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Nutritional Values and Percentages of Macronutrients Among Congolese Athletes Participating in National and International Competitions

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Abstract

Nutritional values are an interesting indication and allow consumers to find their way around and choose their foods according to their needs, dietary constraints or expectations.Due to the deterioration of living conditions in Congolese households, we asked ourselves whether the nutritional value of macronutrients found in Congolese athletes during competition is favorable compared to that of walkers. The general objective of this study was to determine the nutritional values and percentages of macronutrients contained in the diet of Congolese athletes practicing endurance racing. The results obtained through the 24-hour booster method made it possible not only to assess the different foods consumed, but also to unseal the percentages of macronutrients compared to the recommended nutritional intakes. The age, weight, height and BMI were respectively 26.16 ± 2.79 years, 57.28 ± 4.49 kg, 1.69 ± 0.07m and 19.73 ± 1.49 kg / m2 for the athletes(or experimental group) and 27.44 ± 3.34 years 63.13 ± 4.03 kg; 1.66 ± 0.04 m and 22.49 ± 1.50kg / m2 for walkers(or control group). However, the control group differed significantly from the experimental group in weight and BMI, respectively (63.13 ± 4.03 kg vs 57.28 ± 4.49 kg and 22.49 ± 1.50 kg/m2 vs 19.73 ± 1.49 Kg / m^2). In fact, there is a significant difference in height in favor of the experimental group (1.69 ± 0.07m vs 1.66 ± 0.04 m). The energy value of macronutrients in percentages was respectively (74.17% vs. 50.04 of carbohydrates; 13.65% vs. 20.12% of fat; 12.17% vs. 28.21% of protein; and 66.59 % vs 52.18% of carbohydrates, 19.50% vs 24.00 of lipids and 13.90% vs 23.81% of proteins in girls and boys athletes and walkers). In conclusion, the diet of the athletes was unbalanced and not in accordance with the recommended nutritional intakes because, hyper carbohydrate, hypo lipid and hypo protein.

Keywords: Diet; Nutritional Values; Percentage of Macronutrients; Congolese Athletes

Introduction

In sports practice, energy resources are depleted and the replenishment of these resources spent during the athlete's physical effort is only possible with a substantial intake of food. Therefore, better the foods are chosen, better they adhere to the standards and principles of sports dietetics, and faster the results are felt.

Therefore, physical activity requires a diet adapted to the effort. Athletes must be provided with a quantity of food to meet their needs in terms of energy, quality, macro nutrients (carbohydrates, lipids, and proteins), micronutrients (vitamins and minerals) and water. A good diet effectively helps to support not only the training phases, but also those of the competition (1). Adopting a balanced diet helps to achieve good athletic performance. If in Western European countries, eating to reach peak performance is a common phenomenon among athletes (2), the same is not true for the Congo.

In Congo Brazzaville, few studies have been carried out in the field of sports nutrition (3, 4, 5). These focused respectively on footballers in the pre-competitive period, on beginner basketball players, on sprinter athletes and on middle-distance runners in the preparation period. In fact, athletes participating in various competitions are characterized by poor performance and dropouts in endurance races (6). Thus, to our knowledge, no study has been interested in determining the nutritional values and the percentages of macronutrients of Congolese athletes engaged in national and international competitions. It is in that way we wanted to verify whether the energy intake and the percentage of macronutrients of runners meet the standards of nutritionists?

Goal of the study

The general objective of our work is to assess the nature of the food consumed for breakfast, lunch, snack and dinner while determining the energy intake and the percentages of macronutrients compared to the recommended intakes.

Methodology

This exploratory and cross-sectional study took place from June 10 to December 30, 2019 in Brazzaville, capital of the Republic of Congo.

Sampling

The non-random method and the reasoned choice technique allowed us to retain a sample of 64 subjects including 32 athletes practicing endurance races and considered as an experimental group and 32 walkers constituting the control group whose average age was respectively 26.16 ± 2.79 years and 27.44 ± 3.34 years.

Conduct of the investigation

The questionnaire, submitted to athletes, adapted by Cupisti (7) and of the "24-hour reminder" type (8) made it possible to collect not only data on their physical activities, but also on their eating habits in order to assess the percentages of macronutrients (9). This involved asking athletes and walkers to report all food and drink that had been consumed in the past 24 hours (10, 11). However, FAO food composition tables (12) for use in Africa; theCiqual (2008 and 2017) (13,14) were used for the calculation of nutritional data and values.

