



ASSESSMENT OF SPORT NUTRITION KNOWLEDGE OF CONGOLESE ATHLETES IN THE BRAZZAVILLE DEPARTMENTAL ATHLETICS LEAGUE, REPUBLIC OF THE CONGOⁱ

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ⁱ ÉVALUATION DES CONNAISSANCES EN NUTRITION SPORTIVE DES ATHLÈTES CONGOLAIS DE LA LIGUE DÉPARTEMENTALE D'ATHLÉTISME DE BRAZZAVILLE, RÉPUBLIQUE DU CONGO

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Abstract:

The place of a balanced diet in sport has proven to be very important. The objective of this study was to assess the nutritional knowledge of athletes in the Brazzaville athletics league. Our study was conducted on a sample of 50 athletes including 29 Boys and 21 Girls from the events combined with an average age of 23.50 ± 3.32 years and 21.33 ± 9.41 years respectively. The method used was the Abbreviated Sports Nutrition Knowledge Questionnaire (ANSKQ) to collect data related to nutrition knowledge from athletes. The results showed ignorance of ranking products for carbohydrate, fat, and protein gain respectively by 62.06% of Boys and 47.61% of Girls, 51.72% of Boys 80.95% of Girls, and 51.72% of Boys versus 61.90% of Girls). Similarly, 51.72% of Boys and 52.38% of Girls ignored the percentages of a balanced diet. Knowledge of what to eat to perform was low in 62.06% of boys and 66.66% of girls. The type of ration established was based on traditional experience in 65.51% of boys and 42.85% of girls. The level of nutrition knowledge was low in 51.72% of boys and 52.38% of girls. This justified the non-respect of meal intake and meal times before sport practice respectively in 82.75% of boys and 95.23% of girls. Hence the non-participation in the composition of the menus of 100% of Boys and 100% of Girls. In conclusion, Congolese athletes have a very low level of knowledge in the field of nutrition. However, a low level of knowledge in nutrition is associated with a negative impact on sport performance.

Keywords: evaluation, knowledge, diet, nutrition, athletes

Résumé :

La place de l'alimentation équilibrée dans le domaine sportif est avérée très importante. L'**objectif** de cette étude était d'évaluer les connaissances en nutrition des athlètes de la ligue d'athlétisme de Brazzaville. Notre étude a été menée sur un échantillon de 50 athlètes dont 29 Garçons et 21 Filles des épreuves confondues avec un âge moyen respectivement de $23,50 \pm 3,32$ ans et $21,33 \pm 9,41$ ans. **La méthode** utilisée était le Questionnaire Abrégé sur la Connaissance en Nutrition Sportive (ANSKQ) afin de collecter les données liées aux connaissances en nutrition auprès des athlètes. **Les résultats** ont montré l'ignorance de classer les produits pour le gain glucidique, lipidique et protéique respectivement par 62, 06% des Garçons et 47,61% des Filles, 51,72 % des Garçons 80,95% des Filles, et 51,72% des Garçons versus 61,90% des Filles). De même,

51,72% des Garçons et 52,38% des Filles ont ignoré les pourcentages d'une alimentation équilibrée. La connaissance de ce qu'il faut manger pour performer était faible chez 62,06% des Garçons et 66,66% des filles. Le type de ration établie était basé sur l'expérience traditionnelle chez 65,51% des Garçons et 42,85% des Filles. Le niveau de connaissance en nutrition était faible chez 51,72% des Garçons et 52,38% des Filles. Ce qui a justifié le non-respect des prises des repas et des heures repas avant la pratique sportive respectivement chez 82,75% des Garçons et 95,23% des Filles. D'où la non-participation à la composition des menus de 100% des Garçons et 100% des Filles. **En conclusion**, les athlètes congolais ont un niveau de connaissance très bas dans le domaine de nutrition. Or, le faible niveau de connaissance en nutrition est associé à un impact négatif sur la performance sportive.

Mots clés : evaluation, connaissance, alimentation, nutrition, athlètes

1. Introduction

Since its origins, man has always focused his intellectual and physical efforts on the quest for food, an essential and vital area. This is the case for the vast majority of the inhabitants of our planet, including athletes. This relationship between diet and physical activity profoundly influences the behavior of our players, the way of being, and the way of considering good sports performance among practitioners (Thurecht et al., 2020).

Well-adapted sports nutrition improves sports performance, reduces fatigue and the risk of disease and injury, and it also allows athletes to optimize their training and recover quickly (Kerksick et al., 2018).

Applied in training and competition, nutrition has proven to be an essential tool for the proper functioning of the body, good health and optimizing sports performance. In this perspective, a balanced diet and adequate eating behavior are sought to adjust them to the needs of each individual and each age and each level of physical activity (Arcusa Saura et al., 2019).

Before, athletes were doomed to food choices without benchmarks, hence the adaptation observed every day about what we eat and what we absorb took more and more an important place in training, and competition (Eck et al., 2021). And so, some researchers had previously adopted the idea that nutritional knowledge probably had little effect on a diet (Huang et al., 2021; Suliga et al., 2020).

