

Prevalence of carbohydrate ration in Congolese endurance runners: case of Brazzaville athletes

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Abstract

Objective: to determine the level of macronutrient intake of Congolese athletes practicing endurance race in relation to their performances.

Methodology: Our study was prospective and conducted in Brazzaville over a period of 14 days, from February 14 to 28, 2017. Twenty-nine (29) mid-distance athletes and nineteen (19) riders High-level backgrounds and males participated in the study.

A questionnaire consisting of recording what each athlete ate for seven (7) consecutive days in three periods of the day: morning, noon and evening had been distributed. The quantities of food consumed had to be increased by using the principles of the household units (cup, tablespoon, and plate), pieces (sugar, meat, chicken leg, vegetable, cassava etc.) and to name the foods consumed. The "weekly diary" method (Cubeau J., Pequinot G, 1980) was applied to determine the amount and nature of food consumed by athletes.

Results: The energy intake of carbohydrate was 2074.81Kcal, or $518.704 \pm 68.60\text{g}$ with a percentage of 80.90% in middle distance runners (MDR) and 2420.6 Kcal, or $605.15 \pm 37.82\text{g}$ with a percentage of 68.17% for long distance runners (LDR). While the lipid intake was 356.54Kcal, or $39.22 \pm 4.43\text{g}$ with a percentage of 6.12% in MDR and 543.27Kcal, or $59.76 \pm 3.67\text{g}$ with a percentage of 6.73% in the LDR. On the other hand, the protein intake was 332.49Kcal, or $83.12 \pm 8.89\text{g}$ with a percentage of 12.96% in the MDR and 25.09% in the LDR.

Conclusion: The feeding behavior of Congolese endurance runners(ER) does not meet the standards of nutritional balance recommended by modern nutritionists and therefore has a negative effect in athlete's performance.

Keywords: prevalence, carbohydrate ration, endurance races, sports performance, Congo

1. Introduction

Physical and sporting activity in general is an area where the essential functions of organisms can be worked in the most elementary forms of animal life, the main objective of which is to maintain the internal balance of the organism (Roux, 1986) ^[1].

The practice of physical exercise has the effect of unbalancing the energy balance of an individual in the direction of an increase in the energy expenditure associated with physical activity. Indeed, if the caloric intake is maintained at the level of the needs estimated before the protocol, this imbalance will then lead to a loss of weight (Tremblay *et al.*, 1984) ^[2].

However, the energy cost of physical activity depends on the type of activity, the duration of the exercise, and the individual who performs it. Consequently, the higher energy expenditure induced by exercise will cause a disruption of the individual's needs in the direction of a quantitative but also qualitative modification of his energy and micronutrient intakes (Vitamins, Minerals).

It should be noted that the dietary habits of the person subjected to regular physical training have been the subject of several studies (Klepping *et al.*, 1984, Muet *et al.*, 1988) ^[3]. Because the practice of endurance races, requires numerous physical qualities such as endurance, strength, flexibility and coordination. However, an intense physical preparation is necessary in order to bring the organism to a physiological adaptation.

The exercise required for maximum performance is a major consumer of energy and this is brought or delivered by food (Jenour P. and coll., 1993) ^[4]. Indeed, an adapted diet makes the difference between the winner and the loser, which is why it is surprising that many athletes are not yet involved in these aspects of nutrition: there is often a lack of knowledge on the basis Diet and major mistakes in the choice of foods. Because some practices observed in athletes have had a strong impact on performance but others have no beneficial effect and may even be harmful.

In the Republic of the Congo, balanced nutrition (Mbemba *et al.*, 2006) [5] to be able to perform sports performances remains an aspect not only very badly perceived but also neglected for the sole benefit of respecting the training program (Bouhika and *et al.*, 2016) [6]. However, training is an additional "aggression" factor of the organism which requires a significant contribution of energy. This exhaustion of the energy reserves leading to dehydration, electrolytic transfers, intra and inter cellular are the causes of fatigue or even physical form (Roux, 1986) [1]. How is the recovery or replacement of calories lost in Congolese endurance athletes?

Thus we can question whether the diet of Congolese endurance athletes meets or meets the standards of the recommended dietary balance that can provide a daily energy intake enabling the achievement of an optimal athletic performance?

