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The impact of modern technological applications of physical fitness on improving the functional physical performance of football players.
(A field study at the level of the seniors of the Spanish Barcelona Club)

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Abstract

The study aims to identify the importance of modern technological applications for physical fitness in improving the functional physical performance of Barcelona senior football players. For this purpose, we used the descriptive approach on a sample of 64 individuals randomly, and we used the questionnaire tool to collect information. After collecting the results and processing them statistically, we concluded the great importance of these applications in improving functional physical performance. On this basis, the study recommended the necessity of integration with wearable devices with wearable devices.

I. Introduction

Football has always been more than just a game; It is an art, a culture, and a history intertwined with the paths of civilizations. Since its simple inception on grass fields, this game has evolved to form a huge global industry (CABALLERO, 2021), where emotions, statistics, individual skills, and teamwork intertwine to form a complex artistic painting that deserves study and analysis. Football has also gone beyond being a mere sports competition to become a complex social phenomenon that affects and is affected by the surrounding environment (Radnedge, 1998). With every touch of the ball, feelings of belonging, competition, joy, and sadness are renewed, making it a mirror reflecting the societies to which it belongs. The world of football has witnessed remarkable development thanks to rapid technological progress, as smart applications and wearable devices have become an integral part of the training routine for professional players (Wilson, 2018). These applications contribute greatly to improving the functional physical performance of players by providing accurate data on physical and physiological performance, allowing coaches to develop customized training programs for each player individually (Peace, 2007). Thanks to these applications, many vital indicators such as heart rate, running speed, strength, and endurance can be measured and accurately analyzed to determine the strengths and weaknesses of each player (Tifo, 2022). Based on this data, coaches can design customized training aimed at improving the aspects Which needs to be developed, leading to improved performance in general, and sports performance analysis applications and sites play a vital role in developing players, as they allow for the analysis of player's performance during matches and training, identifying common mistakes, and suggesting solutions to improve performance (kuper, 2003). Thus, modern technological applications have revolutionized the world of football, which has contributed to raising the level of physical fitness of players and improving their performance significantly (JOYCE, 2024). This field is a large and broad field that does not allow us to study all the conditions and standards, but we have allocated some of them for study, which is the necessity of knowing the impact of modern technological applications for physical fitness on improving the functional physical performance of football players (Wenger, 2021). Most countries in the world face problems in this field, most notably Spain, which has worked with all its efforts to develop this field to create players capable of

representing Spanish football in the best way, which leads to its development and thus creating a sports generation capable of carrying the local and international banner. The club in this study is Barcelona Club (Jacobs, 2022), where through the use of modern technological applications in training as well as in allocating training programs, and the contribution of sports performance analysis applications and sites in training is greater, which leads to improving the functional physical performance of Barcelona players. Many studies have emerged in this field, including Mahfoudy Mahmoud's study "The Role of Technology in the development of sports training for football players "2023 The study aims to highlight the original role played by modern technology in advancing the level of football players, and the use of computer applications and sites in the process of improving the functional physical performance of football players. The research was conducted on a random sample of twenty-four sports coaches, and the descriptive-deductive approach was used with a questionnaire as a tool for collecting data, as the results showed an important role for technology in realizing the basic skills of football players and influencing the functional physical performance of football players(Mahfoudi, 2023) and studying the study of Mazouz Islam "Information Technology and Its Contribution to Improving the Training Process for Football Coaches in the State of Umm Al-Bouaghi" 2021 The study seeks to highlight the role of technology in the field of sports training for football coaches in the state of Umm Al-Bouaghi, as the researcher worked to clarify the role of modern technological devices in developing modern training programs, planning and monitoring the training pattern for players, and educating them about modern training methods, as the researcher worked extensively to work on generalizing the idea of developing training by linking it to technology(Mazouz, 2021), all of the above made us shed light on the study due to its importance and our presentation The next question: Do modern technological applications for physical fitness contribute to improving the functional physical performance of senior football players of Barcelona FC?

And also three secondary questions:

- Does the use of modern technological applications in training lead to a significant improvement in the functional physical performance of Barcelona senior football players compared to traditional methods?

- Do technological applications contribute to further customizing training programs, leading to improving the performance of Barcelona senior football players individually?
- Do sports performance analysis applications and sites in training contribute to improving the functional physical performance of Barcelona senior football players?
-

I.1. Importance of the study:

- Highlighting the important role played by modern technological applications for physical fitness in improving the functional physical performance of Barcelona senior football players.
- Delving into research related to the field of training, especially in modern technological applications and artificial intelligence, because research in this field is rare.
- Making it a guide to benefit from and launch other studies and expand them.
- Highlighting the importance of technological applications in the modern training process for players.
- Highlighting the status of using modern technological application devices and their impact on players performance.