Statistical analysis of data

For the data processing, we used the Statistical Package of Social Science for Windows (SPSS) version 22. The frequency, the relationship and the crossing between the quantitative and nominal variables, were made from the descriptive statistics. The comparison between two or more means was made using an inferential statistic.To do this, the comparison of the means between two groups was done using the "t" test for independent samples and the comparison of the means between three groups and more was done using the test of analysis of variances (ANOVA). Quantitative variables are expressed as the mean ± standard deviation (± σ), and qualitative variables as a percentage. The significance level was set at $p < 0.05$.

Ethical considerations

This research has received parental permission for the participation of athletes and walkers. Likewise, the informed consent of every middle and cross-country skier and walker was required.

Results and Discussion

This study focuses on the nutritional value of foods consumed by Congolese long-distance race athletes. Indeed, it consisted of knowing the different foods consumed by athletes in order to determine their nutritional value in relation to the activity practiced and according to the standards recommended by modern nutritionists.Note, however, that the different dietary assessment methods each have their strengths and weaknesses and are all subject to numerous biases (17).

This table shows that the two groups do not differ in age. But, the control group differed significantly from the experimental group in weight and BMI, respectively (63.13 ± 4.03 vs 57.28 ± 4.49 kg and 22.49 ± 1.50 vs 19.73 ± 1.49 Kg / m^2). However, there is a significant difference in height in favor of the experimental group (1.69 ± 0.07 vs 1.66 ± 0.04 m).

Regarding the food consumed for breakfast, studies by Charpentier (18) suggest eating foods such as fruit (1 whole fruit or 1 glass of 100% pure fruit juice from 125 to 175 g) for breakfast; cereal product (wholemeal bread of 50 to 150 g depending on energy expenditure) and other cereals (semolina, corn or soy porridge,

Table 1: Anthropometric data of subjects

Variables	Experimental Groupe (Girls = 10 ; Boys=22)	Control Groupe (Girls = 10 ; Boys=22)	t	Sig
	$\bar{\bar{X}} \pm \sigma$	$\bar{X} \pm \sigma$		
Age (years)	26.16 ± 2.79	27.44 ± 3.34	-1.66	NS
Weight (Kg)	57.28 ±4.49	63.13 ±4.03***	-5.47	<0.000
Height (m)	1.69 ±0,07*	1.66 ± 0.04	2.05	<0.05
BMI (Kg / m^2)	19.73 ± 1.49	22.49 ± 1.50***	-7.37	<0.000

Legend: NS = not significant; * : significant ; **: very significant; ***: highly significant

Table 2: Foods eaten by athletes for breakfast

Composition of the dish	Girls (N = 10)		Boys (N = 22)	
	n	%	n	%
Cup of milk + buttered bread	1	10	3	13.64
Buttered bread + Sausage + Fruit juice	-	-	1	4.54
Corn porridge + donuts	2	20	5	22.72
Rice pudding + donuts	3	30	5	22.72
Cup of lemongrass + donut	-	-	1	4.54
Spaghetti + Cao + buttered bread	2	20	3	13.64
Cup of milk + Peanut paste bread	2	20	4	18.18

etc.); sweet products (honey or jam, counting for carbohydrates); dairy products (skimmed milk of at least 350 ml, or yogurt of 125 g, or cheese of 30 g, counting as protein); fats (10 g margarine or butter, counting for fat) and water, tea or coffee for drinks as you like and want.Other research has, in fact, indicated that breakfast should be generous and digestible in order to allow the athlete to participate in the effort before lunch (19). However, it seems that Congolese athletes were not used to cooking and were content with what they could find to "close" the day.In this regard, our results indicate that the majority of athletes ate on purchased foods such as corn porridge with donuts (20% in girls and 22.72% in boys), rice pudding with donuts. (30% of girls and 22.72% of boys), spaghetti and CAO (legumes) plus buttered bread (20% of girls and 13% of boys) and a cup of milk plus peanut paste bread (20% of girls and 18.18% of boys) (Table 2). These results differ greatly from those found by CREDOC (20) which stipulated that 25% of young French people consume at least one portion of cereals and dairy products every morning and agree with those obtained by FAO (2001) (21) which indicated that , one in five Congolese does not eat any food in the morning; one in two Congolese was satisfied with a coffee with or without solid food according to the mood or the time available and 16% of the children would go to school with an empty stomach.