Currently, some studies have shown that to maintain a good nutritional state, the athlete must make a consequent choice of foods to consume (Eck et al., 2021), have a good knowledge of foods and especially the nutritional value of these foods in order to maintain a daily balanced diet, a guarantee of physical fitness and performance (Collins et al., 2021). Making a good food choice requires special knowledge of sports nutrition because sports performance is to a very large extent dependent on one's nutritional status or nutritional condition (Pelly et al., 2022). In sports circles, coaches and athletes represent

an important source of information and influence food choices and behaviors (Vázquez-Espino et al., 2022).

These supervisors must be trained in sports nutrition and have sufficient knowledge to carry out the subject in order to guide athletes on the foods to be consumed in all circumstances. Athletes have specific energy and nutritional needs to allow them to reach their full athletic potential by meeting the needs related to daily training. In this perspective, Jacob et al. (2019) reported that coaches are considered an important source of nutritional information by their athletes. However, their knowledge in this field is often insufficient for good supervision and can lead to the dissemination of false information concerning sports nutrition.

Coaches and athletes should have specific training in nutrition, which would allow them to have a high or sufficient level of knowledge to provide adequate support in terms of nutrition. A good diet allows athletes to maintain their weight, recover after exercise, rebuild energy reserves, reward the expenditure made and obtain optimal performance in physical and mental activities (Purcell, 2013).

Following the advantages of nutritional knowledge, the work of Kwon et al. (2020) and Okano et al. (2021) suggested that energy intake should be distributed as follows: 50 to 55% of carbohydrates, 30 to 35% of lipids and 10 to 15% of protein. Despite extensive research on athletes, it is established that diet is adapted according to the type of sport practiced and the nutritional needs of the athlete (Papadopoulou et al., 2022; Braun et al., 2019; Lis et al., 2019). This requires the necessary knowledge related to nutrition (Scalvedi et al., 2021; Ozdoğan et al., 2011).

Due to the increasing increase in training programs and competitions, the increasing incidence of junk food, disordered eating (Buckley et al., 2021; Kontele et al., 2021; Melin et al., 2014) and nutritional pathologies in athletes (Gastrich et al., 2020; Ramona et al., 2021) and the contradictory results obtained in these athletes, further studies are needed to assess sports nutrition knowledge in athletes.

In Congo Brazzaville, the state of nutrition knowledge is not well known by athletes and coaches. The nutritional practices of Congolese athletes are not satisfactory and would be based on traditional principles. Athletes would have a lack of benchmarks and knowledge of what they need to eat in order to perform. Indeed, a few studies have been conducted on the diet of athletes (Mbemba et al., 2006; Bouhika et al., 2022; Bouhika et al., 2022).

However, the authors ignored any research that focused solely on the nutritional knowledge of athletes. These studies failed to show the link between nutritional knowledge and dietary intake. Therefore, this study will seek to elucidate the nutritional knowledge of athletes and lay the foundation upon which further research in this specific cohort can be built. To this end, this study was undertaken to assess the sports nutrition knowledge of Congolese athletes in the Brazzaville departmental athletics league.

2. Materials and Methods

2.1 Study Protocol

This study is of an exploratory and qualitative type involving 50 athletes including 29 Boys and 21 Girls from athletic disciplines combined with an average age of 23.50 ± 3.32 years and 21.33 ± 9.41 years respectively, belonging to athletics clubs of the departmental league of Brazzaville, in the period from March 22 to June 22, 2022. The Abridged Nutrition for Sport Questionnaire (ANSKQ) (Elsahoryi et al., 2021) of 50 questionnaires was used to collect data on the nutrition knowledge of Congolese athletes. Similarly, a protocol was planned including the following questions: identification of the athlete, type of event practiced, best ranking, number of training days per week, and medical visits at the start and middle of the season. sport, food knowledge, the amount of water consumed and many other questions related to the consumption of vegetables and legumes, the consumption of fish, meat, sweets and pastries, soft drinks, fruits, red meat, frequency of meals, the number of meals taken during the day, the time meals are taken before physical activity. All these questions spread over three (3) sections were part of the concerns that each athlete should answer by ticking the different boxes.

2.2 Attendees

A total of 50 athletes were selected. Due to the lack of a population sampling frame and the requirements of a large sample size to properly assess knowledge, respondents were selected for convenience (non-probability sampling method) (Hosseininejad et al., 2017). To be included in the sample, you had to fulfill the following inclusion criteria: practicing athletics (speed or endurance running, jumping and throwing), playing in one of the athletics clubs of the city of Brazzaville, training regularly, having a valid license, be in good health and have answered the questionnaire. Athletes in this study were defined as people who exercise to improve their sports performance and spend time practicing athletics in the context of training (Araújo et al., 2016) or competitions and the criteria for exclusion were sick people, and people who were not athletes and who did not meet the inclusion criteria.

2.3 Measures

A Beurer (BG-22, Germany) digital display impedance meter scale, sensitive to 100 g and with a maximum capacity of 150 kg, was used to determine body mass. Standing height was measured using a Stanley height rod installed on a hard, horizontal and stable surface. The body mass index (BMI) was calculated by taking the ratio of body mass in kg and height in square meters (m^2). The International Obesity Task Force (IOTF) age-sex BMI cut-off reference standards have been used to identify overweight and obesity in athletes (Jabakhanji et al., 2022).

