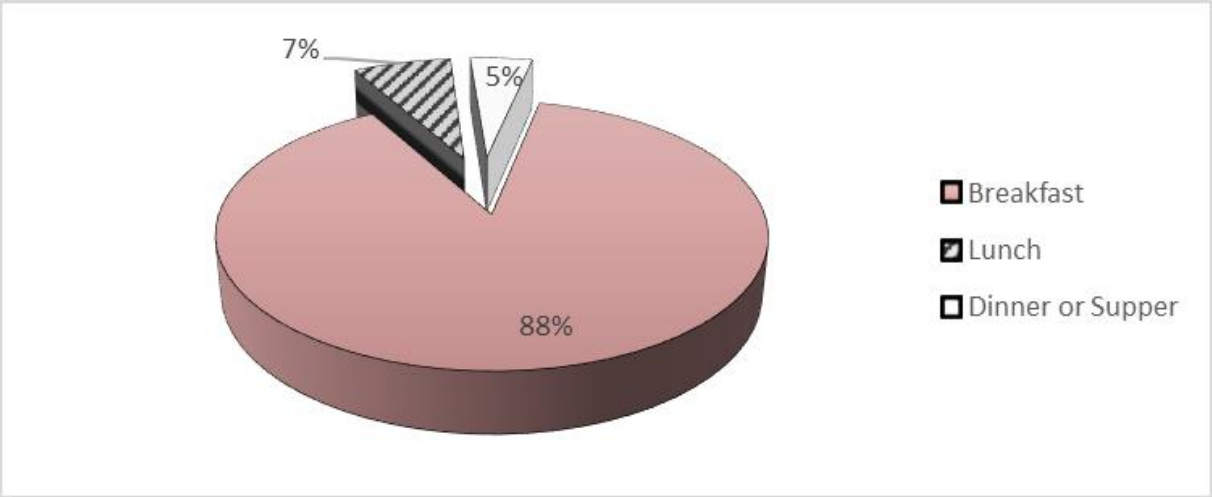
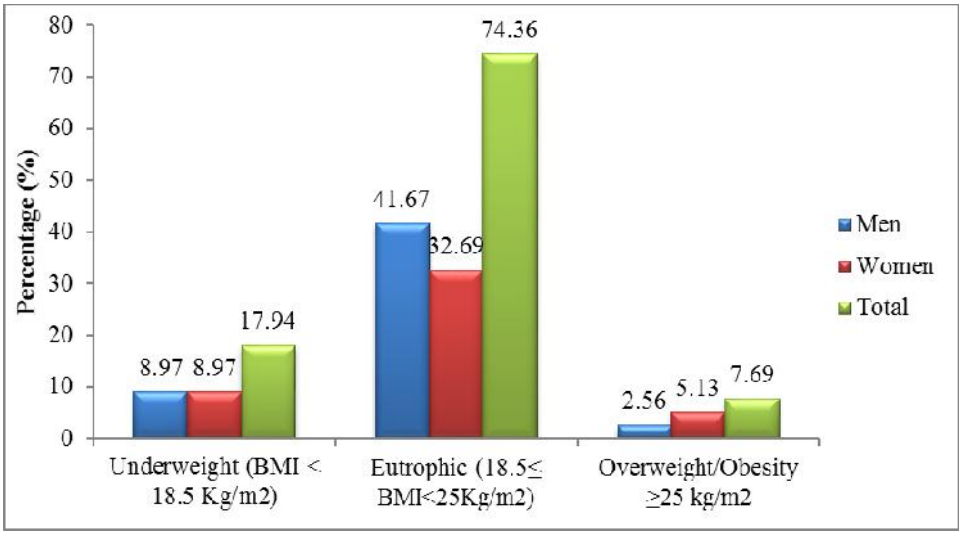


Figure 3: Distribution of the Students According to the Weight Status and the Sex



As for proteins, their contribution varies from 9.72% to 15.37% for all the menus.

In all the menus, except menu 2, lipids parts vary from 10.5% to 20.19%. Only menu 2 gives a proportion of 28.35% bordering part recommended for lipids in a daily food ration.

DISCUSSION

The results obtained in this study show irregularity for most students' dietary behaviour. That can be explained by the fact that most of students live in family and have not lot of time to take the breakfast. As evoked by some of the students, this irregularity could also be due to financial problems.