Our results state that, the foods eaten for breakfast were not sufficiently complete, especially since foods such as eggs, juice, ham, jam and fruit were missing.Thus, in terms of quality, breakfast should provide all the macronutrients (proteins, fats, and carbohydrates) and micronutrients (vitamins and minerals). We note that this insufficient consumption of dairy products, fresh fruits, vegetables, eggs, meat and fish, would undoubtedly limit the intake of lipids and proteins in these athletes.Moreover, the common mistake made by these Congolese athletes is to practice physical activity with the almost total absence of breakfast. However, many studies have shown that eating in the morning improves performance (22).For example, the first meal of the day taken after 10 hours of fasting (breakfast) would ensure the recovery of the body by covering the needs of the morning. It should help prevent the 11-hour craving and provide 30% of our daily energy needs.Eating breakfast every morning and all year round is one of the most important rules of a balanced diet. From what has just been said, remember that eating breakfast in the morning would make an important contribution to overall food and nutritional intake for the day (23).Conversely, children who do not eat breakfast in the morning would have difficulty compensating for the same energy and nutritional intake in their daily diet.

For the food taken at lunch, the study by Anita Bean (24) had reported that it is very important to combine starters of raw vegetables, potatoes, dessert, fruits, egg and fruit juice…, in sufficient quantity to claim to ensure an energy intake that would suit the activity practiced.Unlike this study, the foods that were consumed by our athletes consisted of salted fish, beans, foufou, gnetum, peanut paste, palm nuts, eggplants, cassava, game meat, vegetables, pork, rice, chicken wing, chicken thigh, sorrel, smoked

Table 3: Foods eaten by athletes for breakfast

Composition of the dish	Girls (N = 10)		Boys (N = 22)	
	n	%	n	%
salted fish + Bean + Foufou	2	20	3	13.64
Salted fish + gnetum + peanut paste + foufou	1	10	4	18.18
Smoked fish + gnetum + Palm nut + foufou	1	10	3	13.64
Smoked fish + pigeon peas + palm nuts + cassava	-	-	1	4.54
Salted fish + Eggplant + cassava	2	20	3	13.64
Sakasaka + fresh fish + eggplant + rice	-	-	1	4.54
Hunting meat + vegetables + palm nuts + foufou	1	10	-	-
Pork + beans + rice	1	10	2	9.09
Pork tail + vegetable + cassava	-	-	2	9.09
Chicken wing + cassava	1	10	-	-
Chicken thigh + sorrel + cassava	1	10	-	-
Chicken + vegetables + cassava	-	-	1	4.54
Chicken thigh + gnetum + foufou	-	-	2	9.09

fish, pigeon peas, saka-saka and pork tail.The vast majority of athletes had shown a preference for salted fish, beans and foufou (20% in girls and 13.64% in boys); another preference for salted fish, eggplants and cassava (20% for girls and 13.64% for boys); finally, another preference over salted fish, gnetum, peanut paste and foufou, mainly for boys (18.18%) (Table 3).In short, from our results, we found that our subjects lacked some nutritional provisions.

Table 4: Foods eaten by athletes during snacking

Response	Girls (N = 10)		Boys (N = 22)	
	N	%	N	%
Yogurt	1	10	-	-
Cookies	1	10	-	-
Orange Juice	-	-	1	4.54
Water	3	30	11	50
Nothing	5	50	10	45.45

Because the composition of the food consumed during competition was incomplete and far from ensuring a balanced diet.Regarding the foods taken during the snack (Table 4), our results show that the majority of the athletes did not take anything (50% of the girls and 45.45% of the boys), except half who had taken the water (30% of girls and 50% of boys) and a few who had only had a little cookie, yogurt and orange juice.However, some authors suggest taking one or two snacks if the time between two meals is more than 4 hours (25). Simply, because the snack plays a very important role in maintaining the energy of athletes just before sports practice (24). This is the opposite among Congolese athletes, especially since they ignore or even ignore the benefits of the snack. Indeed, our results report that 80% of girls and 95.45% of boys had nothing or water between the two meals.However, 20% of girls versus only 4.54% of boys reported consuming yogurt and cookies for snacks (Table 4). We can say that snacking was not part of the eating and lifestyle habits of the vast majority of our athletes.

As for foods eaten during dinner, Makrelouf (26) recommends that athletes adhere to the principles of 421 GPL, i.e. 4 servings of carbohydrate, 2 servings of protein and one serving of fat.However, the results of our work underline that the Congolese long distance athletes had consumed more smoked fish, gnetum, foufou, bread, spaghetti, cup of milk, bread with butter, meat from pork, beans, rice, turkey wing and cassava (Table 5).In view of all that has just been quoted, we can say that the foods consumed by the athletes were not really balanced. This is due to the fact that they lacked the starter of raw vegetables, fruit juice, and dessert in their ration. To this must be added the lack of consumption of grain, dairy and drink products.