2.4 Ethical Consideration

This project has been approved by the Ethics Council of the Higher Institute of Physical and Sports Education of the Marien NGOUABI University of Brazzaville (n°018 /UMNG /Dir /DA /SP/CS). Information about the study was communicated in writing to each parent of the participant prior to data collection. All participants gave their informed consent.

2.5 Authors' Contributions

BEJ designed and conducted the study and wrote the manuscript. MKPR, MSI, NF, MJM, LDS, BAM, EM and MV participated in data acquisition, performed statistical analyses, and reviewed the manuscript. The study protocol and the revision of the manuscript were carried out by IOYS, MJGA, NE, and MF.

2.6 Statistical Analysis

IBM SPSS software version 17 (IBM corporation, USA) was also used for statistical analysis. Data from this study were expressed as mean \pm standard deviation. They were tested for distribution with the Fisher-Snedecor F test. Student's t-test was used when both tests were verified. An ANOVA was used for repeated measures to compare time interactions by the group. A post hoc test of the Tukey group was carried out when the difference was significant. The significance level for all tests was set at $p < 0.05$.

3. Results

3.1 Anthropometric Data of Athletes

Table 1: Nutritional status of boys and girls according to BMI

Nutritional status	Boys		Girls	
	n (29)	%	n (21)	%
Severe obesity	-	-	-	-
Overweight	06	20.68	03	14.28
Normals	22	75.87	18	85.71
Slight thinness	01	3.44	-	-
Moderate thinness	-	-	-	-
Severe thinness	-	-	-	-

Table 2: Anthropometric data of female and male athletes

Variables	Boys				Girls				Meaning	
	Minimum	Max	\bar{X}	δ	Minimum	Max	\bar{X}	δ	you	
Age (years)	15	60	23.50	3.32	16	26	21.33	9.41	0.05	S
Size (m)	1.49	1.80	1.69	0.16	1.20	1.87	1.49	0.07	0.04	NS
Weight (kg)	50	89	64.65	7.56	49.00	78	61.47	8.47	0.39	NS
BMI(kg/m^2)	19.80	27.46	22.49	5.23	17.18	48.61	19.8	2.05	0.09	NS

Legend: Min: Minimum; Max: Maximum; BMI: Body Mass Index; \bar{X} : Average; δ : Standard deviation;

4.2 Food Habits of the Subjects

Table 3: Frequency of meals per day

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Once	-	-	01	4.76
Two times	15	51.72	11	52.38
Thrice	12	41.37	05	23.81
Four times	03	10.34	04	19.05
Five times	01	3.44	-	-

Table 4: For hydration during training or competition would be to drink when thirsty

Variables	Boys		Girls	
	n (29)	%	n (21)	%
True	15	51.72	13	61.90
False	05	17.24	05	14.29
Do not know	09	31.04	03	23.81

4.3 Nutrition Knowledge of Subjects

Table 5: Consumption of cereals (cereal, pasta, rice etc.), fruits and vegetables and dairy products (chocolate milk) for a gain: carbohydrate, protein or lipid

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Carbohydrate	06	20.69	02	9.52
Protein	03	10.34	01	4.76
Lipid	02	6.90	07	33.33
Do not know	18	62.07	11	52.39

The carbohydrate gain through the consumption of cereals was ignored by 62.07% of boys and 52.39% of girls.

Table 6: Consumption of margarine, butter, vegetable or animal oil, mayonnaise and other fats for a gain: carbohydrate, protein or lipid

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Carbohydrate	00	00	00	00
Protein	11	37.93	02	9.52
Lipid	03	10.34	02	9.52
Do not know	15	51.72	17	80.95

Lipid gain through the consumption of vegetable and animal oils was ignored by 51.72% of boys and 80.95% of girls.

Table 7: Consumption of meat, chicken, fish, beef, dairy products (cheese, milk, yogurt), nuts, legumes (peas, beans, etc.) for a gain: carbohydrate, protein or lipid

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Carbohydrate	05	17.24	02	09.52
Protein	03	10.34	04	19.04
Lipid	06	20.69	02	9.52
Do not know	15	51.72	13	61.90

Protein gain through the consumption of meat, chicken and fish was ignored by 51.72% of boys and 61.90% of girls.