Among the three main meals of the day, the breakfast showed the highest rate of omission. This must point the attention, because it can compromise students' health. Skipping breakfast implies metabolically undergoing a period of fasting of more than twelve hours, in general, during which the body does not receive nutrients. Thus, breakfast is recognized as the most important meal of the day for its

Table 3: Distribution of Students According the Frequency of Eating the Food at the Lunch

Food		Always		Often		Rarely		Never	
		Staffing	Percentage (%)	Staffing	Percentage (%)	Staffing	Percentage (%)	Staffing	Percentage (%)
Cereals, Starchy foods and Legume	Rice	62	39.74	85	54.49	6	3.85	3	1.92
	Spaghetti	5	3.2	74	47.44	54	34.62	23	14.74
	«Attieké» (Semolina of cassava)	37	23.72	104	66.67	10	6.41	5	3.2
	«Placali» (paste based cassava)	8	5.13	82	52.62	34	21.79	32	20.51
	«Foutou»	6	3.85	60	38.49	57	36.54	33	21.15
Milk and milk product	Yoghourt	2	1. 28	36	23.08	55	35.26	62	39.74
	Dèguê	1	0.64	31	19.87	58	37.18	66	42.31
Fruits		33	21.15	84	53.85	32	20.51	7	4.49
Meat and Fish	Meat	22	14.1	83	53.21	35	22.44	16	10.26
	Fish	59	37.82	77	49.36	12	7.69	8	5.13
Fatty matters	Butter, margarine and oil	14	8.97	32	20.51	54	34.62	56	35.9
Water and beverage	Local juice	5	3.2	65	41.67	53	33.97	33	21.15
	Soda	4	2.56	42	26.92	70	44.87	40	25.64
	Alcohol	0	0	19	12.18	34	21.79	103	66.03
Sauce	Aubergine	21	13.46	118	75.56	13	8.33	4	2.56
	Pulp of palm	9	5.77	91	58.33	49	31.41	7	4.49
	Okra	5	3.2	65	41.67	68	43.59	18	11.54
	Leaves	6	3.85	99	63.46	46	29.49	5	3.2
	Legumes	14	8.97	112	71.79	27	17.31	3	1.92

Table 4: Composition of the Menus Offered to the University Canteen of the Nanguy Abrogoua University

Restaurant Menu	Composition
Menu 1	*Placali* , sauce of okra, fish and fruit
Menu 2	Rice, sauce of pulp of palm, fish and fruit
Menu 3	Rice, sauce of vegetable (carrot, tomato, courgette, cabbage), meat and fruit
Menu 4	Spaghetti, tomato juice, fish and fruit
Menu 5	Rice, sauce of aubergine, meat and fruit
Menu 6	*Attiéké* , tomato juice, fish and fruit

Note: *Placali*: The local meals based paste of cassava; *Attiéké*: The local meals based semolina of cassava.

role in the health context and in the understanding of human physiology.

The literature points out that the access to higher education is still influenced by the socioeconomic level of students (Considine et *al*., 2002).

In 2001, Cissé and collaborators showed a regularity in the frequency of the daily meals to more than 90% of the Senegalese students who lived in student residence. These students had a restaurant contrary to those of our study, the majority of whom live with their parents

In the present study, lunch and dinner were given priority by the participants, 82.7% for lunch and 94.9 for dinner.

Indeed, many students chose to wait for the lunch rather than having breakfast because they have financial problems.

Table 5: Biochemical Composition and Energy Contribution of Macronutrients of the Restaurant Menus

Macronutrient		Menu 1	Menu 2	Menu 3	Menu 4	Menu 5	Menu 6	Recommendations (Martin 2001) (% TEI)
Carbohydrates	(g)	165.56±0.02	136.11±0.02	144.53±0.02	158.41±0.02	115.58±0.02	147.56± 0.02	
	% TEI	68.04	61.19	67.7	71.7	66.96	69.65	50 - 55
Lipids	(g)	19.22±0.03	27.69±0.03	15.90±0.03	16.46±0.03	7.71±0.03	18.97±0.03	
	% TEI	17.77	28.35	16.76	16.76	10.05	20.15	30 - 35
Proteins	(g)	34.52±0.05	21.37±0.05	33.16±0.05	25.47±0.05	39.66±0.05	21.62±0.05	
	% TEI	14.19	9.72	15.53	11.53	22.97	10.2	10 - 15
TEI/Lunch	(Kcal)	973.3	879.13	853.86	883.66	690.35	847.45	2800

Note: TEI: Total Energy Intake.

