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The effect of sports season on some anthropometric measurements of amateur soccer players. "Field study of ORBBA team U17"

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Abstract

The Object of the study aims to identify the effect of a sports season on some anthropometric measurements of amateur soccer players, represented in mass index, fat mass, muscle mass and bone mass, for this purpose, we used the method descriptive. On a sample composed of 20 football players (under 17) from ORBBA team. Chosen as a random sample, and for data collection, we used a tool TANITA PRO 780 CM. After collecting the results and having treated them statistically, we conclude an improvement in both BMI and Muscle Mass. While the results showed that the fat and bone mass were not affected by training during sports season, so we conclude season has a positive effect on both body mass index (BMI) and muscle mass of amateur soccer players. On this basis, the study recommended regular monitoring of body composition using modern diagnostic tools can provide valuable insights into the effectiveness of training programmes to guide and improve it.

1. Introduction

Soccer, commonly known as football, is a highly popular sport played and enjoyed by millions of individuals worldwide “During the 1998 FIFA World Cup, Football Association (FIFA) estimated that more than 4 billion spectators watched the game on TV” (Magal & Ron T Smith, Jon J Dyer, Jay R Hoffman, 2009). In the realm of competitive soccer, players constantly strive to enhance their performance and optimize their physical attributes. Anthropometric measurements, such as body mass index (BMI), fat mass, muscle mass, and bone mass, play a crucial role in assessing and monitoring the physical development and performance potential of soccer players.

Anthropometric characteristics significantly influence an athlete's capabilities, including speed, agility, endurance, and strength. In the context of soccer, where physical demands vary across positions and playing styles, understanding the effects of a sports season on anthropometric measurements becomes imperative. The sports season, encompassing intense training and competitive matches, can have a profound impact on the body composition and overall physical attributes of amateur soccer players.

The nature of competition in soccer involves a combination of aerobic and anaerobic activities, dynamic movements, and frequent changes in pace and direction, “the demands of soccer match play, how these demands stress the two main energy systems” (A. Mark Williams & Drust, 2023.p34) the aerobic and anaerobic energy systems This multi-faceted nature places varying demands on the musculoskeletal and physiological systems of players. As a result, long-term engagement in soccer can lead to specific changes in the body, including alterations in body composition, muscle development, and bone density.

Anthropometric measurements provide valuable insights into these changes and serve as objective indicators of physical development and performance potential. Body mass index (BMI) is a widely used parameter that relates an individual's weight to their height, offering an initial understanding of overall body composition. Additionally, assessments of fat mass, muscle mass, and bone mass provide a more comprehensive evaluation of the body's composition and structural integrity, “For example, elite young players (as compared with the subelite ones) could be characterized by high agility and running speed . The aerobic capacity and anthropometric dimensions could be of importance for early selection as well” (Mirkov, Dragan M, Kukolj, Milos, & al, 2010)

Understanding the effects of a sports season on these anthropometric measurements is essential for developing training programs, optimizing performance, and supporting the overall health and well-being of amateur soccer players. By investigating the impact of a sports season on BMI, fat mass, muscle mass, and bone mass, we can gain valuable insights into the physiological changes that occur during this period of intense physical activity and competition.

This scientific article aims to explore the effect of a sports season on the anthropometric measurements of amateur soccer players. By examining changes in BMI, fat mass, muscle mass, and bone mass, we seek to provide a comprehensive understanding of how the body composition of players is influenced by long-term engagement in soccer activities. Such insights can contribute to the development of targeted training strategies, injury prevention programs, and performance optimization techniques for amateur soccer players.

Through this study, we aim to contribute to the existing body of knowledge on the relationship between sports seasons and anthropometric measurements, ultimately enhancing our understanding of the physical adaptations and transformations that occur in amateur soccer players over the course of a sports season.

All this made us ask the following general question:

Is there an **effect** of the sports season on some anthropometric measurements of amateur soccer players?

This general question is further broken down into two sub-questions:

Partial questions:

1. Is the sports season able to positively affect the Body Mass Index (BMI) of amateur players?
2. Does the sports season have a positive influence on Muscle Mass among amateur players?
3. Can the sports season lead to a positive effect on Fat Mass for amateur players?
4. Does the sports season have a positive impact on Bone Mass for amateur players?