Table 8: Balanced eating according to the athletes

Variables	Boys		Girls	
	n (29)	%	n (21)	%
50-55 from C+30-35 from L+15-20 from P	04	13.79	07	33.33
50-55 from C+30-35 from L+15-20 from P	05	17.24	03	14.29
50-55 from C+30-35 from L+15-20 from P	05	17.24	-	-
Do not know	15	51.72	11	52.38

Legend: C=Carbohydrates; L=Lipids; P=Protein

Table 9: Knowledge of what to eat to obtain good results

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Yes	11	37.93	07	33.33
No	18	62.06	14	66.66

Table 10: Experience on the type of ration established

Variables	Boys		Girls	
	n (29)	%	n (21)	%
The traditional experience	19	65.51	09	42.85
Comparison with others	03	10.34	02	9.52
A nutritionist	00	00	03	14.28
Other	07	24.13	07	33.33

Table 11: Skill level of athletes in the field of nutrition

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Very high	-	-	-	-
Raised	01	3.44	-	-
Moderate	06	20.68	05	23.80
Weak	15	51.72	11	52.38
Very weak	07	24.13	05	23.80

Table 12: Athletes' sources of information on nutrition

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Television	10	34.48	03	14.28
Internet	15	51.72	17	80.95
Magazines	-	-	-	-
Colleagues	02	6.89	-	-
A nutritionist/dietician	02	6.89	01	4.76
Journals (scientific)	-	-	-	-

Table 13: Before the practice, respect of the notion of 3 hours after eating

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Yes	05	17.24	01	4.76
No	24	82.75	20	95.23

Table 14: Respect for different meal times

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Yes	05	17.24	01	4.76
No	24	82.75	20	95.23

Table 15: Participation of athletes in the creation of menus

Variables	Boys		Girls	
	n (29)	%	n (21)	%
Yes			01	4.76
No	29	100	20	95.23

5. Discussion

5.1 Criticisms and Limits of the Method

This study on the evaluation of nutrition knowledge has some methodological biases. The study focused on 50 athletes, including 21 girls and 29 boys practicing the various athletics events within the athletics clubs of the departmental league of Brazzaville. The athletics clubs in this league have a small number of athletes practicing middle-distance races. However, in relation to the purchasing power of households, differences may appear in the supply and in nutritional intake. Which can lead to differences in nutritional status from each other.

The survey was based on a general questionnaire including questions on anthropometric data, physical activity and performance-related nutrition. Despite some errors or omissions during the completion of the questionnaires by the athletes which may contain biases, our method is still valid. The taking of information on food and performance through the questionnaire allowed us to evaluate the nutritional knowledge of the athletes of the departmental league of Brazzaville.

5.2 Assessment of Nutritional Status and Anthropometric Data

Apart from a case of slight thinness observed in boys, 28.68% or 06 boys are overweight and 75.87% or 22 in normal condition. 85.71% of Girls are normal and 14.28% are overweight. We find that a significant number of the subjects investigated are in normal condition. This means that these athletes follow some notions of nutrition and also have the means to obtain supplies (Callahan et al., 2020) (Table 1). The results obtained show that the average age of boys was 23.50 years and 21.53 years for girls. This range has proven to be favorable for better physical expression in the field. In addition, the average height was respectively 1.69 m for boys and 1.62 m for girls. However, the average weight was 50 kg in boys and 49 kg in girls, respectively, and the average body mass index was 22.49 kg/m² in boys and 23.90 kg/m² in girls, respectively (Table 2). These results concerning age are contrary to those observed by Mbemba et al. (2006) in high-level athletes in disciplines such as football.

5.3 Food Habits of the Subjects

For the Daily meal frequency (Table 3), the results show that the majority of Boys and Girls (51.72% vs. 52.38%) eat twice a day. Since sprinting was therefore the most practiced discipline, this preference could be explained by the fact that sprinting was the most spectacular and easy to perform in terms of duration (Haugen et al., 2019). From this perspective, we can say that these athletes do not have the basic notions of the number of meals per day for an athlete. This phenomenon can certainly be due to the lack of means observed in their household. This is sometimes a hindrance in improving sports performance. However, for good dietary discipline, athletes must eat at least 3 times a day (Bouhika et al., 2022). This would lead to a sufficient, balanced and suitable nutritional intake for the body subjected to the effort (Kesari, 2022). It is therefore sometimes advisable to take 4 structured meals by drawing sportingly from all the food groups. Studies show that the daily ratio should be taken 3 to 4 times a day in order to provide a sufficient amount of energy (Bouhika et al., 2022).

On the question of drinking water after feeling thirsty during training or competition (Table 4), we note that 51.72% of boys and 52.38% of girls answered (true) that is say that you should drink when you are thirsty. While, 31.04% of Boys and 23.81% of Girls answered (Don't know). Based on these results, it is safe to say that the majority of athletes do not have knowledge about hydration because water represents between 50 and 70% of body mass. Indeed, water losses can increase during physical activity. Training or competition is a physical activity, which induces significant water loss, hence the need to drink all the time even if thirst is not felt. Therefore, a state of dehydration can lead to a decline in performance. To avoid any adverse effect of dehydration on performance, water losses must be compensated by sufficient fluid intake during exercise (Evans et al., 2017).

5.4 Nutrition Knowledge of Subjects

For the question related to the consumption of cereal products such as (bread, cereal, pasta, rice, etc.), fruits, vegetables and dairy products (chocolate milk) for a gain: Carbohydrate, Protein, Lipid, Don't know (Table 5), the results show that 62.07% of the Boys and 52.39% of the Girls answered that they "did not know". Based on these percentages, we point out that the majority of athletes are unaware of the different foods with carbohydrate content. In the same way, we find that the athletes surveyed could not differentiate between carbohydrate, lipid and protein foods because these subjects knew nothing about the categorization of foods according to their nutrient content (Tables 06 and 07). However, the study by Pramuková et al., (2011) suggested that designing the most suitable diet for an athlete required an intimate knowledge of the relevant scientific literature, the training and competition requirements of the sport, the social situation and preferences of the individual athlete. Other studies have demonstrated that the timed ingestion of carbohydrates, proteins and fat can significantly affect the adaptive response to exercise (Holtzman et al., 2021).

