The journal « sports creativity »

Volume: (17) / N°: (02)-(2026), p 496-519

The reality of quantifying training load among Algerian football coaches

واقع تكميم الحمولة التدريبية لدى مدربي كرة القدم الجزائرية

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Received: 19/04/2026 **Accepted: 20/07/2026** **Published: 30/09/2026**

Abstract This study aimed to identify the reality of training load quantification among football coaches in Algeria. The research sample consisted of 20 coaches working in first division professional clubs, in the under-21 category, during the 2023 season. The researcher adopted the descriptive method, appropriate for the nature of the study, and used a questionnaire as the main data collection tool. After analyzing the results using SPSS software, findings revealed that most coaches do not systematically quantify training loads, nor do they utilize this data to plan or adjust training programs, Based on these findings, the researcher recommends adopting scientific methods for training load quantification and monitoring, such as the RPE method and heart rate monitoring, as well as modern tools like GPS. The study also highlights the importance of training qualified physical coaches in football

Keywords: ; quantifying the training load, coach , football

الملخص : هدفت هذه الدراسة إلى التعرف على واقع تكميم الحمولة التدريبية لدى مدربي كرة القدم في الجزائر. وقد شملت عينة البحث 20 مدربًا ينشطون في أندية الرابطة المحترفة الأولى لفئة أقل من 21 سنة، خلال موسم وقد اعتمد الباحث على المنهج الوصفي لملاءمته لطبيعة الموضوع، كما استخدم الاستبيان كأداة رئيسية لجمع البيانات. وبعد تحليل البيانات باستخدام برنامج SPSS، أظهرت النتائج أن أغلبية المدربين لا يقومون بتكميم الحمولة التدريبية بشكل منهجي، ولا يعتمدون عليها في تخطيط أو تعديل البرامج التدريبية. وفي ضوء هذه النتائج، أوصى الباحث على ضرورة الاعتماد على الأساليب العلمية في تكميم ومراقبة الحمولة التدريبية، مثل طريقة الادراك الذاتي للجهد RPE ومراقبة معدل نبضات القلب، إضافة إلى توظيف الوسائل التكنولوجية الحديثة كأجهزة نظام تحديد المواقع GPS. كما شدد على أهمية تكوين محضرين بدنيين متخصصين في كرة القدم لضمان فعالية أكبر في برمجة الأحمال التدريبية.

الكلمات الدالة: تكميم الحمولة التدريبية؛ المدرب؛ كرة القدم

*** Introduction and problematic of the study**: Modern sports training in football is a set of comprehensive training loads that lead to motor harmony and changes in the body's internal and functional systems, which in turn raises the body's physical, technical, and tactical capabilities, while taking into account the player's life and general health as requirements that serve the actual comprehensive training, including technical, tactical, physical, and psychological preparation. Training should primarily aim to achieve these comprehensive goals of the game with all its different elements to the maximum extent, using auxiliary sciences alongside these modern techniques in various training fields (Ghazi & Hashem, 2013, pp. 23-24). The general physical preparation process aims to enable football players to acquire physical attributes comprehensively, and among the most important of these attributes are these physical abilities, in order to bring the player to a state of adaptation to training loads through various training methods. (Ghazi and Hashem, 2013, p. 77) Training load can be divided into external and internal load. External load is defined as the work performed by the athlete and is measured regardless of its internal characteristics, while internal load is defined as the relative physiological and psychological stress imposed. Internal load provides us with the most information about the degrees of adaptation and recovery from fatigue, and therefore it is what we should rely on to adjust the next training load. Monitoring and controlling the training process is crucial for obtaining a valid measure of this internal load, especially in team sports where the external load is usually similar for all players due to the training methodology, which often involves group exercises. Therefore, monitoring and quantifying the internal load for football players is very important to ensure that everyone receives appropriate motivation. Analyzing the data obtained in this process (internal and external load) should be used to achieve the following objectives: individualizing training,

studying the relationships between athletic performance factors and the amount of load performed, and avoiding overtraining or undertraining. (Escribano, 2018, pp. 4-5)

The primary goal of a coach is to improve performance by managing the optimal amount of training and the appropriate recovery period that allows for psychological and physiological adaptations to reach their maximum before competition. Therefore, it is essential to define the training outcomes (physiological and performance tests) and the training process (internal and external load) in order to increase the athletes' fitness level. The training load must be precisely described to induce specific athletic adaptations. Several studies have indicated the importance of varying daily training loads in the short and medium term, i.e., alternating periods of heavy and light training to achieve optimal performance. (Matteo, 2011, pp. 1-2).