To reach answers to these questions, we put forward the following hypotheses:

General Hypothesis:

The sports season has a significant effect on some anthropometric measurements of amateur soccer players.

Partial Hypotheses:

1. The sports season has a positive effect on the Body Mass Index (BMI) of amateur players, leading to an increase in BMI values.
2. The sports season positively influences Muscle Mass among amateur players, resulting in an increase in muscle mass measurements.
3. The sports season leads to a decrease in Fat Mass for amateur players, indicating a reduction in fat percentage over the course of the season.
4. The sports season has a positive impact on Bone Mass for amateur players, leading to an increase in bone density measurements**.**

2. Method and Materials :

2.1. Participants

Twenty boys were recruited to participate in our study. (16 +0.5 years old) played for Boumahra Ahmed (Algeria) football team. This group of young amateur players was selected from 320 players representing sixteen teams of the Annaba Regional Football league. (Ligue regionale de football Annaba, 2023), so they represent: 6.25% of the original community.

Table 1. Characteristics of the Sample

	Age (year)	Weight (kg)	Height (cm)	Season (Week)
N = 20	16± 0,5	62± 2	156± 12	24

2.2. Materials

The researchers used to collect data “Bioelectrical impedance”:

“Bioelectrical impedance analysis (BIA) is a safe, fast, noninvasive and relatively inexpensive method for assessing body composition” (Gibson, 2000) (Houtkooper, 1996)

“BIA estimates TBW by way of electrical current through segments of the body and ultimately predicts BF and FFM.

Assumptions, and properties of BIA, as well as how BIA assesses body composition and the types of BIA devices available for use both healthy individuals and clinical patients “(Kyle & al, 2004).

Body composition of athletes has been widely studied, however, only limited data is available on BIA, Accuracy in the athletic population, and the accuracy of the BIA to determine body components for an athletic population is currently ambiguous. Furthermore, there seems to be insufficient research that focus on using BIA method for anthropometric measurements in young athletes” (FÜGEDI, SZAKÁLY, & SUSZTER, 2023).

For that, researchers choose to use: **TANITA PRO780** body composition analyzer.

How to use it?

To use the TANITA PRO 780, a diagnostic device for measuring body composition, follow these steps:

-Preparation: Ensure that the device is properly set up and calibrated according to the manufacturer's instructions. Make sure the device is on a stable surface and in a suitable environment for accurate measurements.

-User Input: Enter the necessary information, such as age, gender, and height, into the device. This information is used to calculate various body composition parameters accurately.

-Electrode Placement: Stand barefoot on the footplate of the TANITA PRO 780. Ensure that your feet are correctly positioned on the foot electrodes. Hold the handles with both hand. Follow any specific instructions provided by the device for proper foot placement.

-Measurement: The TANITA PRO 780 uses the Bioelectrical Impedance Analysis (BIA) technique to measure body composition. It sends a small, safe electrical current through the body and measures the resistance encountered. The device uses this data to estimate body fat, muscle mass, and other parameters.

-Wait for Results: After the measurement is complete, the TANITA PRO 780 will display the results on its screen. These results typically include body weight, body fat percentage, muscle mass, bone mass, and other relevant metrics. Take note of the measurements or record them as needed. (Corporation, 2014, p 20)

2.3. Design and Procedure :

Each Measurement were made on a single day between 06:30-10:00 AM. Subjects allowed not to eating and drinking up to eight hours before testing and refrained from exercise for at least the previous twelve hours,

Researcher took three measurements during the season as follows:

Table 2. Date of pre and post-test:

	Test 1	Test 2
Sport Season	Week one	Week twenty four
Date	25/10/2022	28/04/2023

Variables:

Independent variable: sports season.

Dependent variable: some anthropometric characteristics.

Areas of study:

Special field: clinic of doctor SALHI, Guelma.

Time field: from 25/10/2022 to 28/04/2023.

