Journal of Sport Science Technology and Physical Activities
ISSN : 1112-4032
eISSN 2543-3776

VOL:17 / N°: 2 December **(2020), p: 30-44**

Prevalence of malnutrition among adolescent football players (15 to 18 years) and its association with their level of nutritional knowledge in SIADA state.

Mazouz ghaouti[1]; Bloufa boudjema[2]
[1,2] Physical Education Institute, University of Mostaganem, Algeria, [1]ghawrym@yahoo.com
[2]bloufa.boudjema@univ-mosta.dz

ARTICLE INFORMATION
Original Research Paper
Received : 14/07/2020
Accepted : 26/09/2020
Published :01/12 /2020

Keywords:
Prevalence of malnutrition;
Nutritional knowledge;
adolescent Football players (15 to 18 years)

Corresponding author: Mazouz Ghaouti,
e-mail: ghawrym@yahoo.com

Abstract

Objectives The study aimed to assess the prevalence of malnutrition in adolescent football players aged (15-18 years) in Saida state (North-western region of Algeria), and to determine the relationship between the nutritional status and the level of nutritional knowledge of these players.

Methods We used a descriptive method, on 142 adolescent players, we applied some anthropometric measurements (weight, height, and body mass index) to measure nutritional status, and a questionnaire, to assess nutritional knowledge.

Results after analyzing data using the SPSS version 22, the results showed that malnutrition, specifically under nutrition was still a problem for adolescent football players, and this problem was significantly related to the player's level of nutritional knowledge.

ConclusionsOn this basis, The study recommended that paying more attention to the nutritional status of adolescent players and strengthening their nutritional knowledge could help remarkably to improve the health and the performance of these players in the future

1. Introduction

Food is the source of life, and man has long recognized the role and importance of food as a source of energy, activity and vitality, and its protection from many diseases (Eastwood, 2003). However, this food has become a double-edged sword, meaning that its deficiency is a major problem, in the same time its excessive consumption may cause several health problems (Belounis Rachid, 2019). Therefore, it is necessary to eat balanced food according to the needs of the body.

Adolescence is a time of rapid growth and development (Khiat, 2010). It is estimated that during puberty, adolescents gain 50% of their adult weight, 20% of their adult height, and 45% of their adult skeletal mass. These rapid growths and developmental rates during adolescence exert a profound effect on energy and nutrient needs. Deficient intakes may delay pubertal development, impede growth and muscle development, and affect cognitive performance (Driskell, 2001). So because any form of malnutrition resulting from a lack of some elements may affect not only the processes of biological growth but also other factors related to the psychological and social wellbeing of the children or the adolescents (Hima Bindu Malla, 2017).

The nutritional status would become more and more important when the adolescent is practicing a disciplined exercise regularly as football who according to Bonnici, this game places various physiological demands on players, who are required to respond by carrying out a range of locomotor activities at different intensities. Such activity patterns contribute to a high energy turnover in both training and match-play, which requires the intake of adequate fuel sources to sustain it (Bonnici, 2017).

1.1. Literature Review

Although a large number of nutritional studies and surveys have been conducted by different workers on the health and nutritional status of school's children and adolescents in Algeria (Abdellah, 2005), (Abdelmalek, 2008), (Nora, 2018). Most of these studies either did not take into account the factor of sport and exercise practiced by children and adolescents as a determinant of their nutritional needs, or excluded purposefully the athlete ones from their samples. Besides that, and as far as we could reach, we did not find any study that attempted to examine the relationship between the nutritional knowledge of young football players

and their nutritional status, while many studies showed that one reason for the inadequate eating of young players can be poor nutritional knowledge since most athletes still poorly educated about proper nutritional practices and unskilled in making suitable daily nutritional choices (Grete R. Hornstrom, 2011).

