International Journal of Physical Education, Sports and Health 2019; 6(1): 33-36

P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2019; 6(1): 33-36

www.kheljournal.com
Received: 23-11-2018
Accepted: 26-12-2018

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Nutritional status of elite Congolese athletes practicing endurance races in competitive periods

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Abstract
Objective: The objective of this study was to assess the nutritional status of Congolese athletes (middle distance and long distance) and to analyze its relationship with the poor performance achieved.
Methodology: 64 subjects (32 elite athletes constituting the experimental group and 32 walkers constituting the control group) were included in this study. The evaluation and analysis were carried out using a questionnaire validated and adapted by Cupisti *et al* and the 24-hour recall method.
Results: our results show that subjects did not differentiate according to age. However, the size of the elite athletes was significantly high (1.69 ± 0.07m vs. 1.66 ± 0.04m, t = 2.05, $p<0.05$) while their weight and BMI were significantly lower, respectively (57.28 ± 4.49kg vs 63.13 ± 4.03kg, t = -5.47, $p<0.000$) and (22.49 ± 1.50 kg / m2 vs 19.73 ± 1 49 kg / m2, t = -7.37, $p<0.000$).
Conclusion: The nutritional status of endurance athletes was normal. However, despite this normality, Congolese endurance athletes have performances that are at the bottom of the ladder during national and international competitions.

Keywords: Nutritional status, athletes, endurance races, performance, competition period

Introduction
The achievement of the results of athletes is linked to the combination of several factors like: dietetics, hard training, technique, commitment and the will of the sportsman, and others.
Thus, of these different factors, necessary for the achievement of the sports results, we propose to study the nutritional state compared to the food profile and the anthropometric data of the Congolese endurance athletes and particularly those of Brazzaville. As a result, we have wondered whether the nutritional status of endurance athletes is the answer to achieving sports performance?

Research questions
Knowing that a varied and balanced diet is necessary to meet the energy needs of the athlete, it must be based in large part on the choice of foods rich in nutrients such as vegetables (raw or cooked), fruits, starch (pasta, rice, potatoes, legumes, cereals), dairy products, sausages, avocados and olives, oils, margarines, lean meats, fish, eggs and cheeses. This diverse and regular diet is sought after by anyone wanting to maintain balance and fitness.

We can ask the following questions
- Is the nutritional status of the athletes consistent with the sport practiced?
- Is the decline in performance related to their nutritional status?

To answer these questions, we made the following hypotheses
- The nutritional status of Congolese athletes is abnormal compared to the sport practiced
- The performances of Congolese athletes practicing endurance races are related poor nutritional status.

Methodology

Our cross-sectional study took place from 10 to 30 October 2018 in Brazzaville, capital of the Republic of Congo.

During our study, there were 2 groups namely

- An experimental group consisting of 32 Elite athletes, ie 22 boys and 10 girls practicing endurance races; 26.16 ± 2.79 years of age.
- A control group consisting of 32 subjects, that is 22 boys and 10 girls practicing the walk of health; 27.44 ± 3.34 years of age.

First, we collected anthropometric data and submitted a questionnaire to endurance athletes and walkers. This Questionnaire adapted by Cupisti *et al* (2002) [9] and "Recall 24 hours" (Arab *et al*., 2011) [2] allowed to collect, not only the data on their training and competition mode, but also on their habits to determine their nutritional status (Cade J., *et al*., 2002) [6].

Secondly, we evaluated the performances of the athletes by coming into contact with the results of the competitions during the various competitions in the 800m, 1500m and Half-marathon, the Congolese athletics federation and the internet. We compared national performance against world record data for endurance races.

Results

Table 1: Classification of Nutritional Status by Body Mass Index

Body mass index	Nutritional status
> 40	Very severe obesity
35.3-39.99	Severe obesity
30.0-34.99	Moderate obesity
25.50-29.99	Overweight
18.50-24.99	Normal
17.0-18.49	slight thinness
16.0-16.99	Moderate thinness
< 16.00	Severe thinness

Source: WHO (1995)

Table 2: Social situation of athletes (experimental group)

Variables	Girls (n= 10)		Boys (n=22)	
	N	%	n	%
High school Student	2	20	2	9.09
Bachelor student	5	50	14	63.63
Worker	0	00.00	1	4.54
Without job	3	30	5	22.74

This table shows that the majority of athletes were students (50% girls and 63.63% boys) and unemployed (30% girls and 22.74% boys).