2. Methodology

Our study was conducted in the Department of Brazzaville over a period of 14 days, from 14 to 28 February 2017. The study concerned the high level Congolese runners. Our sample consisted of 48 athletes from the five (5) clubs with mid-distance runners (MDR) and Long distance runners (LDR) of high-level participating in national and international competitions. Twenty-nine (29) MDR and nineteen (19) LDR belonging to the clubs: Horizon, Inter-club, Patronage, Elec-sport and Unis-sport.

2.1. Method

A questionnaire was distributed to each subject to record what they ate for seven (7) consecutive days each morning, noon and evening. All athletes concerned were instructed to express the quantities of food consumed using the principles of the

household units (cup, tablespoon, plate), pieces (sugar, meat, chicken leg, crawfish, cassava etc) and the use of a variety of foods (vegetable, beans, yoghurt, etc.). That weekly diary method (Cubeau J., Pequino G,1980; Bogio, V., *et al.*, 1980; Souci SW. *et al.*, 1994; Dorosz Ph., 2000;) [11, 25, 7, 8] was applied to this study to determine the amount and nature of foods consumed each day.

2.2 Nutrient Conversion

After analyzing each questionnaire, we converted the values obtained in weight (gram) using the FAO table [1970] for use in Africa. This allowed us to obtain the different energy resources of macros and micronutrients.

3. Results

Table 1: Age of training of the athletes

Duration	(MDR) (n = 29)	%	LDR (n = 19)	%
1 – 3 Years	01	3.44	01	5.26
4 – 6 Years	15	51.72	09	47.36
7 – 9 Years	07	24.13	08	42.10
10 – 12 Years	03	10.34	01	5.26
13 – 15 Years	01	3.44	00	00
≥ 16 Years	02	6.89	00	00

Legend: MDR = Mid- Distance Runners;
LDR = Long distance Runners

This table indicates that the training age for CDFs and CFs was between 4 and more than 15 years.

Table 2: Anthropometric data

Variables	MDR (n = 29)						LDR (n = 19)						T	S
	Mini	Maxi	±	η	s ²	X̄	Mini	Maxi	±	η	s ²	X̄		
Age (an)	17	38	±	4,47	20,75	27,50	20	37	±	2,06	4,48	28,57	0,09	NS
Poids (Kg)	48,98	68,5	±	11,18	32,75	58,74	43,07	62,1	±	4,96	26,06	52,54	4,56	S***
Taille (m)	1,54	1,67	±	0,083	0,007	1,71	1,58	1,70	±	0,05	0,003	1,64	7,36	S***
IMC (Kg/m ²)	16,11	22,25	±	1,54	2,46	20,25	17,3	26,12	±	2,00	4,26	20,76	0,94	NS

This table indicates that the mean age in MDR was 27.50 (±4.47) whereas it was 28.57 (± 2.06) in LDR, with a non-significant difference (t = 0.09). The mean weight was 58.74 (± 11.18) for MDR and 52.54 (± 4.96) for LDR, with a highly significant

difference (t = 4.56). The mean size was 1.71m (± 0.083) for MDR and 1.64m (± 0.05) for LDR, with a highly significant difference (t = 7.36) and the BMI was 20, 25 for MDR and 20.76 for LDR, with a non-significant difference (t = 0.94).

Table 3: Standards of nutritional status: classification of nutritional status according to body mass index

Indice de masse corporelle	Etat nutritionnel
> 40	Very severe obesity
35.3 – 39.99	Severe obesity
30.0 – 34.99	Moderate obesity
25.50 – 29.99	Overweight (Overweight)
18.50 – 24.99	Normal
17.0 – 18.49	Light Thinness
16.0 – 16.99	Moderate thinness
< 16.00	Severe thinness

Source: WHO 1995

Table 4: Nutritional status of athletes

Nutritional status	MDR (n = 29)	%	LDR (n = 19)	%
Very severe obesity	00	00	00	00
Severe obesity	00	00	00	00
Moderate obesity	00	00	00	00
Overweight	00	00	01	5.26
Normal	25	86.20	16	84.21
Light Thinness	03	10.34	02	10.52
Moderate thinness	01	3.44	00	00
Severe thinness	00	00	00	00

This table shows that the majority of our athletes are normal (86.20% of MDR and 84.21% of LDR).

Table 5: Daily Intake of Macronutrients in MDR

Nutrients	Carbohydrates	Lipids	Protides	Total
Energy for balanced nutrition (Kcal)	1883.64	1027.44	513.72	3424.8
	55%	30%	15%	100%
Energy Supplied (Kcal)	2674.81	396.54	353.78	3425.13
	78.10%	11.57 %	10.33%	100%

Legend: Kcal: Kilo calorie; %: Percentage.