Nowadays, Football among youth categories suffers from many problems in our country, which resulted directly or indirectly in a low level of expectations for a promising future based on the local young players (GHOUAL Adda, 2015), in the same time the Algerian Football Federation is keenly looking for solutions to change this reality for the better (Saddate Redouan, 2016). Among the solutions, researchers believe that this body should probably look at the nutritional factors of these young players, while they are being exhausted in intense training, without respecting the potential impact that training may have on nutrient requirement because it is critical that the short term and the long-term effects of exercise or training on the nutritional status must be determined, that adolescents soccer players need a sound nutritional status which plays a key role, both in athletic excellence and long term good health (Hima Bindu Malla, 2017). In the present study, we tried to assess the nutritional status of adolescent football players in the range of age between 15 and18 years old, living in the North-western region of Algeria (State of Saida), and we also examine the nature of the relationship between player's nutritional status and their level of knowledge in nutrition.

2. Method and Materials :

Our study followed the descriptive method, through a cross-sectional survey and before presenting the study procedures, it is important to introduce some terms related to the main variables in this study, where we describe the prevalence of malnutrition in our study sample according to the definition of The European Society for Clinical Nutrition and Metabolism and the World Health Organization:

Nutritional status: is the physiological state of an individual which results from the relationship between nutrient intake and requirements, and also from the body's ability to digest, absorb, and use these nutrients.

Malnutrition: arises either from deficiencies or excesses of specific nutrients or from undiversified diets (wrong kinds or proportions of foods).

Nutritional assessment: identifying characteristics known to be associated with malnutrition, measurement of the body through

anthropometries, biochemical testing, clinical examination, and dietary intake.

Nutrition knowledge: refers to knowledge of concepts and processes related to nutrition, and the individual's ability to understand and defining nutritional information that maintains his health and vitality.

2.1. Participants:

The target population was all the football players aged (15to18) years, who compete in football and follow up a regular training (at least three times a week) in the administrative district of SAIDA State (Algeria). And registered in the various official football federations. Their total number according to the official records of the regional league of football in SAIDA reached (608) players, representing 11 local clubs, active in various levels of national competition during the sports season of 2019/2020.

The study sample has comprised a total of 142 young players (All male, whose ages range between 15 and 18 years) chosen randomly from 5 different football clubs in SAIDA, with a mean training age of 3.9±2.6 years. We categorized players into four age groups (Under 16 years old =41players, under 17 years old = 39 players, under 18 years old = 34, and players under 19 years old = 28 players).

2.2. Materials:

2.2.1. Materials and methods used for the assessment of nutritional status:

To measure and study the prevalence of malnutrition in a population or a group of individuals, especially children, and adolescents, the World Health Organization recommends the use of anthropometric indicators (weight, height, and body mass index) as it is considered one of the best and most reliable methods besides the fact that its use is inexpensive, non-surgical and appropriate in surveys on large samples (de Onis M, 2007). Accordingly, researchers used the standards and references of the World Health Organization for child and adolescent growth (WHO, 2011), and the references of the Centers for Disease Control and Prevention (CDC 2000) in the United States of America (Kuczmarski RJ, 2002). Anthropometric data (weight, height, age) were used to estimate the prevalence of underweight, stunting, thinness, and overweight. The estimation of prevalence had to go through the calculation of the anthropometric indices (Weight for Age, Height for Age and BMI for Age) expressed in Z-score using as a basis for

calculating the growth references of WHO 2007 for children and adolescents aged 5 to 19 years (de Onis M, 2007). We used free software Who AnthroPlus version 1.0.4 (WHO, 2011). We imported the data: weight (kg), height (cm), BMI (kg / m2), sex (Female/male) and age (month) or the date of birth and the date of the survey. Body Mass Index or (B.M.I) was computed using the following standard equation: BMI = weight (kg) / height (m2), therefore Anthropometric indicators (references) adopted for this study are summarized in the table below:

Table 1: The table presents the anthropometric indices according to the WHO classification