Speaking of a balanced diet, the results obtained show that 51.72% of Boys and 52.38% of Girls mainly chose "don't know". These results sufficiently prove that our athletes do not have knowledge of the recommended percentages for balanced nutrition (Table 8). However, a balanced diet should provide 50% to 55% of carbohydrates, 10% to 15% of proteins and 30% to 35% of fats (lipids) of total energy intake (Kwon et al., 2020; Ruddick- Collins et al., 2022; Arcusa Saura et al., 2019; Aragon et al., 2017).

When it comes to what to eat for good performance, the results reveal that the majority of male and female athletes do not have specific knowledge on this subject. Indeed, 62.06% of Boys and 66.66% of Girls answered "no" to the question, which proves sufficiently that the latter do not have any knowledge of nutrition. In this perspective, their answer, therefore, justifies our main hypothesis which states "The Congolese athletes of the Brazzaville departmental athletics league do not have any real knowledge of sports nutrition" (Table 9). Athletes must consume foods rich in macronutrients, such as carbohydrates, proteins and fats which are energy elements and constitute the fuel necessary for a living organism and practicing physical activities (Braun et al., 2019). These results agree with the recommendations of Economos et al. (1993) in athletes and coaches. These state that the nutritional intake of elite athletes is a critical determinant of their athletic performance and their ability to compete both physically and mentally. They also reported that athletes in training should consume 70% of their total calories as carbohydrates. Athletes on a low-energy diet (<2200 kcal/day) should have a diet containing <25% fat, and athletes with high-energy requirements should consume 30% fat in their diet.

Regarding the experience of the rations (Table 10), the results show that the rations consumed by the athletes are established according to the traditional experience. Because 65.51% of Boys and 42.85% of Girls responded mainly in this sense to this question. However, this dietary practice described as "traditional" is not based on a scientific basis

and can cause a lot of trouble for athletes (Frączek et al., 2021; Burke et al., 2019). Given the importance of specialists in the field, the presence of a nutritionist within sports clubs is essential, he is responsible for anticipating, diagnosing and taking charge of disorders related to nutrition, from diabetes to obesity through cholesterol, food intolerances, anorexia or bulimia (Wilson, 2019). They know perfectly the nutritional contribution of foods, their effects on health and adapt the athlete's diet to his needs (Nascimento et al., 2016; Pramuková et al., 2011; Iwasa-Madge et al., 2022). The lack of knowledge of these athletes in nutrition is also supported by the answers given to the question concerning their level or degree of skills (Table 11). The question results show that 51.72% of Boys and 52.38% of Girls have a low level of proficiency in this question (Table 11). However, the majority of these athletes use the internet as their source of information. This is to say that these athletes do not go to libraries, and they do not read scientific journals demonstrating the need for knowledge in nutrition. They certainly have the ease of accessing nutrition knowledge through the internet by its low reach or by using phones or social networks (Ryan, 2022; Żarnowski et al., 2022) (Table 12).

In addition, the athletes surveyed have no knowledge of the 3-hour law, it appears from these results that 82.75% of boys and 95.23% of girls do not eat in compliance with this law (Table 13). Whatever the sport envisaged, a sport requiring an effort of long and short duration, a rule is essential, and must always be observed. That of always respecting the period of 3 hours minimum and 4 hours before practicing physical effort, that is to say, between the time of the last meal and the start of the competition. Indeed, digestion induces hyper vascularization which significantly hinders muscular effort by requiring intense muscular and cerebral vascularization. This meal should be digestible and relatively hearty. If the competition takes place in the morning around 10 a.m., this forces the subject to get up early to eat this meal. If the competition takes place in the afternoon, breakfast will be light and lunch will be taken early in order to respect this important interval of 3 to 4 hours (Kerksick et al., 2018). In hot weather, it will be necessary to advise on the subject of lightening the meal taken before the competition and to respect an even longer interval, because digestion is disturbed by the effort and the heat.

Indeed, for good digestion and to promote energy reserves by avoiding digestive disorders, it is recommended to eat three (3) hours before physical exertion in order to achieve optimal performance. Physical exertion also slows down digestion and gastric emptying, which can cause discomfort during physical exercise (DeOliveira & Burini, 2011). In this same perspective (Table 14), the results show that athletes do not respect meal times because 82.75% of boys and 95.23% of girls do not respect food consumption times. Consuming the right amount of macronutrients, micronutrients and fluids is essential to provide the energy needed for growth and activities (Evans et al., 2017; Lis et al., 2019). With this in mind, to optimize performance, young athletes must learn what, when and how to eat and drink before, during and after activity. Good nutrition is essential for athletes to grow well and achieve optimal sport's performance (Purcell, 2013).