Training load can be divided into external or internal load. External load is defined as the work performed by the athlete and is measured independently of its internal characteristics, while internal load is defined as the relative physiological and psychological stress imposed. Internal load gives us the most information about the degrees of adaptation and recovery from fatigue, and therefore it is what we should rely on to adjust the next training load. Although both types of load are important for understanding the training load supported by athletes, a combination of the two can be ideal for proper training monitoring. In fact, it may be more of a good relationship between external and internal loads that can help detect fatigue and not just internal load. The ability to monitor training is essential for quantifying it, determining its duration, evaluating the athlete's responses and workloads, and determining the relationship between training and performance. Over the past few years, several

methodologies have been developed for quantifying training load in football, both internal and external load, some less so and others more so for various reasons. (Escribano, 2018, p. 4) Training load is considered one of the most important factors influencing the improvement of players' physical and functional performance in football. Its effectiveness depends on the accuracy of its monitoring and organization in terms of intensity, volume, and rest, according to the requirements of each training stage. The under-21 age group is considered one of the most important youth categories, as it represents the transitional stage between basic development and advanced training. This requires precise training programming to achieve maximum physical and technical development. Among the most important elements of this programming is the training load, which must be organized and carefully planned in terms of intensity, volume, and rest. In this context, the concept of training load quantification has emerged as a scientific method aimed at monitoring and analyzing training load, whether internal or external, using advanced tools such as global positioning systems (GPS), heart rate monitoring (HR), and others. These are among the most prominent standards used globally in monitoring and adjusting training load to align with the objectives of each age group.

Despite the significant advancements in training load quantification methods globally, it remains unclear to what extent coaches in Algeria systematically and effectively utilize these methods. Do they actually quantify training loads? Do they possess the necessary tools and knowledge? Or does the process often rely on subjective assessment and personal experience, without employing modern quantification methods and tools? These questions piqued our interest in understanding the reality of training load quantification among Algerian football

coaches, and the extent to which they apply modern scientific concepts and methods in this field. This led the researcher to pose the following question:

General Question:

What is the reality of training load quantification among Algerian football coaches for the under-21 age group?

General Hypothesis:

"The majority of coaches do not systematically quantify training loads and utilize them effectively."

1. General Objective of the Study

Study Objectives:

- To highlight the importance of using training load quantification methods in training load quantification.
- To determine the extent to which coaches use technological tools in training load quantification.
- To demonstrate the extent to which coaches rely on modern methods in training load quantification.
- To demonstrate the extent to which coaches rely on training load data and utilize it to modify training programs.

2.2. Significance of the Research:

- It helps coaches evaluate and improve their current practices regarding load quantification based on scientific data.

- It provides indicators that can be used to develop training programs and accurately monitor player progress.
- It draws attention to the necessity of training coaches in the use of modern quantification tools and methods.
- It encourages the integration of modern load quantification tools, such as heart rate monitors and GPS systems, into basic training.
- It contributes to preventing injuries resulting from the poor distribution or quantification of training load, especially among players in the physical development phase.

2. Operational Definition of Research Concepts:

1.2. Quantifying Training Load:

- Operational Definition: The student researcher defines it as a systematic process of monitoring and measuring training load, whether internal or external, to express the total volume or intensity of each training session or match. This is done using standardized and comparable measurement tools and methods, such as the Rate of Perceived Exertion (RPE) scale, or heart rate monitoring (HR), global positioning systems (GPS).

1.1.2 Coach:

- Operational Definition: The student researcher defines it as the person responsible for training and preparing the team. They plan, organize, and manage training sessions to develop the players' technical, tactical, physical, and psychological abilities in order to improve their individual and team performance in competition.

2.1.2 Football:

Operational Definition The student researcher defines it as a competitive game played between two teams of eleven players each on a rectangular field of specific dimensions with two goals, during a period of time (90 minutes) divided into two halves, with adherence to specific rules regarding how to play and fouls, where players try to move the ball with their feet and head across the field and shoot it into the opponent's goal to score goals, and the team that scores the most goals wins.