Type of malnutrition	Indicator
Underweight	Weight for age (P / A) <-2 Z score
Stunting (statural growth retardation)	Height / age (T / A) <-2 Z score
Thinning	Body mass index (BMI / age) <-2 Z score
Overweight	Body mass index (BMI / age)> +2 Z score

2.2.2. Materials and methods used for the assessment of nutritional knowledge:

The nutritional knowledge of adolescent's players was assessed using a modified and abbreviated version of a nutritional knowledge questionnaire, that was originally developed and used during the Master's thesis by the same researcher Mazuoz Ghouthi (Ghaouti, 2014), And its validity and reliability were confirmed during this study, in addition to the fact that it was applied on a similar sample and in the same environment in which the current study was conducted. The questionnaire was divided into two parts, the first contained general information about the subjects (date of birth, year's number of practicing football, frequency, duration of training per week, education levels, and place of living). The second part of the questionnaire has comprised 30 phrases (items), intended to test the level of young player's knowledge in nutrition, each phrase could either be correct or wrong scientifically and healthily, the respondent could answer it by choosing one of the answer options(True, False, Not sure) according to his opinion about the soundness of the phrase, the(Not sure) response was included in the respondent choices to avoid guesswork or random answers, the questionnaire items assessed four dimensions of knowledge in nutrition which are:

General nutritional knowledge dimension comprises 10 items that test the level of a young player's knowledge and their understanding of basic information in nutrition, such as the role of different nutrients in the human body and their sources.

The energy nutrients dimension which comprises 7 items, assesses the player's level of knowledge in the term of energy foods that he needs for physical exertion.

The third dimension comprises 7 items, and it reflects the extent of the athlete's understanding of growth and building nutrients and their role in the athlete's body.

The fourth dimension tests the young athlete's understanding of the role of water and prevention and maintenance nutrients such as vitamins and minerals, and this dimension comprises 6 items.

As we mentioned before, the questionnaire was structured into closed questions with three response options (True, False, not sure), only one response option was correct. If the subject answer was correct, he received two points, and if the subject chose the wrong option he received no point, and if the answer was "Not sure" the participant got one point. A maximum score of 60 points could be achieved when each item was answered correctly. For better interpretation, the total score was classified into three categories using the following system:

- Above 45 points (>75%) = good nutrition knowledge.
- Between 30 and 44 points (<75%-50%>) =insufficient nutrition knowledge.
- Under 30 points (<50%) = poor nutrition knowledge.

2.3. Design and procedure :

The researchers performed anthropometric measurements following the protocol and recommendation of the WHO, the anthropometric material used were: (a) height measuring rod, with a precision of 1 mm and a range (130-210 cm); (b) body mass scale with a precision of 0.1 kg and a range (2 kg - 130 kg). All anthropometric measurements were performed before training sessions in the training fields of the clubs, most of them took place during the winter and sprint school holidays of the 2019/2020 academic year. In the same fashion, questionnaires were distributed and retrieved, which did not take long for the players to complete it (10 minutes on average), as the researchers themselves took care of the process with the help and cooperation of the club's coaches.

Data were collected from December 2019 until March 2020. Clubs, trainers, players, and their parents gave their consent to take part. Study subjects (adolescent players) were informed of their right to refuse and of the strict respect of the confidentiality of their answers.

2.4. Statistical Analysis :

we used the software SPSS 22.0 for Windows for the statistical analysis in order to express the continuous and category data of sample characterization, absolute (means and standard deviations) and relative (%) frequencies. The association between the category variables was evaluated with the Chi-square test. The significance level accepted was of $p < 0.05$.

3. Results :

The range of age of participants was between 15 and 18 years. young players had been practicing football for 3.9years on average and had been taking training session in regular basis at least three times a week, on average, training sessions took 100±14.6 minutes, on the whole the results of anthropometric measurement revealed that the mean height was 1,61 ± 0,08 M, the mean body weight was 53,5 ± 8,77 kg and average body mass index (BMI) was 19,4 ± 2,71 kg/m2. The weight, height, and BMI of the study subjects were found to be slightly under the required range according to their age. Table 2 shows more details.