Young athletes need to learn what foods to get energy from, when to eat certain foods, how to eat during an event, and when and what to eat to recover after an activity. They absolutely need a well-balanced diet containing the right amounts of macronutrients (proteins, carbohydrates and fats) and micronutrients (vitamins and minerals) to draw energy for their growth, their proper functioning of the body and to carry out their activities (Callahan et al., 2020; Purcell, 2013).

Regarding the participation of athletes in the constitution of menus (Table 15), the results show that there is no relationship between the coach and the athlete in the choice of foods to be consumed by athletes during training or competitions. For this, 100% of the Boys and 95.23% of the Girls confirmed the non-participation in a concerted way in the program or menu of the athletes. This allows us to detect the lack of nutritionist in the clubs. However, the nutritionist plays the role of trainer and educator in nutrition. He develops personalized food programs and monitors the nutritional balance of his athletes (Yokoyama et al., 2022). The nutritionist is responsible for anticipating, diagnosing and managing nutrition-related disorders. The dietician sets up food programs adapted to the needs of each patient and ensures that they adopt a healthy and balanced diet, hence the need for the dietician and nutritionist within sports clubs and federations (DiMaria-Ghalili et al., 2014; Thomas et al., 2016).

6. Conclusion and Suggestions

This qualitative study aimed to assess the level of nutritional knowledge of Congolese athletes in the Brazzaville departmental athletics league.

Like any scientific research, this study certainly presented methodological biases in the collection of information or data.

However, we followed all the necessary steps for a study on the level assessment of nutrition knowledge. At the start of this work, we formulated the following main hypothesis: "The Congolese athletes of the Brazzaville departmental athletics league do not have specific knowledge of sports nutrition". The nutrition of Congolese athletes in the departmental athletics league of Brazzaville is unbalanced and does not meet their energy needs. It appears from this study that the nutritional status of the boys was mostly normal, despite a case of slight thinness, we note the majority of the subjects were normal weight.

Although the nutrition status shows satisfactory results, we can safely say that after analyzing the results, we fully understand that athletes do not have adequate knowledge of nutrition.

The level of knowledge in the nutrition of our athletes is insufficient insofar as they do not know what to eat for the achievement of optimal performance nor the meal times, or the hours of eating before physical and sports activity. The latter even ignore the role of a nutritionist or dietician within a club. We can therefore say that they have an unbalanced diet that does not meet the standards of nutrition; which justify our

hypothesis. This imbalance in macronutrients is due to the lack of nutritional information due to the absence of nutritionists in these clubs. This poses serious health problems for the rest of the sports careers of these athletes. Therefore, we suggest that athletes and even coaches and managers of sports clubs should undergo training in nutrition; the existence of nutritionists and dietitians in sports movements in order to watch over the energy intake during the different phases of the sports season which in turn must be programmed, planned, observed, controlled and directed by qualified trainers in the sports discipline practiced. That the State put in place a policy of financing clubs and more particularly athletes if we want to obtain good results. It would be very desirable to integrate nutritionists and dieticians within the federations and even in these clubs to put in order to this problem which is at the base of the hope of good results after good health and the predispositions related to the practice of sporting physical activity.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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References

- Aragon AA, Schoenfeld BJ, Wildman R, Kleiner S, VanDusseldorp T, Taylor L, et al. International society of sports nutrition position stand: diets and body composition. *Journal of the International Society of Sports Nutrition*. 3 janv 2017;14(1):16.
- Arcusa Saura R, Pilar Zafrilla Rentero M, Marhuenda Hernández J. Sports Nutrition and Performance. In: Mózsik G, Figler M, éditeurs. *Nutrition in Health and Disease - Our Challenges Now and Forthcoming Time* [Internet]. IntechOpen; 2019 [cité 14 janv 2023]. Disponible sur: <https://www.intechopen.com/books/nutrition-in-health-and-disease-our-challenges-now-and-forthcoming-time/sports-nutrition-and-performance>
- Araújo CGS, Scharhag J. Athlete: a working definition for medical and health sciences research. *Scand J Med Sci Sports*. janv 2016;26(1):4-7.
- Bouhika EJ, Boussana AM, Kounga PRM, Nsompfi F, Moussouami SI, Mboutou BC, et al. Dietary and Biochemical Profile of Congolese Athletes in Endurance Races during International Competition. *JBM*. 2022;10(09):340-57.
- Bouhika EJ, Nsompfi F, Alongo YRG, Mabounda Kounga PR, Matondo Ntala D, Mboutou CB, et al. Etude des apports nutritionnels et la dépense énergétique des athlètes