I.2. Study objectives:

The study aims to know the importance of modern technological applications for physical fitness in improving the functional physical performance of Barcelona senior football players by allocating training programs, applications and sites for analyzing sports performance in training, which in turn contribute to influencing the improvement of the performance of Barcelona senior players.

I.3. Benefit from previous studies:

- It helped the researchers in the method of selecting the sample.
- It helped the researchers to determine the correct research methodology that should be applied in the study.
- It helped the researchers to determine the nature and importance of the problem and the study.
- It helped the researchers to identify and highlight that sports medicine is a condition for the formation of football players in the Algerian professional league.

- It paved the way for the researchers to choose the most appropriate scientific statistical methods used in data processing.
- The results of these studies helped the researchers to discuss and interpret the results of the current study.

II. Method and Materials:

II.1.Research methodology:

The researchers used the descriptive approach.

II.2.Study community:

The study community is the same as the study sample and is represented by coaches, assistant coaches, physical trainers, assistant physical trainers, goalkeeping coaches, assistant goalkeeping coaches, performance analysis staff for all age groups and some players for Barcelona Football Club, and their number reached 64 individuals.

II.3.Study sample:

Randomly selected coaches, assistant coaches, physical trainers, assistant physical trainers, goalkeeping coaches, assistant goalkeeping coaches, performance analysis staff for all age groups and some players of FC Barcelona Football Club, totalling 64 individuals.

II.4.Search Fields:

II.4.1. Spatial Field:

The study was conducted at the level of the Spanish European environment at the level of the Spanish FC Barcelona.

II.4.2. Temporal Field:

The study was conducted in its theoretical and applied form during the period from 27/01/2024 to 18/11/2024.

II.5.Materials:

–Study tool description:

The chosen tool in the study is the questionnaire.

The questionnaire is a common research tool used to collect data and information from a group of individuals about a specific topic. The questionnaire consists of a set of questions that are asked to participants to obtain answers about their opinions, beliefs, behaviors, or any other information related to the topic being researched. It aims to:

- Collect data: Obtain information about specific topics from a sample of people.
- Measure opinions and attitudes: find out people's opinions about a topic and their trends.
- Evaluate programs and services: evaluate the effectiveness of specific programs or services.
- Predict behavior: try to predict the future behavior of individuals
- The teaching materials used in the current study (Dehamnia, 2024).

The questionnaire in this study consisted of 03 axes divided according to the following table:

Table 1 : Represents the questionnaire axes.

Axes	Number of questions
01.The use of modern technological applications in training leads to a significant improvement in the functional physical performance of Barcelona senior football players compared to traditional methods.	06
02.Technological applications contribute to further customizing training programs, which leads to improving the performance of Barcelona senior players individually.	06
03.Sports performance analysis applications and websites in training contribute to improving the functional physical performance of Barcelona senior football players.	06
The rusult	18

- Psychometric properties of the study tool:

❖ **Tool validity:**

❖ **Apparent validity of the instrument:**

The tool was presented to a group of judges from university professors from different Algerian universities, with the help of some colleagues who teach in these universities the specialization of sports training and physical preparation, as shown in the following table:

Table 2 : It represents the sample of professors selected to prove the validity of the questionnaire.

University	Country	Number of Doctors
Faculty of Medicine, Health and Sport of Madrid	Spain	12
Leeds Beckett University	Germany	15
University of Catalonia of Science and Technology(Barcelona)	Spain	05
National Higher School of Artificial Intelligence(Alger)	Algeria	10
Unversity Of Soukahras	Algeria	06
University Of Annaba	Algeria	04
University Of Constantine	Algeria	05
University Of Bejaia	Algeria	07
University Of Oran	Algeria	03
The result	67	

The research tool was approved by 94.76% of them, rejected by 5.24%, and they agreed to modify the questionnaire.

- **Tool stability:**

The tool was calculated using Cronbach's alpha equation as shown in the following table:

Table 3: It represents the result of the instrument's stability coefficient by applying the Cronbach's alpha equation.