Adolescents whose habitually skip breakfast were from low socioeconomic backgrounds. According to Rampersaud *et al*. (2005), the number of adolescents skipping breakfast appears to be increasing in developing countries.

The high proportion of students eating lunch could be due to the presence of a student restaurant located on the campus that offers low cost of meals. As for dinner, most students take it at home after their courses.

According to the IFIC (2012), the breakfast plays an essential role for reaching the nutritional recommendations. Cooper *et al*. (2011) examined the effects of breakfast consumption vs. breakfast omission on adolescent's cognitive function and mood. Their study used a randomized crossover design with trials scheduled 7 days apart. Results showed that accuracy on the more complex level of the visual search task was higher following breakfast consumption compared to breakfast omission.

Anthropometric parameters provide a lot of information about body composition and nutritional status, regardless of whether they relate to obesity or malnutrition. In the present study, the BMI of women were higher than the BMI of men. This result was similar to Bencharif's (2011) and was opposed to Anigo's (2005).

It can noticed that, in general, most of BMIs of men and women in the present study are between 18.5 kg/m^2 and 24.99 kg/m^2. 74.36% were eutrophic, with the high percentage of men (41.67%) compared to women (32.69%). It could indicate a possible better nutritional status. Furthermore, 25% of students were malnourished with 17.95% underweight and 7.69% overweight (5.13% women vs 2.56% men, p>0.05).

Some studies conducted in South America showed that significant percentage of adolescents is malnourished, reaching 16% of male teenage population in Brazil, and 31% in Chile (Przys³awski *et al.*, 2010). In some African and Asian countries, the percentage of severely malnourished children is still frighteningly high (Sawaya *et al.*, 1995; and Wang *et al.*, 1998).

The coexistence of the two forms of malnutrition within the same population in the present study is a characteristic of the phenomenon of the nutritional transition (Vorster, 2005; and Sodjinou, 2008). These results also revealed that there is more thinness than overweight among the investigated subjects. It could be due that the energy contribution of consumed food is lower than needs.

Indeed, the energy contribution of lipids of the daily food ration is lower than 20% of the total energy contributions, while, it has to be 30% according to the recommendation (Martin, 2001). Lipids are the energy reserves which contribute strongly to improve the weight gain for an individual having a reduced activity. The present study also shows that women are more overweight than men although without significant difference. It could be explained by the lack of physical activity from these women, associated to a plentiful food taking. These food habits make them susceptible to an excess of weight gain, with consequence of the overweight and/or obesity (Greenfacts, 2006). These results are similar to those of Costas and Vasconcelas (2013).

Concerning the nutrients intake of the dishes eaten at lunch at the university canteen, results showed that the energy contribution is approaching the recommendation

(Martin, 2001) with exception of restaurant menu 5 which could be qualified as a hypocaloric menu, because it contributes to 25% of the Total Energy Intake (TEI), which is widely lower than the nutritional recommendations (40-45% of TEI at the lunch). Moreover, all other menus give-a contribution of carbohydrates widely upper to the recommendation (50-55% of TEI in the form of carbohydrates) and their contribution of lipids is very lower than the nutritional recommendations (30-35% of energy in the form of lipids).

Thus, the restaurant menus of the Nangui Abrogoua University canteen can be considered of high carbohydrate content and small lipid content. As for the contributions of proteins, all the proposed menus correspond well to the nutritional needs for ~~the~~ students (10-15% of TEI).

CONCLUSION

The pilot study in Nangui Abrogoua University, the one of higher education establishment of Côte d'Ivoire demonstrated that 3/4 of students had a possible better nutritional status and ¼ were malnourished. The underweight students were higher than overweight ones. Females were more overweight than males.

The coexistence of the two forms of malnutrition within the same population in the present study is a characteristic of the phenomenon of the nutritional transition.

It highlights the need to implement health education activities, focusing especially on good dietary habits, the body satisfaction, whose attention should be given on the results identified in this study.

Students need to know the principles of healthy eating. They should be motivated to practice them and should be ready to make appropriate nutrition and health choices in their day to day life.

This study contributes to the socioeconomic framework and nutrition knowledge on university students. Besides ensuring the internal validity of data, it can also reflect the reality of other places in the country. Such knowledge can be important to implement educational health measures and to provide more effective energy supply at universities.

An improvement of the balance of the meal would require a light reduction of the quantities of starchy foods or cereal and a light increase of the lipid contributions.

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