- Congolais internés pour le Semi-Marathon International de Brazzaville (SMIB). *Int J Biol Chem Sci.* 2022;16(4):1492-506.
- Buckley GL, Hall LE, Lassemillante ACM, Belski R. Disordered eating & body image of current and former athletes in a pandemic; a convergent mixed methods study - What can we learn from COVID-19 to support athletes through transitions? *J Eat Disord.* déc 2021;9(1):73.
- Braun H, Carlsohn A, Großhauser M, König D, Lampen A, Mosler S, et al. Energy needs in sports. Position of the working group sports nutrition of the German Nutrition Society (DGE). *Ernährungs Umschau.* 15 août 2019;(66(8)):146-53.
- Burke LM, Castell LM, Casa DJ, Close GL, Costa RJS, Desbrow B, et al. International Association of Athletics Federations Consensus Statement 2019: Nutrition for Athletics. *International Journal of Sport Nutrition and Exercise Metabolism.* 1 mars 2019;29(2):73-84.
- Callahan A, Leonard H, Powell T. Nutrition: science and everyday application. v. 1.0. Open Oregon Educational Resources; 2020.
- Collins J, Maughan RJ, Gleeson M, Bilsborough J, Jeukendrup A, Morton JP, et al. UEFA expert group statement on nutrition in elite football. Current evidence to inform practical recommendations and guide future research. *Br J Sports Med.* avr 2021;55(8):416-416.
- DiMaria-Ghalili RA, Mirtallo JM, Tobin BW, Hark L, Van Horn L, Palmer CA. Challenges and opportunities for nutrition education and training in the health care professions: intraprofessional and interprofessional call to action. *The American Journal of Clinical Nutrition.* 1 mai 2014;99(5):1184S-1193S.
- DeOliveira EP, Burini RC. Food-dependent, exercise-induced gastrointestinal distress. *Journal of the International Society of Sports Nutrition.* 4 févr 2011;8(1):12.
- Eck KM, Byrd-Bredbenner C. Food Choice Decisions of Collegiate Division I Athletes: A Qualitative Exploratory Study. *Nutrients.* 6 juill 2021;13(7):2322
- Economos CD, Bortz SS, Nelson ME. Nutritional Practices of Elite Athletes: Practical Recommendations. *Sports Medicine.* déc 1993;16(6):381-99.
- Elsahoryi NA, Trakman G, Al Kilani A. General and sports nutrition knowledge among Jordanian adult coaches and athletes: A cross-sectional survey. Pessôa Filho DM, éditeur. *PLoS ONE.* 18 nov 2021;16(11):e0258123
- Evans GH, James LJ, Shirreffs SM, Maughan RJ. Optimizing the restoration and maintenance of fluid balance after exercise-induced dehydration. *Journal of Applied Physiology.* 1 avr 2017;122(4):945-51
- Frączek B, Pięta A, Burda A, Mazur-Kurach P, Tyrała F. Paleolithic Diet—Effect on the Health Status and Performance of Athletes? *Nutrients.* 21 mars 2021;13(3):1019
- Gastrich MD, Quick V, Bachmann G, Moriarty AM. Nutritional Risks Among Female Athletes. *Journal of Women's Health.* 1 mai 2020;29(5):693-702.

- Haugen T, Seiler S, Sandbakk Ø, Tønnessen E. The Training and Development of Elite Sprint Performance: an Integration of Scientific and Best Practice Literature. *Sports Med - Open*. déc 2019;5(1):44.
- Holtzman B, Ackerman KE. Recommendations and Nutritional Considerations for Female Athletes: Health and Performance. *Sports Med*. sept 2021;51(S1):43-57.
- Hosseinijad SM, Aminiahidashti H, Pashaei SM, Goli Khatir I, Montazer SH, Bozorgi F, et al. Determinants of Prolonged Length of Stay in the Emergency Department; a Cross-sectional Study. *Emerg (Tehran)*. 2017;5(1):e53.
- Huang Z, Huang B, Huang J. The Relationship between Nutrition Knowledge and Nutrition Facts Table Use in China: A Structural Equation Model. *IJERPH*. 10 juin 2021;18(12):6307.
- Iwasa-Madge K, Sesbreno E. A Proposed Conceptual Sport Nutrition Approach for Athlete Development and Assessment: The Athlete Nutrition Development Approach. *Sports Med - Open*. déc 2022;8(1):142.
- Jabakhanji SB, Boland F, Ward M, Biesma R. Prevalence of early childhood obesity in Ireland: Differences over time, between sexes and across child growth criteria. *Pediatric Obesity [Internet]*. nov 2022 [cité 14 janv 2023];17(11). Disponible sur: <https://onlinelibrary.wiley.com/doi/10.1111/ijpo.12953>
- Jacob R, Couture S, Lamarche B, Provencher V, Morissette É, Valois P, et al. Determinants of coaches' intentions to provide different recommendations on sports nutrition to their athletes. *Journal of the International Society of Sports Nutrition*. 15 janv 2019;16(1):57.
- Kerksick CM, Wilborn CD, Roberts MD, Smith-Ryan A, Kleiner SM, Jäger R, et al. ISSN exercise & sports nutrition review update: research & recommendations. *Journal of the International Society of Sports Nutrition*. 5 janv 2018;15(1):38.
- Kesari A, Noel JY. Nutritional Assessment. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing; 2022 [cité 15 janv 2023]. Disponible sur: <http://www.ncbi.nlm.nih.gov/books/NBK580496/>
- Kontele I, Vassilakou T. Nutritional Risks among Adolescent Athletes with Disordered Eating. *Children*. 21 août 2021;8(8):715.
- Kwon YJ, Lee HS, Park JY, Lee JW. Associating Intake Proportion of Carbohydrate, Fat, and Protein with All-Cause Mortality in Korean Adults. *Nutrients*. 21 oct 2020;12(10):3208.
- Lis DM, Kings D, Larson-Meyer DE. Dietary Practices Adopted by Track-and-Field Athletes: Gluten-Free, Low FODMAP, Vegetarian, and Fasting. *International Journal of Sport Nutrition and Exercise Metabolism*. 1 mars 2019;29(2):236-45.
- Mbemba F, Massamba A, Bazolo P, Mabiala Babela JR, Senga P. L'alimentation du footballeur congolais de haut niveau en période de précompétition. *Science & Sports*. juin 2006;21(3):131-6.