Axes	Cronbach's alpha coefficient	Correlation coefficient between correction by Spearman and Brown equation
The first axis	0.58	0.59
The second axis	0.60	0.59
The third axis	0.69	0.68

From the results of Table 3, it is clear that the study tool is characterized by a high and acceptable degree of stability, by calculating the stability coefficient in two different ways (Cronbach's alpha, the correlation coefficient between the correction using the Spearman and Brown equation).

❖ **Logical truth:**

Table 4 : The correlation coefficient represents the stability of the study tool as a whole with its axes and the logical validity of each of them.

Axes	Correlation coefficient	Logical truth
The first axis	0.614	0.783
The second axis	0.792	0.854
The third axis	0.860	0.862
Measuring tool as a whole	0.750	0.866

Table Num 4 shows that the logical truth of the study tool's axes ranged between (0.783 and 0.928), while the correlation coefficient ranged between (0.614 and 0.863), while the logical validity of the tool as a whole reached 0.866, which indicates that the measurement tool with its axes enjoys a high degree of self-validity.

II.6.Statistical Analysis

- Arithmetic mean.
- Standard deviation.
- relative importance.
- Degree

III. Results:

III.1. Presentation, interpretation and discussion of the results of the first axis:

Q1: The use of modern technological applications in training leads to a significant improvement in the functional physical performance of Barcelona senior football players compared to traditional methods

According to the following table:

Table 5: Represents the analysis of the results of the sample members' answers on the first axis.

The Phrases	Arithmetic mean	Standard deviation	relative importance	Degree
Is there a positive relationship between the use of modern technological applications in training and the improvement of the functional physical performance of Barcelona senior football players?	25.816	2.288	86.04	too big
Are there any challenges you face when using modern technology applications compared to traditional ones?	22.266	2.730	74,22	Big
Do you think these applications can completely replace traditional methods of training?	21.883	3.288	72.94	Big
Do you think these apps help customize training for each player?	18.316	2.83	61.04	Medium
Have you noticed any improvement in injury rates among players who did not use these apps?	15.563	2.514	51.72	Weak
Do you think these apps help to better track players' development?	25.816	2.288	86.04	too big
Measuring tool as a whole	116.983	6.659	64.98	Medium

Through the results of the sample members' answers and through Table (5), we see that the answers to questions 1, 2, 3, 4, 5, 6 with arithmetic averages respectively 25.816, 22.266, 21.883, 18.316, 15.563, 25.816, and with a standard deviation respectively 2.288, 2.730, 3.288, 2.83, 2.514, 2.288, and with a relative importance respectively 86.04, 74.22, 61.04, 51.72, 86.04, and with varying degrees respectively very large, large, large, medium, weak, as we notice a slight variation in most of the sample members' answers that there is a positive relationship between the use of modern technological applications in training and the improvement of the functional physical performance of Barcelona senior football players, and they also believe that the speed of development Technology makes its applications fast-paced, and the majority also responded that these applications help in monitoring the development of players better, which

improves training, and that there are challenges you face when using modern technological applications compared to traditional ones, and the few remaining saw that there was a significant improvement in the injury rate among players who did not use these applications, which is consistent with the "Study of Nour El Islem Dahamnia and others" in 2024(Dehamnia, 2024), where the opinions of the physical preparation staff are due to their good training and knowledge of theoretical and practical matters in line with modern technology.

From the above, we conclude that the first hypothesis is achieved.

III.2. Presentation, interpretation and discussion of the results of the Second axis:

Q2:Technological applications contribute to further customizing training programs, which leads to improving the performance of Barcelona senior players individually.

According to the following table:

Table 6: Represents the analysis of the results of the sample members' answers on the second axis.

The Phrases	Arithmetic mean	Standard deviation	relative importance	Degree
Do you think technology applications help in customizing training programs more for each individual?	25.816	2.288	86.04	too big
Have you noticed any improvement in motivation in individuals as a result of customizing training programs?	22.266	2.730	74,22	Big
Do you think that individualization of training programs leads to significantly improved performance?	21.883	3.288	72.94	Big
Are you facing challenges in applying modern technology to develop training programs that contribute to improving player performance?	25.816	2.288	86.04	too big
Do you think apps help identify players' strengths and weaknesses more accurately?	25.816	2.288	86.04	too big
Have you noticed any improvement in injury prevention as a result of customizing your training programs?	25.816	2.288	86.04	too big
Measuring tool as a whole	25.816	2.288	86.04	too big

Through the results of the sample members' answers and through Table Num (6), we note that the answers to questions 1, 2, 3, 4, 5, 6 with arithmetic averages respectively 25.816, 22.266, 21.883, 25.816, 25.816,