Table 2: Anthropometric measurements of the study subjects (young football players in SAIDA) according their ages.

Age / years	(N)	Height Mean± sd / (M)	Weight Mean± sd / (kg)	B M I Mean ± sd/(kg/m2)
≥ 15 years	41	1,54 ± 0,08	45,07 ±7,85	18,80 ± 1,52
≥ 16 years	39	1,56 ±0,11	49,92 ± 8,20	20,37 ±1,58
≥17 years	34	1,63 ±0,09	53,81 ±9,49	18,94 ±1,53
≥18 years	28	1,68 ±0,08	59,2 ±7,94	19,49 ±1,06
Total	142	1,61 ± 0,08	53,5 ± 8,77	19,4 ± 2,71

3.1. The prevalence of malnutrition and the nutritional status of the study subjects:

The results in table :(3) showed that out the 142 young football players who participated in the study, (28.17%) of them were observed to be at highest risk of underweight, (13.38%) of them were suffering from stunting, and (21.83%) from them were touched by thinning, while the prevalence of overweight was (7.04%). In terms of subject's study area of residency from (43.66%) of players living in urban or town areas the prevalence of underweight, stunting, thinning and overweight were (20.97%), (6.45%), (11.29%) and (12.90%) respectively, against (33.75%), (18.75%), (28.75%) and (02.50%) respectively from the (56.34%) of players living in rural or small villages. and from level of education perspective (41.55%) of young

players had a secondary or higher level of education while the rest (58.45%) were under this level.

Table 3: Anthropometric measurements of the study subjects and the prevalence of underweight, stunting, thinness, overweight

Demographical characterisics	Groups	Prevalence of underweight		Prevalence of Stunting		Prevalence of Thinning		Prevalence of overweight		Total	
		N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Age Groups	≥ 15 years	13	31,71	5	12,20	11	26,83	3	7,32	41	28,87
	≥ 16 years	9	23,08	7	17,95	9	23,08	1	2,56	39	27,46
	≥17 years	11	32,35	2	5,88	5	14,71	4	11,76	34	23,94
	≥18 years	7	25,00	4	14,29	5	17,86	2	7,14	28	19,72
Residency	Urban or Town	13	20,97	4	6,45	7	11,29	8	12,90	62	43,66
	Rural or small village	27	33,75	15	18,75	23	28,75	2	2,50	80	56,34
Education Levels	Secondary school or higher	18	30,51	9	15,25	17	28,81	6	10,17	59	41,55
	Middle school or lower	22	26,51	10	12,05	14	16,87	4	4,82	83	58,45
Total		40	28,17	19	13,38	31	21,83	10	7,04	142	100

Out of the total socio-demographic variables considered in the study a significant association were seen with area of residency and the prevalence of overweight and thinning, apart from this, the Chi-square test did not show any relationship between malnutrition and the other socio-demographic variables. (chi-square = 3.19; p <0.56). Noting that the most categories affected by under nutrition were the adolescent players living in the rural and remote areas.

3.2. The Level of nutritional knowledge of the subjects of study:

The questionnaire consisted of 30 nutrition knowledge statements; the highest potential score that could be attained was 60 and the lowest score was 0. The mean nutrition knowledge total score for the entire sample was 29.17 ± 3.90 (48.61 ± 16.79%). The high score was 53 (88.33%) whilst the lowest score was 13 (21. 66%). Participants in the age group of 18 score the highest out of the 4 specified age groups with a mean score of 42.12 ± 7.73(70.02 ±20.02%). The participants in the age group of 15 years had the

lowest score with 21.90 ± 12.823 (36.50 ± 14.33%). When we look at the distribution of levels of nutritional knowledge of the research sample in table (4), 29,58% of the subjects had a poor level of knowledge in nutrition, and 64,79% had an insufficient level, and only 7,04 % of the subjects had a good level of knowledge in nutrition.