Table 3: Anthropometric Data of Subjects

Variables	Experimental Group (Girls = 10 ; Boys=22)	Control Group (Girls = 10 ; Boys=22)	t	Sig
	$\bar{X} \pm \sigma$	$\bar{X} \pm \sigma$		
Age (years)	26.16 ± 2.79	27.44 ± 3.34	-1.66	0.1
Weight (Kg)	57.28 ±4.49	63.13 ±4.03***	-5.47	0.000
Size (m)	1.69 ±0.07*	1.66 ± 0.04	2.05	0.05
BMI (Kg/m²)	19.73 ± 1.49	22.49 ± 1.50***	-7.37	0.000

Table 3 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 / m²). However, there is a significant difference in size in favor of the experimental group (1.69 ± 0.07 vs 1.66 ± 0.04 m).

Table 4: Nutritional Status by Groups and Sex

	Sex	Status	Experimental group n (%)	Control group n (%)	Total N (%)
BMI x GROUP		Normal	26 (81.3)	32 (100.0)	57 (89.06)
		Thinness	6 (18.8)	-	7 (10.94)
BMI x SEX	Girls	Normal	6 (60.0)	10 (100.0)	16 (25.0)
		Thinness	4 (40.0)	-	4 (6.25)
	Boys	Normal	20 (90.9)	22 (100.0)	41 (64.06)
		Thinness	2 (9.1)	-	3 (4.68)

Table 4 shows that 81.3% of subjects in the experimental group have a normal nutritional status, while 18.8% are lean; however, all subjects in the control group are normal. In addition, 100.0% of the girls in the control group compared with 60.0% of the girls in the experimental group had a normal nutritional status. No girl in the control group has a lean nutritional status, while 40.0% of the girls in the experimental group are lean. However, 100.0% of boys in the control group versus 90.9% of boys in the experimental group had normal nutritional status; while no boys in the control group are lean, while 9.1% of the boys in the experimental group are.

Discussion

Using a questionnaire adapted by Cupisti *et al* (2002) [9] containing measurements of anthropometric data and the food situation of endurance runners and walkers according to the 24-hour recall (Arab *et al*, 2011, Souci *et al*. al, 1994, Tran *et al*, 2000, Thompson *et al*, 2013) [2, 24, 23, 26] we assessed the dietary habits of middle-aged and Congolese athletes and walkers. From our results, it appears that the experimental group composed of elite athletes and the control group consisting of walkers did not differ according to age. While weight and BMI were significantly elevated in favor of the control group, the size was significantly elevated in favor of the experimental group (Table 3).

Our results showed that 7 athletes, 4 girls and 3 boys were lean, while the majority were normal. Our athletes were for the majority of students, single, living with parents and the majority of athletes had been training for 6 years. By day, they trained for 2h30 minutes every afternoon. Weekly they trained for 4 days. Although they did not respect meal times,

they had a non-varied diet and ate twice a day (Table 2) (Bouhika *et al*., 2018) [3]. In terms of the quality and quantity of food consumed, the athletes reported that they consumed a poor quality of food served in insufficient quantity compared to the sport practiced. The majority of female and male athletes depended on the social conditions of their parents (Bouhika *et al*., Op cit, Mbemba *et al*., 2007) [17]. Accessibility to food was difficult because of the high price of food on the market. Similarly, Walkers lived under the control of their parents with a status of single, student and unemployed.

Performance

According to the tests at the end, the boys in the experimental group had a low performance compared to the national and world records in the 1500m (4'21 "60 as the national record for girls and 3'47"03 as the national record for boys vs 3'50"07 as the women's world record and 3'26"00 as world record). A gap of 31"53 " for girls and 21"03 for boys was found. Similarly, girls in the experimental group had a low performance compared to national and world records in the 800m (2'04"08 as the national record for girls and 1'49"5 as the national record for boys vs 1'53 ' '28 as world record for girls and 1'40"91 as world record for boys). A gap of 10"80 for girls and 08'14 for boys was found. These poor performances were also seen in the half marathon competitions (1h24'43 "as the girls' national record and 1h 11'58 " as the national record for the boys vs 1h04'52" as the world record for girls and 58 '23' as a world record for boys). A gap of 19'51 "for girls and 13'35 " for boys was found. Our athletes had weak records compared to the African and world level.

Indeed, between the performance obtained at the 8th Games of the Francophonie of Abidjan by our athletes of the experimental group and the best records of these games, there is a gap of 21 " in the 800m ladies (2'21 " vs 2 ') 00) and 1 " to the 1500m men (3'47 " vs 3'46 "). This gap may be due to the lack of a substantial preparation, and then at the level of 1500m, Congolese performances were close to record (Microplus Informatica - www.microplus.it - Timing by Time Tronics (2017) [18].