In general, the dietary composition was out of balance for all of these athletes, opposing the desired health goals. Indeed, different causes can be considered to explain these nutritional imbalances, in the first place there is a deep ignorance of the basic rules of dietetics and the biological value of foods.This ignorance of the basic rules is due to the fact that 85% of our athletes ate at the expense of the quantity and quality of food found by their parents (27), and this according to the unfavorable socio-economic level for the majority Household. In a way, these eating habits do not reflect high level sport, but are a reflection of the “obesogenic” lifestyle of our society turned towards routine, monotony, frozen and imported foods, the

Table 5: Foods eaten by athletes for lunch

Food	Girls (N = 10)		Boys (N = 22)	
	n	%	n	%
Cup of milk + Buttered bread	1	10	2	9.09
Bread + peanut paste	1	10	3	13.63
Corn porridge + donut	-	-	1	9.09
Bread + Spaghetti	1	10	4	18.18
smoked fish + koko + peanut paste	2	20	1	4.54
Salted fish + Eggplant + cassava	1	10	1	4.54
Saka saka + fresh fish + eggplant + rice	-	-	1	4.54
Hunting meat + vegetables + palm nuts + foufou	-	-	1	4.54
Pork + beans + rice	1	10	2	9.09
Turkey wing + cassava	1	10	4	18.18
Chicken wing + cassava	1	10	1	4.54
Chicken thigh + sorrel + cassava	1	10	1	4.54

pursuit of pleasure, etc.Second is the problem of food supply and cost. Indeed, the Congolese markets are often characterized by an offer which does not cover the needs of the customers whereas the costs of these products are regularly criticized by the end consumers.As a result, eating healthy is excessively expensive, because cheap food is often of poor quality.

Moreover, with regard to nutritional or energy intake, the study carried out in France by ANSES (28) made it possible to find the nutritional intake of the French. This revealed that the diet should provide a sufficient amount of the various nutrients necessary to ensure that all the body's needs are met.Although these requirements differed from individual to individual, it was noted that sufficient amounts of energy, macronutrients (proteins, fats, carbohydrates) and micronutrients (vitamins, minerals and trace elements) are important for ensure that all of the organization's needs are covered.These needs in fact make it possible to build up and maintain reserves for optimal physiological functioning and prevention against diseases. They are influenced by many factors, including sex, age, physiological state (growth, pregnancy, breastfeeding), physical activity, as well as specific characteristics of each individual, some of which are still poorly understood.

Initially, the values of the Recommended Nutritional Intake (RNI) were developed to provide tools for identifying and correcting deficiencies in essential nutrients (health protection). Since the almost total disappearance of clinical deficiencies in industrialized countries and the very rapid accumulation of fundamental knowledge in nutrition making it possible to establish a link between nutritional factors and health, we are witnessing an evolution of the concept of Recommended Nutritional Intake (RNI). In France, an ANREF study (29) defined the values for each nutrient (proteins, iron, vitamin C, etc.) as being the contribution making it possible to cover the physiological needs of the majority of the population (97, 5% of individuals), population in good health or assumed to be so. These values are called "RNI" and we have: 50-55% carbohydrate, 30-35% fat and 10-15% protein.

Nutritional intake in trained athletes (boy = 6000 Kcal and girl = 3300 Kcal); Source: Malina, 2010 (15). Percentage of carbohydrates macronutrients (55%); lipids (30%) and proteins (15%); source: Bigard et al., 2014 (16). t = Student's test for single sample.

Our results showed that the carbohydrates intakes found were significantly high compared to the recommended intakes (2964.29 ± 92.18 Kcal vs 1815 kcal; t = 39.43; p <0.000 or 74.17% vs 55%), then, the nutritional lipid intakes were significantly lower than the recommended intakes (545.75 ± 83.68 Kcal vs 990 kcal; t = -16.79; p <0.000 or 13.65% vs 30%) per day.However, no difference was observed concerning protein intakes (486.40 ± 51.79 Kcal vs 495 kcal; t = -0.53; p> 0.05 or 12.17% vs 15%) (Table 6). Considering the energy intake found, it was significantly above the recommended energy intake (REI) (3996.44 ± 560.16 Kcal vs 3300 kcal; t = 39.43; p <0.000) per day.In male athletes in the experimental group(the walkers), on the other hand, the intakes found in lipid and protein were significantly lower compared to the recommended intakes respectively (1800 Kcal vs 952.01 ± 26.83 kcal; t = -148.24; p <0.000 corresponding to 30% vs 13.65% and 900 Kcal vs 678.45 ± 46.54 kcal; t = -22.33; p <0.000 or 15% vs 13.90%) per day. However, no difference was observed regarding carbohydrate intake (3300 Kcal vs 3250.04 ± 108.47 kcal; t = -2.16; p> 0.05 which is equivalent to 55% vs 66.59%).