Table 4: Nutritional Knowledge of the subject of the study

Demographical characterisics		Level of nutritional knowledge						Chi-square
		Poor		Insufficient		Good		
		F	%	F	%	F	%	
Age groups	≥ 15 years (N= 41)	13	31,71	26	63,41	02	4,88	χ2=0,17 P=0,92 No sig
	≥ 16 years (N= 39)	10	25,64	25	64,10	04	10,26	
	≥17 years (N= 34)	11	32,35	22	64,71	03	8,82	
	≥18 years (N= 28)	08	28,57	19	67,86	01	3,57	
	Total	42	29,58	90	64,79	10	7,04	
Education Level	Secondary school /+	13	30,95	21	22,82	02	20,00	χ2=5,61 P=0,02 **sig**
	Middle school / -	29	69,05	71	77.18	08	80,00	
	Total	42	29,58	92	64,79	10	7,04	
Residency	Urban or Town	16	38,09	33	35,80	03	30,00	χ2=0,96 P=0.68 No sig
	Rural or village	26	41,91	59	64,20	07	70,00	
	Total	42	29,58	92	64,79	10	7,04	

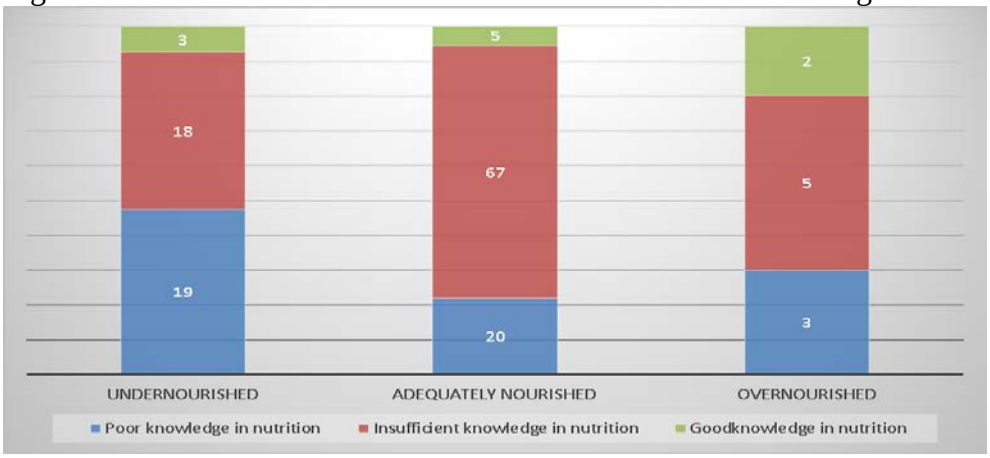
Results of Chi-square test from table (4) showed that there is no statistically significant association between the level of nutritional knowledge of the participants and their ages or areas of living. Since Chi-square had a P-valuegreater than 0,05 (0,92 and 0.68respectively). On the other hand, the educational level was significantly associated with the score of nutritional knowledge as Chi-square had a P-value of 0,02which was less than 0,05.

3.3. The association between nutritional status and the level of nutritional knowledge in the study sample:

In order to ascertain the association between nutritional status and the level of nutritional knowledge of the study sample, we classified the nutritional status into three categories: (1) Undernourished, (2) adequately nourished, and (3) over nourished according to WHO Z-score classifications. While the level of nutritional knowledge was classified as (1) Poor, (2) Insufficient, and (3) Good, and figure (01) summarizes this results.

As both variables (nutritional status and nutritional knowledge) were categorical we used cross-table of Chi-square to determine this association, result indicates that nutritional status of the subjects of the study was significantly ($p < 0.05$) associated with their level of knowledge in nutrition as Chi-square($\chi 2$) =12,62, df=4, p=0.01. Which mean that the participants with a high score of nutritional knowledge tend to have a better nutritional status.