The energy brought in carbohydrates yielded 2674.81 kilo calories or 78.107%; the lipids gave 396.54 kcal ie 11.57% and the proteins were 353.78 kilo calories or 10.33%. The total

energy in macronutrients was 2763.83 kilo calories (3425.13 kilo joules).

Table 6: Daily Intake of Macronutrients in LDR

Nutrients	carbohydrates	Lipides	Protides	Total
Energy for balanced nutrition(Kcal)	1883.64	1027.44	513.72	3424.8
	55%	30%	15%	100%
Energy Supplied (Kcal)	2420.6	891	543.27	3854.87
	62.80%	23.11%	14.09 %	100%

Legend: Kcal: Kilo calorie; %: Percentage.

For the energy supplied: the carbohydrates yielded 2420.6 kcal or 62.80%; the lipids are 891 kilo calories or 23.11% and the energy provided in proteins is 543.27 kcal (14.09%). The total

energy in macronutrients was 3854.87 kilo calories (16136.48 kilo joules).

Table 7: Comparison of Percentage of Macronutrients in MDR and LDR

Variables	MDR (n = 29) %	LDR (n = 19) %	ANR %
carbohydrates	78,10	62,80	55
Lipids	11,57	23,11	30
Protéins	10,33	14,09	15

For macronutrient percentages, there are 78.10% of carbohydrates; 11.57% of the lipids and 10.33% of the proteins

for the MDR while 62.80% of the carbohydrates, 23.11% of the lipids and 14.09% of the proteins for the LDR.

Table 8: Food equilibrium in the middle Distance and Long Distance runners

Variables	Protides	Protides	P.A	L.A	L.V
	Végétaux	Animaux	$\frac{P.V}{L.T}$	$\frac{L.A}{L.T}$	$\frac{L.V}{L.T}$
MDR	38,55	44,56	1,15	0,91	0,08
LDR	42,07	80,68	1,91	0,93	0,06

Legend: P.A: Animal proteins; P.V.: Vegetable proteins; L.A.: Animal Lipids, L.V.: Plant Lipids, L.T.: Total Lipids

This table indicates that the ratio $\frac{P.A}{P.V} = .,1$ for MDR and 1.91 for LDR whereas the recommended equilibrium should be ≥ 1 ; the ratio $\frac{L.A}{L.T} = 0.91$ for the MDR and 0.93 for the LDR, whereas the

recommendation is 0.6; finally, $\frac{L.V}{L.T} = 0.08$ for the MDR and 0.06 for the LDR, the recommended equilibrium is 0.4.

Recommended Balance

$$\frac{P.A}{P.V} \geq 1; \frac{L.A}{L.T} \leq \frac{3}{5} = 0.6; \frac{L.V}{L.T} \geq \frac{2}{5} = 0.4$$

4. Discussion

Our research focused on the eating habits of high level Congolese endurance racers in general and especially those of Brazzaville practicing mid-distance (MD) and Long distance (LD) racing.

In order to obtain the results, a questionnaire containing general information, anthropometric data and the social situation of the athletes (subjects) was used. Then, the method of the weekly diary (Cubeau and Pequinot, 1980) [11] was used to collect dietary habits and evaluate the diet of athletes for a period of 7 consecutive days. Indeed, the interest of this method is confirmed by numerous works intended to specify the optimum duration of the food registration (Charles F.W. Dupin H. and Coll, 1992) [12]. This method allowed us in one week to conduct the consumer survey through the prospective recording of foods ingested per day. Thus, we chose this approach in order to appreciate the energy balance.

Indeed, our results indicate in table no.1 that the duration of the practice (training age) of the athletes that 01 MDR (3, 44%), and 01 (5, 26%) LDR have a Training age from 1 year to 3 years. However, in the range of 4 to 6 years there are 15 (or 51.72%) MDR and 9 (47.36%) LDR. While for the training age of 7 to 12 years, there are 10 (or 24, 13%) of the MDR and 9 (42.10%) of the LDR.