As a result, the energy intake found was significantly lower compared to the recommended total energy intake (6000 Kcal vs 4880.50 ± 124.00 kcal; t = -42.35; p <0.000) per day.

Table 6: Daily Nutritional Intakes of macronutrients found in girls and boys athletes

Sexes	Parameters	Intake recommended	Intake found $\bar{x} \pm \sigma$	t	Sig
Girls	Carbohydrate (Kcal)	1815	2964.29 ± 92.18***	39.43	<0.000
	Fats (Kcal)	990***	545.75 ± 83.68	16.79	<0.000
	Protein (Kcal)	495	486.40 ± 51.79	0.53	0.61
	Total energy (Kcal)	3300	3996.44 ± 560.16**	3.93	<0.003
Boys	Carbohydrate (Kcal)	3300	3250.04 ± 108.47	2.16	0.042
	Fats (Kcal)	1800***	952.01 ± 26.83	148.24	<0.000
	Protein (Kcal)	900***	678.45 ± 46.54	22.33	<0.000
	Total energy (Kcal)	6000***	4880.50 ± 124.00	42.35	<0.000

These results agree with those found among French long-distance runners aged 35-60 by Rieth et al. (30), among Congolese footballers by Mbemba et al. (3), among Canadian teenage footballers by Moussavou (31), among Malian basketball players by Coulibaly (32), among Congolese sprinters by Mboungou et al. (33), among Congolese endurance runners during the preparation period by Mbanzoulou et al. (34), in middle distance and long distance Congolese runners by Bouhika et al. (35) etc.Indeed, these studies have generally shown that the food consumed had a fairly high content of carbohydrate, while it was low in fat and protein.For example, the studies carried out in Congo Brazzaville by Mboungou et al (33) had reported an energy intake in carbohydrate of 2729.3 kcal with a percentage of 79.70; 321.2 kcal in lipids, or 9.37%) and 374.3 kcal in protein with a percentage of 10.93.Mbanzoulou et al. (34) by observing the dietary habits of cross country runners and middle distance runners during the preparation period, found the nutritional intake of around 3240.3 kcal in carbohydrates, or 76.19%; 542.8 kcal in lipids or 12.77% and 469.8 kcal in protein or 11.04%.Likewise, Bouhika, et al. (35) by working on the prevalence of carbohydrates, had observed a very high percentage of carbohydrates (78.10% and 62.80%) respectively in male middle- and long-distance runners.Long before these authors, Mbemba et al. (3), by working on the eating habits of footballers in the pre-competitive period had already found a Nutritional Intake of 3240.3 kcal in carbohydrates with 76.19%; 542.8 kcal in lipids with 12.77% and 469.8 kcal in proteins with 11.04%.

Our results showed that the carbohydrate intake in the girls in the experimental group was significantly higher compared to the recommended carbohydrate intakes (2964.29 ± 92.18 Kcal vs 1815 Kcal; t = 39.43; p <0.000). These results showed that there was no significant difference in carbohydrate intake in boys (3250.04 ± 108.47 Kcal vs 3300 Kcal; t = -2.16; p>0.05) (table 6). However, carbohydrates contributed more than half of the total energy intake of these boys. Much work has shown that carbohydrate intake is generally higher in boys compared to girls, whether in athletes or non-athletes (7,42,43).In view of our results, the carbohydrate intake of boys in the experimental group was significantly high compared to girls in the experimental and control groups respectively (3250.04 ± 108.47 Kcal vs 2964.29 ± 92.18 Kcal: p < 0.000 and 3250.04 ± 108.47 Kcal vs 3093.72 ± 60.66 Kcal; p <0.05); similarly, the carbohydrate intake of boys in the control group was significantly higher compared to girls in the experimental and control groups respectively (4386.67 ± 258.69 Kcal vs 2964.29 ± 92.18 Kcal: p <0.000 and 4386 , 67 ± 258.69 Kcal vs 3093.72 ± 60.66 Kcal; p <0.000).