Figure 1. Presentation of nutritional status and nutritional knowledge.



4. Discussion :

The purpose of this cross-sectional study was to study the prevalence of malnutrition and the incidence of nutritional deficiency signs, among adolescent football players, and to assess its association with the level of nutritional knowledge of these players.

Various studies have shown that an inverse relationship exists between physiological age and nutrient needs (Dahoune, 2018) (Heaney, 2011), when we look at the range of age in our study, about 100% of the study sample were found to be adolescent's athletes. Biologically, adolescence by itself is the phase of completion of growth and of sexual maturation (Khiat, 2014), and an adolescent athlete who consumes less or more than is recommended, or feeds in an unbalanced manner, is more vulnerable to the possibility of being in an unhealthy degree of malnutrition. As a study performed by Khalifa showed that the physical effect imposed by sports in training and competition increases the athlete's need for nutrition compared to non-athletes (Khelifa, 2004).

When we look at the data of anthropometric measurements of the studied sample, the average body weight was 53,5 ± 8,77 kg and average body mass index (BMI) was 19,4 ± 2,71 kg/m2.this measurements were slightly less than the finding of certain local studies (Aradji, 2011), (Dahoune, 2018) and (Nora, 2018). Furthermore, the range of weight, height, and BMI of the studied subjects were also lower than the required range according to their

age regarding the WHO references (de Onis M, 2007).

In term of the prevalence of malnutrition, (28.17%) of the adolescent football players in our study were observed to be at risk of underweight, (13.38%) of them were suffer from stunting, and (21.83%) were touched by thinning, while the prevalence of overweight was (7.04%), these findings were better in comparison with the results of C.Warjri, that about 40.11%, 52.28% and 10.46% of the children in the age group 1 0-18 years, were underweight, stunted and wasted , respectively (C.Warjri 2009). However, an Algerian very recent study performed by Bahchachi Nora, found a tendency to over nutrition among Algerian children and adolescents (6– 18 years of age) schooled in Constantine, where she found thatthe prevalence of stunting, thinness and overweight according to WHO (2007) was 2.8%, 3.3% and13.7% respectively (Nora 2018). Thus, according to Mekhancha-dahelit is very probable that stunting, thinness and obesity coexist (Mekhancha-dahel, 2005).

The researchers believe that these results might be explained by the fact that adolescent football players are being effected by observed transition tendencies (urbanization and modification of modes of life which are very rapid) and the socio-economic situation which is known by Algeria (Mekhancha-dahel, 2005).

The nutritional status distribution of subjects based on area of residency, showed that the prevalence of underweight, stunting, thinning and overweight were (20.97%), (6.45%), (11.29%) and (12.90%), respectively, in players living in urban or town areas, against (33.75%), (18.75%), (28.75%) and (02.50%), respectively, in players living in rural or small villages. Out of the total socio demographic variables considered in the study a significant association was seen between area of residency and the prevalence of overweight and thinning (chi-square = 3.19; $p < 0.56$), apart from this, the chi-square test did not show any association between malnutrition and the other socio demographic variables. Noting that the most categories affected by under nutrition were young players living in the rural and remote areas. The results of the present study were in concurrence with the study of (Venkaiah K, 2002) in India.

The next stage in this research was to investigate the level of nutritional knowledge of the studied subjects. We found that the mean of nutrition knowledge score for the entire sample was 29.17 ± 3.90 (48.61 ± 16.79%), which was classified as insufficient. The high score was 53 (88.33%) whilst the lowest score was 13 (21.66%). Participants in the age group of 18 scored the highest out of the 4 specified age groups with a mean score of 42.12 ±

7.73(70.02 ±20.02%). The participants in the age group of 15 years had the lowest score with 21.90 ± 12.823 (36.50 ± 14.33%), Overall, 29,58% of the subjects had a poor level of knowledge in nutrition, and 64,79% had an insufficient level, and only 7,04 % of the subjects had a good level of knowledge in nutrition. Significant associations were found between nutrition knowledge and the level of education of the participants, and in favour of higher level of education.