Human field: 20 soccer players (under17)

Study approach:

"The nature of the study is what determines the type of method used, because whatever the subject of the research, the value of the results depends on the value of the methods used". (انجرس و ترجمة بوزيد صحراوي، 2004، صفحة 97)

In our study, we chose the **descriptive** approach because it is most appropriate to the nature of the research

2.4. Statistical Analysis :

Statistical analysis is a fundamental aspect of research that enables us to better understand the factors that influence our study and reach meaningful conclusions. The choice of statistical methods depends on the type of problem, data characteristics, and research objectives. In our study, we used SPSS version 26 to perform statistical analysis, and we employed the following methods:

- **Mean:** the sum of all scores divided by the number of scores." (Gravetter & Wallnau, L. B., 2014, p. 110).

- **Standard deviation:** "The standard deviation is a measure of variability that reflects the average distance of any score in the distribution from the mean of the distribution. It is the square root of the variance." (Arthur Aron, Elliot Coups, & Elaine N. Aron, 2018, p. 121)

- **T test:** "A t-test is a parametric statistical test used to determine whether two groups of scores are significantly different from one another. It does this by comparing the means of the two groups while taking into account the variability of the scores within each group." (Coolican, 2014, p. 166)

3. Results :

3.1. Validity and reliability of tests:

The researcher reached the validity of the test based on the reliability coefficient, the researcher arrived at the validity of the test based on the stability coefficient, as to obtain the validity of the test, and we calculated the validity coefficient from the following equation:

Validity=$\sqrt{stability\ coefficient}$

We got the following results:

Table 3. Results of stability and reliability coefficient of different measurements:

	Stability coefficient	Reliability coefficient
IBM	0,993	0,996
Fat Mass	0,957	0,978
Muscles Mass	0,997	0,998
Bone Mass	0,992	0,995

It is evident from the table that all the correlation coefficients have values close to 1. This indicates a strong stability coefficient and a high degree of validity for the tests employed, highlighting their reliability and accuracy.

3.2. Normality tests:

Table 4. Results of normal distribution of different measurements:

	Shapiro - Wilk signification				Sign	Result
	IBM	Fat mass	Muscle M	Bone mass		
Pre- test	0,927	0,207	0,940	0,749	0,05	Normal Distribution
Post- test	0,989	0,123	0,893	0,798		

It is evident from the table that all the statistical significance values of the Shapiro-Wilk test, whether for the pretest or the post-test, are greater than the level of statistical significance (0.05). Therefore, we conclude that we fail to reject the null hypothesis, indicating that the data are normally distributed.

Presentation and analysis of the results of (B.M. I) Measurement:

Table 5. Results of pre and post test of BMI measurement:

	Befor		After		T cal	T tab	sig(2tailled)	Stat sig
	Mean	Std .dev	Mean	Std .dev				
BMI	18,27	1,83	18,65	1,72	5,54	2,09	0,00	sig

A comparison analysis was conducted between the pretest and posttest results of the IBM measurement for the sample, utilizing tables. In the preliminary test, the mean was 18.27 with a standard deviation of 1.83, whereas in the post-test, the mean value increased to 18.65 with a standard deviation of 1.72. The calculated T-value was found to be 5.54 at a significance level of 0.05, with 19 degrees of freedom, exceeding the critical value of T (2.09). These findings indicate a statistically significant difference in favor of the posttest. Moreover, the T-test table revealed a significance level (2-tailed) of 0.00, which is lower than the predetermined significance level of 0.05. Consequently, the alternative hypothesis, that

suggesting significant differences in BMI between the beginning and the end of the sports season, is accepted.

Presentation and analysis of the results of Fat Mass Measurement:

Table 6. Results of pre and post test of Fat Mass measurement:

	Befor		After		T cal	T tab	sig(2tailled)	Stat sig
	Mean	Std .dev	Mean	Std .dev				
Fat M	7,45	1,38	7,29	1,38	1,23	2,09	0,23	No sig

We observed from the table that the results of the pre- and post-test for measuring fat mass in our research sample were as follows: In the preliminary test, the mean was 7.45 with a standard deviation of 1.38, while in the post-test, the mean value was 7.29 with a standard deviation of 1.38. The calculated T-value was 1.23 at a significance level of 0.05, with 19 degrees of freedom, which is lower than the critical value of T (2.09). This indicates, from a statistical perspective, that there is no significant difference between the two tests. Furthermore, the T-test table revealed a non-significant (two-tailed) p-value of 0.23, exceeding the predetermined significance level of 0.05. Consequently, we reject the alternative hypothesis and accept the null hypothesis, which states that there are no statistically significant differences in the fat mass of the study sample individuals between the beginning and the end of the sports season.