Nutritional status of subjects in relation to practiced sport

Many studies have shown that size, body mass, segmental relationships and body surface area are essential factors in the practice of sport and are an essential tool for the coach (Chibane 2010, Julie *et al*. Bulgakova, 1978) [7]. Although the work of Goubet (1988) had, in the past, given little importance to the impact or role of morphological characters on performance, many of the studies have claimed that morphological data played a role in the effectiveness of the game, in the largest number of duels, and represented the first levels of the determinants of performance (Chibane, op cit, Swapan, 2015, Angoneese, 1990) [15, 1]. For the results of all the morphological parameters of our sample, we notice that the subjects of the experimental group differed significantly from those of the control group regarding the size (1.69 ± 0.07m vs 1.66 ± 0.04m; t = 2.05, p<0.05). This good development of subjects in the experimental group, compared with those in the control group, was almost similar (26.16 ± 2.79 years vs 27.44 ± 3.34 years, t = -1.66, p> 0.05), was probably due to the fact that the practice of endurance for a long time had stimulated bone growth (Ratel S. & Martin V., 2014) [22]. With regard to the weight of subjects in the experimental group, however, it is evident that it is lower than that of the control group (57.28 ± 4.49 kg vs. 63.13 ± 4.03 kg; 5.47, p<0.000) (Table 3). Indeed, a large muscle mass in endurance runners would limit their ability to run easily for a long time. This is why some studies have shown that in endurance athletes, runners are the smallest, the lightest and a small body with few muscles.

This is what is observed in marathon runners: the musculature is reduced to a minimum because, one must not be too big (average 1, 68m to 1.78m), not too heavy (average 54kg to 68kg) and have little muscle (BMI: 19.5kg / m^2 to 21.21kg / m^2) (Helena Wehling *et al*, 2017) [12]. In this case, the leanness observed in our athletes could be likened to under nutrition. Under nutrition is considered as a state of loss of lean mass and body fat. And, more it is important, more the BMI is lower (HAS, 2011) [11].

The nutritional status of athletes or BMI or Quetelet index is an index that provides information on the performance level of the athlete (Chibane, Op cit). BMI values <18.50kg / m^2 are distinguished for subjects or athletes with a nutritional status of thinness. However, thinness is a sign of malnutrition (WHO, Op cit, FAO, 2012) [10], which explains why subjects are content to consume foods that are within their reach regardless of their nutritional intake and their preparation (Bouhika *et al*. 2017) [4], thus exposing itself, at any time, to the risk of malnutrition (Mouloki, 2007) [19]. However, for good sport practice, it is important for athletes to have a good nutritional status, ie a normal index between 18.50 kg / m^2 and 24.99 kg / m^2 (WHO, 1995). For the attainment of a weight and a deficiency of any kind can compromise both athletic performance in general and particularly short-run running in the short term and long-term health, especially with a real risk of deterioration of reproductive capacity and bone status (Maughan *et al*., 1999) [16].

Our results reveal that subjects in the experimental and control groups had normal nutritional status. However, control subjects were significantly elevated compared to subjects in the experimental group (22.49 ± 1.50 kg / m^2 vs. 19.73 ± 1.49 kg / m^2, t = -7.37; <0.000) (Table 4). With regard to the comparison of data on the nutritional status of the groups according to the sexes, it appears that in the experimental group, 6 subjects or 18.8% in total were lean and 26 subjects or 81.3% in the group total 32 subjects or 100% of the control group had a normal nutritional status. Among the 6 lean subjects in the experimental group, two (02) boys, 9.1% had a BMI between 17.19kg / m^2 and 17.28kg / m^2, and four (04) girls or 40% had a BMI between 17, 39kg / m^2 and 17.99kg / m^2. Our results also indicate that 20 boys, 90.9% and 06 girls, ie 60% of the experimental group against 22 boys or 100% and 10 girls or 100% of the control group were normal (Table 4). Normal nutritional status has been shown to be an important factor in achieving athletic performance (Clothilde Mora, 2013) [8]. However, our athletes ate well and had a normal nutritional status in the range of 18.50 kg / m^2 to 24.99 kg / m^2. These normal values are encouraged in all sportsmen and women to be in optimal physical condition (Jean-François Toussaint, 2015, Julien Schipman *et al*., 2015) [13, 15]. However, in our athletes, despite their normal physical and nutritional condition, have not made efforts to achieve good results.

Conclusion

Our study aimed to evaluate the nutritional status of Congolese athletes practicing endurance races and to analyze its relation with the poor performance achieved.

The present study had hypotheses that nutritional status was

abnormal and the poor performance of Congolese athletes was related to nutritional status.

In view of the results, we found that the athletes had a normal nutritional state but the performances were far from the African records, the Francophonie games record and the world record. Indeed, these poor performances were not related to nutritional status and may be caused by other factors that need to be explored.

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