In a systematic review conducted by (Heaney and al.2002) nutrition knowledge in adolescent and adult athletes was assessed. Most of the studies reported mean nutrition knowledge scores of 50-70% (Heaney, 2011). In the present study the mean nutrition knowledge score was low. One explanation might be the fact that the questions of the questionnaire might have been too difficult to be answered correctly for the young athletes of lower education level, who formed a considerable proportion of the sample (58,45%). Which may support our claim that there is a relationship between nutritional knowledge and the educational level.

In a related context several studies reported a close relationship between higher nutrition knowledge and better diet, and suggest that knowledge is an important factor in food choice and should not be discounted as a part of health promotion (Parmenter, 1996). In the same line Hachaichi has seen that unsound food habits and lack of nutritional awareness are considered to be the main factors in determining nutritional status in adolescents (Hachaichi, 2020). In this regard, our study found that that nutritional status of the subjects of the study was significantly ($p < 0.05$) associated with their level of knowledge in nutrition as Chi-square($\chi 2$) =12,62, df=4,p=0.01. Which mean that the participants with a high score of nutritional knowledge tend to have a better nutritional status.

5. Conclusion :

Within the limits of the researchers' knowledge, this was the first time that nutritional status and nutrition knowledge had been assessed in Algeria with a sample of this size and quality (N= 142, adolescent athletes), where the study provided accurate quantitative and qualitative scientific data on the nutritional status and nutrition knowledge of this class of society.

The overall picture that emerges from our study places the adolescent football players in SAIDA state, (especially those who are living in remote areas) below the ’well-to-do" Algerian adolescents. They are sometimes

much lighter and shorter than them at all age levels. They fall below the WHO standards in both height and weight. Therefore, the adolescent understudy seems to suffer from moderate and marginal grades of malnutrition. In the researcher's point of view, this problem is more understandable if we consider some factors; first, the rapid growth phase of adolescence, second, the unhealthy or insufficient nutrition, third, the excessive physical demands of practicing football which requires a specific nutritional diet, and finally, a good knowledge, attitudes, behaviors in nutrition among these young athletes, so diet plays an important role in the athletic performance and the overall health of these adolescents when it is essential to provide nutritional education programs that address these young athletes and their coaches lacks in terms of nutrition awareness, especially in rural areas and to the weaker sections of the society.

References :

Abdellah, B. (2005). Evolution des caractéristiques morphofonctionnelles de l'enfant algérien selon l'Đgepubertaire. UniversiteMentouri De Constantine.

Abdelmalek, M. (2008). Caractéristiques morpho fonctionnelles des enfants sédentaires (Filles et garçons) âgés de 13 - 15 ans du sud-est Algérien. « Commune de Biskra ». -Université Mentouri-Constantine.

Aradji, A. (2011). Effets de l'entraînement sur le niveau de développement des qualités physico – techniques et des indices anthropométriques des jeunes footballeurs algériens. Revue Scientifique I.S.T.A.P.S, N :08 P60 :75.

BelounisRachid, A. A. (2019). Overweight and obesity, link with sedentary indicators. Journal of Sport Science Technology and Physical Activities, VOL : 16 / N° : 2 p 1 :12.

Bonnici, D. C. (2017). Nutrition in soccer. Edge Hill University.

Burke, L. (2001). Energy needs of athletes. Canadian Journal of Applied Physiology, pp. 202-219.

C.Warjri, B. (2009). Growth and nutritional status of Khasi children in west Khasi hills district of Meghalaya -INDIA. NORTH EASTERN IDLL UNIVERSITY -INDIA.

deOnis M, O. A. (2007). Development of a WHO growth reference for school-aged children and adolescents. Bulletin of the World Health Organization, 85 :660-7.