Table no. 2 on anthropometric data indicates that the average age for MDR is 27.48 ± 4.47 years (minimum: 17 years and maximum 38 years); The average weight is 58.74 ± 11.18 kg (minimum: 48.98 kg and maximum: 68.5 kg); And the average size is $1.71m \pm 0.083m$ (minimum: 1.54m and maximum 1.88m; while the BMI indicates an average of $20.25 \pm 1.54Kg/m^2$ (minimum $16.11kg/m^2$ And maximum $22.25Kg/m^2$). However, the average age for LDR is 28.57 ± 2.06 years (minimum: 20 years and maximum: 27 years, average weight is 52.54 ± 4.96 kg (minimum: 43.07 kg and Maximum 62.1 kg, mean size is $1.64m \pm 0.05$ (minimum 1.58m and maximum 1.70m) and the mean BMI is 20.76 ± 2.00 kg / m² (minimum We found that age, weight and body mass index differed significantly (S ***) between MDR and LDR, On the other hand it is not significant on size (NS).

Table no 4: showing the nutritional status of athletes shows that there were 25 (or 86.20%) normal MDR athletes, 3 (10.34%) were mildly thin and 1 (or 3.44 %) Which has a moderate thinness,

On the other hand, on the LDR side, there were 16 (or 84.21%) normal, 01 (5.26%) were overweight, and 02 (10.52%) were mildly thin. As a result, we can deduce in a general way that the MDR and LDR athletes have a normal nutritional state able to get optimum performance in endurance races. The attainment of unrealistic weight and adiposity can compromise both athletic performance in general and particularly short-term running and long-term health, in particular with a real risk of Deteriorating reproductive capacity and bone status. (Maugham R, Fen R.J and Lipire J.P, 1989) [13].

For Table no 5, based on energy intakes of macronutrients, it should be noted that, on the basis of the many studies available to date, it can be estimated that the energy inputs of athletes practicing endurance Range from 45 to 85% kcal / kg / j, from

3100 to 6100 kcal / j for a subject over 60 kg (IOC, 2010). This important variation depends on the period, the seasonal measurement, the workload at training and the method used (A-X. Bigard and Y. Guezennec, 2014) [14].

However, for our study, MDR have an energy intake of 3425.13 kilojoules, or 2674.81kcal of carbohydrates, 396.54kcal of lipids and 353.78 kcal of proteins. While the LDR had 16136.48 kilojoules, or 2420.6 kcal of the carbohydrates, 891 kcal of the lipids and 543.27 kcal of the proteins.

We can safely assert that the energy contributions of Congolese endurance runners are not only predominantly carbohydrate (hypo-carbohydrate), hypo-lipid and hypo-protein but also do not meet the quantitative standards required for good performance. Because the results show not only insufficient quantitative supply but also the low qualitative contribution of foods absorbed daily by the athletes. One of the basic rules of nutrition is to maintain the adequacy between nutrient requirements and dietary intakes.

For this purpose, the daily intakes of macronutrients (carbohydrates, lipids and proteins) in MDR and LDR are as follows:

Carbohydrate intake by athletes

Carbohydrates are the sporting fuel of sports, and represent the excellence energy food of the athlete [Père G., 2009] [15]. The maximum time to maintain a long-term exercise (mid-distance and Long run) is thus dependent on the carbohydrate content of the food intake; In fact, the results obtained in the two samples show a clear overconsumption of the carbohydrates by the athletes (MDR and the LDR). In this perspective, Monod H. and Flambrois (2000) [22] stipulate that the carbohydrate intake margin is between 39.1 and 65%. As for François Creff (2004) [16], the average food ration must be 55% carbohydrate. Similarly, Anses (2010) [17] presents the nutritional balance of macronutrients such as carbohydrates from 50 to 55%. Thus, in our case, we find that MDR have an energy intake of carbohydrate of 2674.81Kcal or 11196.75 kilojoules with an average diet of 78.10% (hyper-carbohydrate); Which is beyond this normal margin.

The LDR have a carbohydrate intake of 2420.6 Kcal or 10132.63kilo joules with an average diet of 62.80% (hyper-carbohydrate). However, it should be noted that the diet of our athletes is unbalanced from the carbohydrate point of view because it exceeds the recommended percentage (50-55%) [Monod and Flambrois, 2000; François Creff, 2004 and Anses, 2010] [22, 16, [17]. This carbohydrate diet is all the more interesting in that it provides a significant (but relatively low) performance gain for prolonged and continuous efforts. Thus, to speak like (Tanser, 1987) [18]; A carbohydrate-rich ration like that of Kenyan runners, he said, would seem perfectly suited to improve performance. The difference is highly significant $t = (44.75)$ S***.