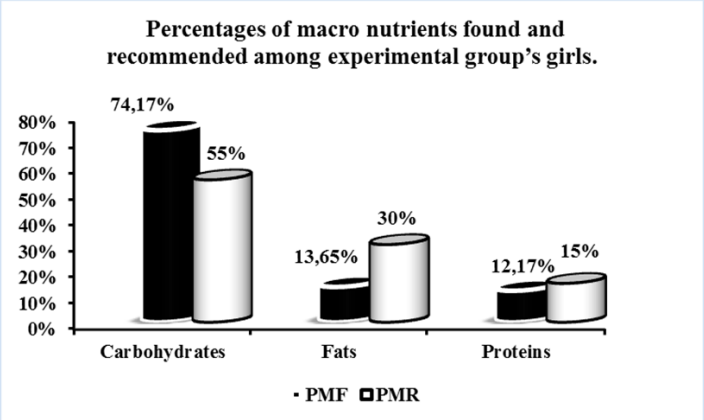

Figure 1: Percentages of macro nutrients found and recommended among experimental group's girls (PMFREGG)

Legend: PMF:Percentages of Macronutrients Found, **PMR:** Percentages of Macronutrients Recommended

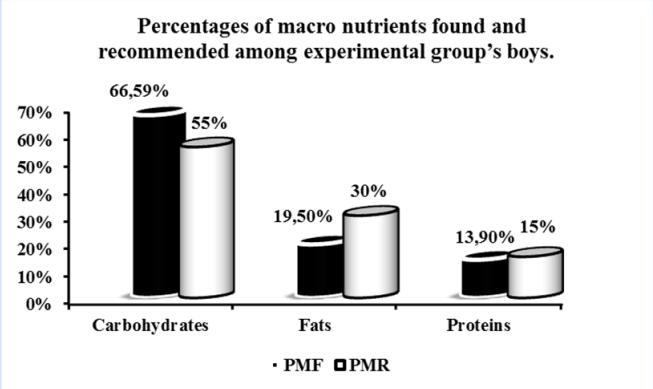

Figure 2: Percentages of macro nutrients found and recommended among experimental group's boys (PMFREGB)

Legend: PMF: Percentages of Macronutrients Found, **PMR:** Percentages of Macronutrients Recommended

The percentages of carbohydrates that are above the recommended percentages (66.59% vs 55%) can be explained by the fact that carbohydrates represent almost half of the energy value (4880.50 Kcal / 3250.04 Kcal = 1.50 Kcal; or 66.59%).However, we retain that the energy provided by carbohydrates is much greater than that provided by lipids and proteins, whether in girls or boys (3,996.44 kcal for girls and 4,880.50 kcal for boys).This is to say that the diet of Congolese athletes is hyper carbohydrate, especially since 74.17% in girls and 66.59% in boys are higher compared to 55% recommended as the norm (Figure 1 and 2).This hyper-carbohydrate diet is explained by the fact that the eating habits of Congolese in general,and athletes in particular, are more focused on the overconsumption of products such as cassava, foufou, pasta, white bread, bananas, cassava tubers, potatoes, yams, in short, products very rich in starch.For example, it has been shown that a Congolese's table is more filled with cassava, foufou, yams, potatoes and plantains for less fish, less meat, less vegetables and less fruit (36). These foods are also qualified as staple foods and constitute the ingredients of the dishes found on the Congolese plate.Likewise, a food like gnetumafricanum provides a lot of carbohydrates. Indeed, the work of Mialoundama (1996) (37) reported, for example, that gnetumafricanum had 70 g of carbohydrate, 16.5 g of proteins and 6 g of lipids.The work of Mbemba et al. (38) reported that Cuerveaisangiensis or NsingaNkuata (De wild.) N. Hallé is a vegetable that includes protein (9.59g), fat (4.00g) and carbohydrate (25.75g) or 177.36 kcal of energy apart from the micronutrients (potassium, calcium, phosphorus and sodium) that it is full of.

However, carbohydrates are a good element for the replenishment of the energy reserve. Indeed, according to the results of some research, the carbohydrates consumed in the hours following exercise quickly go into the muscles to form glycogen (muscle energy) that can be used during subsequent exercises.These same carbohydrates also play a very important role before and after exercise in speeding up repair of muscle tissue (39). Unlike carbohydrates, lipids presented a lower daily energy intake (30%). The lipid intakes found in low quantities in our athletes (13.65% in girls and 19.50% in boys) are at the origin of an imbalance in energy reserve. This is undoubtedly due to the low consumption of foods high in fat such as pork, animal and vegetable oils, etc. (28). Regarding protein, our found results report that protein intake is low (12.17% in girls and 13.90% in boys). It is urgent that these athletes improve their diet by consuming fish, meats and especially caterpillars.Indeed, the work of Mabossy-Mobouna et al. (40) recommend consuming the imbrasiatruncata caterpillars supplied by the northern part of the Republic of Congo, as a replacement for meat and fish in the protein supply.This suggestion is consistent with the recommendations of the French Association for Food Safety (AFSSA) currently ANSES (National Agency for Environmental Sanitary Safety) (28) which stipulated since 2001 that athletes over 18 should consume proteins ranging from 12 to 16%.