Driskell, I. W. (2001). Nutrition applications in Exercise and Sport, Second Edition. London : CRC Press.

Eastwood, M. (2003). Principles of Human Nutrition- Second edition. Oxford United King dom : Blackwell Science.

Ghaouti, M. (2014). The effect educational program on the enhancement of nutritional knowledge among athletes of high school level, An unpublished master thesis. Mostaganem : University of Mostaganem (Algeria).

GHOUAL Adda, B. A. (2015). L'apport de la préparation physique integrée a l'entrainement en football des jeunes footballeurs algeriensu-17 (Les qualités physiques et techniques combinées). Revue Scientifique I.S.T.A.P.S, N :12 P : 11-24.

Grete R. Hornstrom, C. A. (2011). Nutrition Knowledge, Practices, Attitudes, and Information Sources of Mid-American Conference College Softball Players. Food and Nutrition Sciences, 2, 109-117.

Heaney, S. O. (2011). Nutrition knowledge in athletes: a systematic review. International Journal of Sport Nutrition and Exercise Metabolism, 21 : (3) 248-261.

Hima Bindu Malla, M. D. (2017). Nutritional status of athletes: A review. International Journal of Physiology, Nutrition and Physical Education, 2(2) : 895-904.

Khelifa, S. A. (2004). Etude de l'évolution de certains paramètres physiologiques sous l'effet du jeunes (ramadhan) chez les sportifs de haut niveau. Revue Scientifique I.S.T.A.P.S, 113-116.

Khiat, B. (2010). Evolution des filieresaerobie et anaerobie au cours du developpement pubertaire chez des nageurs de 11-14 ans. Revue Scientifique S.T.A.P.S, N 07 P : 38-44.

Khiat, B. (2014). Effet de la maturation pubertaire sur le développement de la puissance anaérobie chez des collégiens algériens de 11-16 ans. Revue Scientifique I.S.T.A.P.S, N° 11.

Kuczmarski RJ, O. C. (2002). 2000 CDC growth charts for the United States : Methods and development. National Center for Health Statistics.Vital Health Sta, 11(246).

Mekhancha-dahel, C. C. (2005). Cadre pour la surveillance nutritionnelle des enfants et adolescents Cas du Khroub (Constantine, Algérie) - 1996/97 - 1999/00 - 2001/02.Universite Mentouri de Constantine.

Nora, B. (2018). Anthropometrie nutritionnelle : Premières courbes algériennes de croissance et de corpulence (6 - 18 ans). Universite Mentouri de Constantine.

SaddateRedouan, C. A. (2016). La professionnalisation du sport en Algérie un modèle à définir. Revue Scientifique I.S.T.A.P.S, N° 13 P : 54-64.
Venkaiah K, D. K. (2002). Diet and nutritional status of rural adolescents in India. European Journal of Clinical Nutrition, N56 P: 1119–1125.
WHO. (2011, 11 2016 08). AnthroPlus for personal computers Manual: Software for assessing growth of the world's children and adolescents. Geneva : 2011) 6. Consulté le 06 15, 2019, sur http://www.who.int/growthref/tools/en/
عومري دحون، بن خالد الحاج، عطا الله احمد، طاهر طاهر (2018). تقييم مستوى عناصر اللياقة البدنة المرتبطة بالصحة عند تلاميذ المرحلة الثانوية باستخدام برنامج حاسوبي. المجلة العلمية لعلوم والتكنولوجية للنشاطات البدنية والرياضية، العدد:15 الجزء: 2 الصفحات:83-103.
حشايشي عبد الوهاب، (2020). مستوى النشاط البدني لدى تلاميذ مرحلة التعل م الثانوي في ضوء متغيرات الجنس والمستوى الدراسي والممارسة بحصة التربية البدنية ومؤشر كتلة الجسم. المجلة العلمية لعلوم والتكنولوجية للنشاطات البدنية والرياضية. المجلد 17/العدد: صز16-212