Intake of lipids in athletes

The main energy reserve for the body, the use of lipids depends on several factors: intensity of exertion, duration of exercise, level of training, age and condition of the subject. Thus, these factors are Important for the endurance race, and lipids occupy a good place realising a good performance [Lasserre S. *et al.*, 2016] [19]. In this perspective, when lipids are present in quantities greater than glycogen (4 to 8 kg vs. less than 1 kg), triglycerides have an attractive energy potential, but their slower

oxidation gives them less energy efficiency, Says Lasserre *et al.* (2016)^[19]. Indeed, according to the recommendations of modern nutritionists, daily energy intake to lipid is about 30%. Its role is no longer to be demonstrated especially in thermoregulation, a fundamental principle when outdoor temperatures are "hostile" in air as in water, metabolic reserve (in the form of TG in adipose tissue), insulation Thermal and shock absorbing. However, a finding can be made about the MDR and LDR athletes, since lipids have a very low daily energy intake: 396.54Kcal, a percentage of 11.57% (Table no.5), which corresponds to hypo-lipid feeding MDR and 891Kcal, a rate of 23.11% (Table no.6) corresponding in the range required in the LDR. At this level, the difference is highly significant $t = (10.64) S^{***}$.

As a result, this has a positive impact on achieving optimal performance (Collective, Position of Dietitians of Canada, 2000). Then, Congolese runners have to increase their energy intake in order to comply with dietary standards.

Contribution of Protides to Athletes

Although proteins do not play a role in energy supply [www.dietetique.conseil.fr]; It is important to note that they play a very important role in the athletes' resistance to a long-term effort. Similarly, adequate protein intake is essential for good muscle function. Also, its contribution in the diet of the athletes makes it possible permanently to the reconstruction of the tissues (Academy of Nutrition and Dietetics, 2016). For this purpose, an energy intake recommended by modern nutritionists is about 15% (Monod and Flambrois, 2000)^[22]. For subjects well trained in endurance (4 to 5 days per week for at least one hour), the increase in need would seem to be only 20 to 25% compared to the sedentary population (Monod H. and Flambrois R, 2000)^[22]. However, it should be noted that in MDR, the energy intake from protein is about 353.78Kcal, a percentage of 10.33% (Table no.5), which corresponds to a hypo-protein diet and Does not meet the recommended energy intake standards and therefore poses serious problems for the optimization of good performance. While in LDR, the energy intake of protein is about 14.09% (Table no.6), this justifies a good percentage of energy intake very favorable for the performance of a sporting performance. The difference is highly significant, $t = (44.75) S^{***}$.

As regards table no.8 on the food balance in MDR and LDR, we obtained the following results: The ratio Protein Animal on Protein Vegetable is 1.5 for the MDR and 1.91 for the LDR. The required value is $PA / PV \geq 1$. We can therefore say that MDR and LDR meet the recommended equilibrium standards;

The ratio of Lipid Animal to Total Lipid in MDR is 0.91 and 0.93 in LDR, while the recommended value is $L.A./L.T. \leq 3 / (5)$ or 0.6. Hence we can say that MDR, just like LDR, do not agree with this value; Similarly, the ratio $L.V$ on $L.T \geq 2/5$ or 0.4 is not in agreement with the results obtained, as it is 0.08 for MDR and 0.06 for LDR.

However, these different results lead us to infer that the feeding of the Congolese runners is not adapted and balanced. When you look at the standards for a balanced diet, we realize that the energy provided by carbohydrate into percentage is higher than that provided by a balanced diet, i.e. hyper carbohydrate: 78.10% or 62, 80% to 55%. These results are similar to those found at football payers: 79.51% and the basketball players: 78.24% [Mbemba *et al.*, 2006; Mbemba *et al.*, 2007]^[5, 26].

Conclusion

The goal of this study was to verify whether the diet of Congolese endurance runners provides daily energy intake and macronutrient amounts in a balanced proportion that meets the recommended dietary balance.

From a qualitative point of view, MDR show a significant overconsumption of carbohydrate intakes (80%) compared to energy recommendations 39.1 to 70.1%.

However, with respect to energy intakes of lipids despite diversification in food intake, MDR and LDR have a very low energy intake.

This validates our hypothesis that the feeding behavior of Congolese runners does not correspond to the standards of the nutritional balance recommended by modern nutritionists and therefore can't achieve better performance.

The wish is that the athletic club leaders and athletes will once again step up efforts to put into practice the principles of sports dietetics that require that the foods consumed be balanced in order to think of a possible performance.

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