25.816, and with a standard deviation respectively 2.288, 2.730, 3.288, 2.288, 2.288, 2.288, and with a relative importance respectively 86.04, 74.22, 61.04, 51.72, 86.04, and with varying degrees respectively very large, large, large, very large, very large, very large, as we note that the majority of the sample members' answers were close, as the majority notices that technological applications help in customizing training programs more for each individual, and the majority believes that these face challenges in applying technology Modern training programs contribute to improving players' performance. The majority of the sample believes that applications help to identify players' strengths and weaknesses more accurately, and that these devices also help to identify players' strengths and weaknesses more accurately. They also noticed an improvement in injury prevention as a result of customizing training programs. All of this is due to the development of the sports system as a result of technological development.

From the above, we conclude that the second hypothesis is achieved.

III.3. Presentation, interpretation and discussion of the results of the third axis:

Q3: Sports performance analysis applications and websites in training contribute to improving the functional physical performance of Barcelona senior football players.

According to the following table:

Table 7: Represents the analysis of the results of the sample members' answers on the third axis.

The Phrases	Arithmetic mean	Standard deviation	relative importance	Degree
Do you think performance analysis apps and websites contribute to improving the functional physical performance of players?	25.816	2.288	86.04	too big
Have you noticed any improvement in injury rate among players after not using these tools?	22.266	2.730	74,22	Big
Do you think these tools help in personalizing training for each individual player?	21.883	3.288	72.94	Big
Do you think these tools help to better track player development?	25.816	2.288	86.04	too big
Do you think performance analysis helps in identifying strengths and weaknesses in team performance?	25.816	2.288	86.04	too big
Do you think performance analysis helps in evaluating the effectiveness of training?	25.816	2.288	86.04	too big
Measuring tool as a whole	25.816	2.288	86.04	too big

Through the results of the sample members' answers and through Table Num. 7, we note that the answers to questions 1, 2, 3, 4, 5, 6 with arithmetic averages respectively 25.816, 22.266, 21.883, 25.816, 25.816, 25.816, and with a standard deviation respectively 2.288, 2.730, 3.288, 2.288, 2.288, 2.288, and with a relative importance respectively 86.04, 74.22, 61.04, 51.72, 86.04, and with varying degrees respectively very large, large, large, very large, very large, very large, as we note that the majority of the sample members' answers were close, as the majority saw that performance analysis applications and sites contribute to improving the players' functional physical performance, and these tools can help in following up on the development of Players are better, and performance analysis helps evaluate the effectiveness of training. The majority believe that performance analysis helps identify strengths and weaknesses in team performance. They also see no improvement in injury rates among players after not using these tools. We also noticed that the majority of the physical preparation staff believe that these tools help customize training for each player individually.

From the above, we conclude that the third hypothesis is achieved.

General conclusion:

By discussing and interpreting the three hypotheses, the researcher concluded that the previous hypotheses are valid, and thus the general hypothesis, which means:"Modern fitness technological applications contribute to improving the functional physical performance of Barcelona senior football players" is achieved.

Therefore, the study as a whole has a high degree of importance and credibility.

IV. Conclusion

Technological applications have become an integral part of the training routine of football players, as these applications contribute to further customizing training programs, which leads to improving physical and functional performance. Through accurate data analysis, players' strengths and weaknesses can be identified and customized training can be designed to improve them. In addition, these applications help in monitoring progress and evaluating the effectiveness of training, which contributes to making more informed training decisions. The study worked to reveal the role of technological development, which highlighted the role of modern technological applications in improving the functional physical performance of football players, which resulted in a series of results, including customizing training (applications contribute to customizing training programs for each player individually, which leads to improving strengths and correcting weaknesses), adding performance analysis (applications help in accurately analyzing players' performance, which allows identifying areas that need improvement and making more targeted training decisions), and improving their physical abilities, as well as contributing to improving players' performance, which contributes to improving the results of the overall level of the team, The study also led to a series of suggestions, including integration with wearable devices: integrating applications with smart watches and fitness trackers to provide more accurate data on player performance, such as heart rate, calories consumed, and sleep quality; virtual and augmented reality (using virtual and augmented reality technologies to create realistic and personalized training environments for each player, helping to improve their technical and tactical skills); predictive analysis (developing algorithms capable of analyzing big data to predict potential injuries and suggest preventive training programs); and player-coach collaboration (designing applications that allow collaboration between player and coach, where the coach can remotely monitor the player’s performance and provide immediate feedback).

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