Presentation and analysis of the results of Muscle Mass Measurement:

Table 7. Results of pre and post test of Muscle Mass measurement:

	Befor		After		T cal	T tab	sig(2tailled)	Stat sig
	Mean	Std .dev	Mean	Std .dev	3,69	2,09	0,02	sig
Muscle M	42,63	6,89	43,30	6,83				

Comparison analysis was performed between the results of the pretest and posttest of the Muscle Mass measurement of our sample using the tables. In the pre- test, the mean was 42.63 with a standard deviation of 6.89, while in the post-test, the mean value was 43.30 with a standard deviation of 6,83. The calculated value of “T” was found to be 3,69 at the significance level of 0.05 for the degree of freedom 19, which is higher than the critical value of “T” at 2.09, this indicates a statistically significant difference in favor of the posttest. In addition, the T-test schedule showed a significant (2-tailed) level of 0.02, which is lower than the significance level of 0.05, confirming the

acceptance of the alternative hypothesis that there are significant differences in Muscle Mass between the beginning and the end of the sports season.

Presentation and analysis of the results of Bone Mass Measurement:

Table 8. Results of pre and post test of Bone Mass measurement:

	Befor		After		T cal	T tab	sig(2tailled)	Stat sig
	Mean	Std .dev	Mean	Std .dev				
Bone M	2,30	0,33	2,33	0,31	2,34	2,09	0,30	No sig

We note from the table that the results of the pre- and post-test for measuring Bone mass for our research sample were as follows: In the pre-test, the mean was 2.30 and a standard deviation of 0.33, while in the post-test, the mean value was 2.33 and a standard deviation of 0.31. The calculated value of "T" was 2.34 at the level of significance 0.05 and the degree of freedom 19, which is less than the tabular value of "T" which was 2.09, and this indicates from a statistical point of view that there is no significant difference between the two tests. In addition, the T-test schedule showed a significant (two-tailed) level of 0.30, which is greater than the significance level of 0.05, which confirms the rejection of the alternative hypothesis and the acceptance of the null hypothesis, which states that there are no statistically significant differences in the Bone mass of the study sample individuals between the beginning and the end of The sports season.

4. Discussion

The researchers hypothesized that the sports season would have a positive effect on the Body Mass Index (BMI) of amateur players. The results of the study strongly supported this hypothesis, as evidenced by statistically significant differences in BMI between the pre and post-test measurements. The findings, as presented in Tables 3, 4, and 5, consistently favored the post-test period.

The observed improvements in BMI align with previous research findings reported in scientific articles and doctoral theses. These findings consistently demonstrate the positive impact of sports seasons on BMI among amateur soccer players. For instance, (Bunc, , Pavel Hráský, & Marie Skalská, 2015) This study investigated changes in body composition, including BMI, among collegiate soccer players during a competitive season, this reinforcing the notion that sports seasons contribute to BMI enhancement.

Additionally, the current study's findings align with theoretical frameworks and physiological mechanisms. Regular participation in a sports season involves increased physical activity, which can lead to improvements in

body composition, including reductions in body fat and increases in muscle mass. These changes are often reflected in improvements in BMI, as observed in our study.

It is worth noting that while the focus of our study was on BMI, future research should consider investigating other anthropometric measurements, such as fat mass, muscle mass, and bone mass, to gain a more comprehensive understanding of the effects of sports seasons on body composition among amateur soccer players.

The researchers hypothesized that the sports season will lead to a decrease in the fat mass of the amateur players, which indicates a decrease in the percentage of body fat over the course of the season. However, the results of the study do not support this hypothesis, as there were slight differences observed in fat mass between pre and posttest measurements. These differences were not statistically significant, as shown in Tables 3, 4 and 6.