- Melin A, Torstveit MK, Burke L, Marks S, Sundgot-Borgen J. Disordered Eating and Eating Disorders in Aquatic Sports. *International Journal of Sport Nutrition and Exercise Metabolism*. août 2014;24(4):450-9.
- Nascimento M, Silva D, Ribeiro S, Nunes M, Almeida M, Mendes-Netto R. Effect of a Nutritional Intervention in Athlete's Body Composition, Eating Behaviour and Nutritional Knowledge: A Comparison between Adults and Adolescents. *Nutrients*. 7 sept 2016;8(9):535.
- Okano Y, Okamoto M, Yazaki M, Inui A, Ohura T, Murayama K, et al. Analysis of daily energy, protein, fat, and carbohydrate intake in citrin-deficient patients: Towards prevention of adult-onset type II citrullinemia. *Molecular Genetics and Metabolism*. mai 2021;133(1):63-70.
- Ozdoğan Y, Ozcelik AO. Evaluation of the nutrition knowledge of sports department students of universities. *Journal of the International Society of Sports Nutrition*. 4 févr 2011;8(1):11.
- Papadopoulou SK, Mantzourou M, Kondyli-Sarika F, Alexandropoulou I, Papathanasiou J, Voulgaridou G, et al. The Key Role of Nutritional Elements on Sport Rehabilitation and the Effects of Nutrients Intake. *Sports*. 26 mai 2022;10(6):84.
- Pelly FE, Thurecht RL, Slater G. Determinants of Food Choice in Athletes: A Systematic Scoping Review. *Sports Med - Open*. déc 2022;8(1):77.
- Pramuková B, Szabadosová V, Soltésová A. Current knowledge about sports nutrition. *Australas Med J*. 2011;4(3):107-10
- Purcell L, Canadian Paediatric Society, Paediatric Sports and Exercise Medicine Section. Sport nutrition for young athletes. *Paediatrics & Child Health*. 2 avr 2013;18(4):200-2.
- Ramona F, Sara G, Carlo P. Risk of developing eating disorders through the misperception of the body image and the adoption of bad eating habits in a sample of young volleyball athletes. *Arch Food Nutr Sci*. 8 mars 2021;5(1):007-17.
- Ruddick-Collins LC, Morgan PJ, Fyfe CL, Filipe JAN, Horgan GW, Westerterp KR, et al. Timing of daily calorie loading affects appetite and hunger responses without changes in energy metabolism in healthy subjects with obesity. *Cell Metabolism*. oct 2022;34(10):1472-1485.e6.
- Ryan M. The ethics of dietary apps: Technology, health, and the capability approach. *Technology in Society*. févr 2022;68:101873.
- Scalvedi ML, Gennaro L, Saba A, Rossi L. Relationship Between Nutrition Knowledge and Dietary Intake: An Assessment Among a Sample of Italian Adults. *Front Nutr*. 13 sept 2021;8:714493.
- Suliga E, Cieśla E, Michel S, Kaducakova H, Martin T, Śliwiński G, et al. Diet Quality Compared to the Nutritional Knowledge of Polish, German, and Slovakian University Students—Preliminary Research. *IJERPH*. 4 déc 2020;17(23):9062.
- Thomas DT, Erdman KA, Burke LM. Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and

- Athletic Performance. *Journal of the Academy of Nutrition and Dietetics*. mars 2016;116(3):501-28.
- Thurecht R, Pelly F. Key Factors Influencing the Food Choices of Athletes at two Distinct Major International Competitions. *Nutrients*. 27 mars 2020;12(4):924.
- Vázquez-Espino K, Rodas-Font G, Farran-Codina A. Sport Nutrition Knowledge, Attitudes, Sources of Information, and Dietary Habits of Sport-Team Athletes. *Nutrients*. 23 mars 2022;14(7):1345.
- Wilson PB. 'I think I'm gonna hurl': A Narrative Review of the Causes of Nausea and Vomiting in Sport. *Sports*. 4 juill 2019;7(7):162.
- Yokoyama H, Deguchi M, Hongu N. The Role of Diets and Dietitians for Para-Athletes: A Pilot Study Based on Interviews. *Nutrients*. 9 sept 2022;14(18):3720.
- Żarnowski A, Jankowski M, Gujski M. Nutrition Knowledge, Dietary Habits, and Food Labels Use—A Representative Cross-Sectional Survey among Adults in Poland. *IJERPH*. 9 sept 2022;19(18):11364.

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