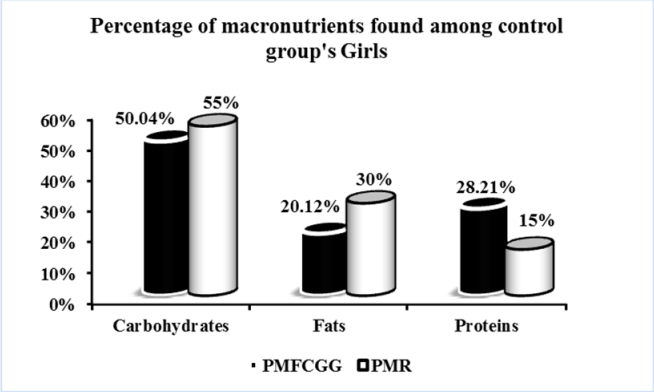

Figure 3: Percentages of macro nutrients found and recommended among Control Group's Girls (PMFRCGG)

Legend: PMFCGG: Percentages of macro nutrients found among control group's girl
PMR: Percentages of macronutrients recommended

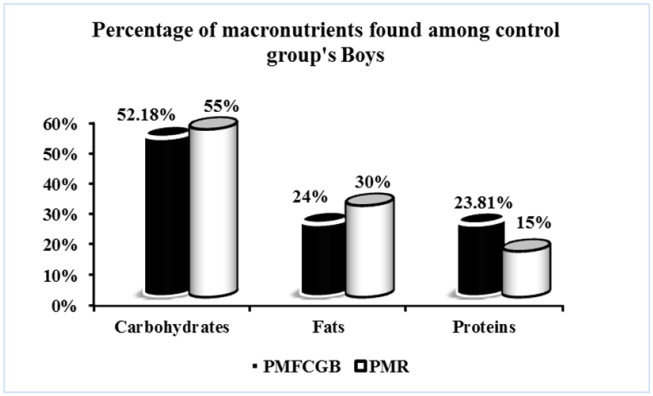

Figure 4: Percentages of macro nutrients found and recommended among Control Group's boys (PMFRCGB).

Legend: PMFCGB: Percentages of macronutrients found among control group's boys;
PMR: Percentages of macronutrients recommended.

In an attempt to understand the effects of training on nutritional intake in our athletes, the energy intake levels of the latter were compared to the nutritional intake of subjects practicing maintenance sport or control group. Our results show that macronutrient and energy intakes were significantly elevated in subjects of the control group compared to those in the experimental group.In endurance athletes, these intakes were significantly low, on the one hand because the majority of these subjects had a meal frequency of twice a day for a training rate of 2.5 hours a day for 4 times a week.

Regarding the percentages of the macronutrients found in the subjects of the control group, compared to the recommended percentages, the percentages found were 50.04%, 20.12% and 28.21% for carbohydrates, fats and proteins, respectively.While the percentages of macronutrients found in boys in the control group, compared to the recommended percentages, the percentages found were 52.18%, 24.00% and 23.81% for carbohydrate, fat and protein respectively (Figures 3 and 4).

According to Malina (15) and Brenner J.S. (41), when an athlete ensures an adequate energy intake to balance the energy expenditure associated with activity, it provides good growth, development and maturation. Our results are contrary to these statements.In fact, the energy intake of our athletes was significantly lower than the recommended intake for boys. Likewise, this intake was also significantly lower compared to the energy intake found in subjects in the control group.This undoubtedly had an influence on the growth, good development and maturation of our athletes. Moreover, according to the work of Zakrzewski et al. (42), carbohydrate intake provides essential energy for nutrition and is therefore a very important fuel for intense exercise.This seems to be in agreement with our results which showed that, for both girls and boys, carbohydrate intake constituted the major part of the energy intake found. Compared to the control group, both girls and boys athletes had a significantly lower carbohydrate intake than that found in subjects in the control group. This decrease in the amount of carbohydrates was probably due to the intensity of the workout.