Our findings are similar to Previous research, we mention (MS, Zarrouk N, Filetti C , Rebai H, Elloumi M, & Moalla W, 2015), study reviled that no significant changes were observed in anthropometric measurements throughout the study, as (HAMMAMI, et al., 2013), study indicated no difference in the percentage of body fat (%BF).

The lack of significant changes in fat mass throughout the sports season contradicts the established hypothesis. While there may be slight differences in fat mass, these differences were not large enough to reach statistical significance. It is important to note that statistical non-significance does not necessarily imply no practical significance, as small changes in fat mass may still have physiological and performance implications for players. These results differ from some previous studies and may be attributed to several factors

The researchers hypothesized that the sports season would have a positive effect on Muscle Mass among amateur players, leading to an increase in muscle mass measurements. The results of the study strongly supported this hypothesis, as evidenced by statistically significant differences in Muscle Mass between the pre and post-test measurements. The findings, as presented in Tables 3, 4, and 7, consistently favored the post-test period.

The observed increase in Muscle Mass aligns with previous research findings and theoretical frameworks. Regular participation in a sports season often involves strength training, endurance exercises, and other

physical activities that stimulate muscle growth. These activities can lead to hypertrophy and an overall increase in muscle mass, which was reflected in our study's findings.

The significant differences observed in Muscle Mass between the pre and post-test measurements indicate that the sports season has a positive influence on muscle development among amateur players. These findings are consistent with similar studies conducted by (Lesinski, Olaf Prieske, Norman Helm, & Urs Granacher, 2017) study indicated that significant medium-to-large associations were observed between training and anthropometrics/body composition/physical fitness , and soccer training and/or growth/maturation contributed to significant variations in anthropometry, body composition, on the other hand, the study of (khoudir, 2022) found results contrary to ours, it indicate that The parameters of the body composition did not change significantly during the sporting season. The difference in the results of the studies opens the way for future research in order to gain a comprehensive understanding of the relationship between sports seasons and the development of muscle mass.

The researchers hypothesized that the sports season would have a positive effect on Muscle Mass among amateur players.

The study did not support this hypothesis, as there were minimal differences observed in bone mass between pre-test and post-test measurements. These differences were not statistically significant, as shown in Tables 3, 4, and 8. The lack of significant changes in bone mass throughout the sports season is contrary to our hypothesis. It is important to note that bone density is influenced by various factors, including age, genetics, hormonal status, and lifestyle habits. While regular participation in a sports season can contribute to overall physical fitness and health, it may not directly impact bone mass in the short term.

These findings are consistent with some previous research studies, which have also reported limited or non-significant changes in bone mass following sports seasons among amateur athletes, as study of (Minett, T.B. Binkley, L.A. Weidauer, & B.L. Specker, 2017), it indicated that Bone density measures did not change over the entire study timeframe.

Based on the foregoing analysis and the results obtained from the partial hypotheses, it can be concluded that the general hypothesis has been partially supported. The sports season has been found to have a positive effect on certain anthropometric measurements, specifically the Body Mass Index (BMI) and muscle mass, among amateur soccer players (U17).

However, there were no significant effects observed on fat mass and bone mass. Therefore, while the sports season positively influences BMI and muscle mass, its impact on fat mass and bone mass in this specific group of amateur soccer players is limited.

5. Conclusion :

Based on the discussions and findings presented in this article, it can be concluded that the sports season has a positive effect on the Body Mass Index (BMI) and Muscle Mass of amateur soccer players. The study observed statistically significant improvements in BMI and Muscle Mass following the sports season, which aligns with previous research and theoretical frameworks. This suggests that regular participation in a sports season, involving increased physical activity and training, can lead to enhancements in BMI and Muscle Mass among amateur soccer players. However, the sports season did not have a significant impact on Fat Mass and Bone Mass. Although slight differences were observed, they were not statistically significant, indicating that the sports season alone may not be sufficient to induce significant changes in these variables. Future research should explore additional factors that may influence Fat Mass and Bone Mass in amateur soccer players during the sports season, such as nutritional factors, specific training regimens, and lifestyle habits. Overall, these findings highlight the importance of regular physical activity and training in improving body composition, emphasizing the need for effective training programs to promote overall health and fitness among amateur soccer players.

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