Table 7: Comparison of energy intake by group

Variables	Experimental's Group (n=32)	Control's Group (n=32)	t	Sig
	$\bar{x} \pm \sigma$	$\bar{x} \pm \sigma$		
Carbohydrates (Kcal)	3160.74±168.95	3982.55±645.42***	6.96	< 0.000
Fats (Kcal)	825.06±197.79	1775.91±375.16***	12.68	< 0.000
Proteins (Kcal)	618.44±102.11	1921.45±148.80***	40.84	< 0.000
Energy (Kcal)	4604.23±524.26	7679.92±1124.6**	14.02	< 0.01

On the other hand, because insufficient, poor quality and unvaried food was taken care of by parents without financial means. This diet coupled with the level of training, intensity and duration of training increased the energy needs of our athletes.This had greatly influenced their level of macronutrient and energy intake (3160.74 ± 168.95 Kcal vs 3982.55 ± 645.42 Kcal; t = -6.96; p <0.000 in carbohydrate; 825.06 ± 197.79 Kcal vs 1775.91 ± 375.16 Kcal; t = -12.68; p <0.000 in lipid; 618.44 ± 102.11 Kcal vs 1921.45 ± 148.80 Kcal; t = -40 , 84; p <0.000 in protein and, 4604.23 ± 524.26 Kcal vs 4604.23 ± 524.26 Kcal; t = -14.02; p <0.01) (Table 7).

In addition, a high carbohydrates intake increases the oxidation of carbohydrates and therefore reduces the oxidation of lipids (44). This can undoubtedly increase the stock of lipid in the body. Our results reveal that, compared to the recommended nutritional intakes, the girls and boys in the control group had a significantly high carbohydrate intake respectively (3093.72 ± 60.66 Kcal vs 1815 Kcal and 4386.67 ± 258.69 Kcal vs 3300 Kcal).This intake is undoubtedly the cause of the slowing down of lipid oxidation in these subjects, since their lipid intake is significantly higher than the recommended ratios in both girls and boys (1244.04 ± 88, 28 Kcal vs 990 Kcal and 2017.68 ± 92.15 Kcal vs 1800 Kcal). Contrary to the results found in the subjects of the control group, our results reveal that the athletes of the experimental group (girl as well as boy) had a low lipid intake. This can probably be explained by a diet low in fat. Indeed, according to studies carried out in the sixties, reported by Alice et al. (45), a diet low in lipids, caused hypertriglyceridemia which was responsible for the synthesis of triglycerides in the liver.As is known, the synthesis of triglycerides causes liver fat. In addition, studies have shown that switching from low-intensity to high-intensity exercise results in lowering of the amount of lipids (44). Since our athletes had been practicing endurance for a long time at a sub-maximal intensity, this undoubtedly caused the decrease in the lipid intake found.

Regarding proteins, long-term physical activity (endurance) disrupts the kinetics of the natural balance between protein synthesis and degradation (proteolysis).Bigard et al. (16) had shown that the practice of physical exercise, depending on its duration, but also on its intensity, significantly affects protein

metabolism by inducing an immediate state of amazement in muscle protein synthesis with an increased flow of proteolysis.This flow continues to increase for up to three (3) hours after stopping exercise and then decreases. Our results showed that the protein intake found in boys in the experimental group was significantly lower than the recommended intake and the intake found in subjects in the control group respectively (900 Kcal vs 678.45 ± 46.54 Kcal; t = -22.33; p <0.000 and 1921.45 ± 148.80 Kcal; t = -40.84; p <0.000). The decrease in protein intake was likely due to the duration and intensity of exercise. Moreover, if the energy intake of protein origin is between 10% and 15% of the ration, if to this are added diversified food intake and in a context of energy balance, we conclude that the need is naturally covered (16). Our results reveal that the protein intake found in the athletes in the experimental group was 618.44 ± 102.11 Kcal or 13.90%, but 70% of the girls versus 90.91% of the boys reported that the food intake were not diversified.In view of these results, the protein needs of our athletes were not being met. This also justifies the drop in protein intake found. This decrease in protein intake was observed a lot in girls compared to boys in the experimental group (678.45 ± 46.54 Kcal - 486.39 ± 51.79 Kcal = 192.06 Kcal or 22%). Our results agree with those found by Bigard et al. (16).

Conclusion

The foods most consumed at breakfast, lunch, snack and dinner provided energy in the control group subjects that was significantly higher compared to that found in the experimental group subjects. In terms of percentages, the carbohydrate values in boys and girls in the experimental group were significantly elevated compared to the recommended percentages. The percentages of lipids and proteins of these same subjects were low compared to the recommended percentages.However, the carbohydrate energy intake of boys in the experimental group was significantly higher compared to girls in the experimental and control group. Similarly, the carbohydrate values of boys in the control group were higher compared to those of girls in the experimental and control groups. Moreover, the boys in the experimental group had significantly lower lipid and protein intakes compared to the intakes of boys and girls in the control group.

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