2.2. Previous and Similar Studies:

.2.2.1 A study by Bounab Mohamed Saleh Benkara Yassine entitled "The Effect of Training Load During the Physical Preparation Phase on Maximum Oxygen Consumption and Resting Heart Rate in Football Players in 2020." This research aimed to investigate the effect of training load during the physical preparation phase on the variables of resting heart rate and maximum oxygen consumption, and to evaluate the training load during the physical preparation phase for an Algerian under-20 football team. The research sample included 17 players who officially represented JS Skikda during the 2016-2017 season and agreed to participate in the research procedures. The results revealed that the training load applied to the research sample during the physical preparation phase significantly affected the decrease in resting heart rate and the increase in maximum oxygen consumption.

2.2.2. Khair Eddine Chebbah Abdelrahman Ben Laabid's study, titled "Validity of the RPE (rate of perceived exertion) Method for Quantifying Training Load in Algerian Football," aimed to quantify training load using two methods: an objective method and a relative method. Specifically, it investigated the

reliability of using the relative method to quantify training load in Algerian players. The study quantified and monitored the training load of 37 Algerian professional football players during various training sessions in the 2018-2019 season using both methods simultaneously. The results showed a consistent difference between the training loads calculated using the rate of perceived exertion (RPE) method and the Edwards method. However, despite this discrepancy, the statistical results indicated a positive correlation between the two methods, with a Pearson correlation coefficient of 0.82. The rate of perceived exertion (RPE) method consistently yielded higher results compared to the objective method and allowed for the determination of both psychological and physiological loads. In contrast, the Edwards method only allowed for the determination of the duration of work in each training zone. The intensity allows us to understand the physiological and especially metabolic impact of the training session.

2.3.1. Radouane Boubekeur's study entitled "Evaluating Training Load During Football Training Sessions in 2017" aimed to evaluate the training load during training sessions in Algerian professional football clubs. The study was conducted at the level of clubs in the first professional league, with the aim of determining the quantity and type of weekly programmed training load in these clubs and evaluating it based on obtaining training data in the following areas: average daily and weekly training loads and their standard deviations, in addition to average training intensity, values of the training monotony index, and values of the training stress index. This was done using the exercise perception session (Séance-rpe) method, which is characterized by its validity and reliability, as confirmed by many researchers. This was done using content analysis on a sample of 20 football players belonging to clubs in the first

professional league. The results of the study concluded that the aforementioned method can be used as a valid tool for determining the quantity of training load in football and obtaining values for the monotony and stress indices. The training allowed us to evaluate the load, monotony, and stress of the training and to reveal the differences in the content and intensity of the training of these clubs. Finally, the researcher presented suggestions for future studies and research on methods of determining and evaluating the training load in the field of sports training, especially football, in line with the requirements of modern football.

3-Methodological Procedures of the Study:

3.1 Study Methodology: The nature and specificity of the research problem are among the most important criteria upon which the study methodology is based. Therefore, the researcher chose the descriptive method as a suitable scientific approach for the research problem. The descriptive method is defined as a method for describing the subject under study through a sound scientific methodology and presenting the results obtained in expressive numerical forms that can be interpreted (Al-Mahmoudi, 2019, p. 46).

3.2 The Statistical Population of the Study: The population consists of all the elements and components of the problem or phenomenon under study. In this research, the population consists of 32 coaches distributed across 16 clubs representing the original population, all of whom are active in the Algerian Professional Football League One clubs.

3.3 The Study Sample: The sample is defined as a part of the study population from which the field data is collected. It is considered part of the whole, meaning

that a group of individuals from the population is selected to be representative of the research population. (Zerouati, 2007).

Therefore, we selected the study sample using purposive sampling, which falls under the category of non-probability sampling. This selected sample is sufficient to represent the research population. The study sample consisted of coaches, including 16 coaches distributed across 10 clubs: USM Alger, MC Alger, NA Hussein Dey, Paradou AC, JS Kabylie, MC Oran, WA Tlemcen, NC Magra, JS Saoura, and AS Ain M'lila. 4.3 Research Areas:

3.4.1 Timeframe:

We began this research by precisely defining the study topic and formulating the research problem at the beginning of November 2022. Following this, we gathered information and references, compiled the scientific material, and commenced the theoretical aspect of the research. Our remaining time was dedicated to the applied aspect, which took place during the 2022/2023 sports season. We conducted the field study during the competition period from January 5th to February 5th of the 2022/2023 sports season. The results were then processed, and the study was completed on February 20th, 2023.

3.4.1 Spatial Scope of the Study:

The applied aspect of the study was conducted at the stadiums of the following teams: USM Alger, MC Alger, NA Hussein Dey, Paradou AC, JS Kabylie, MC Oran, WA Tlemcen, NC Magra, JS Saoura, and AS Ain M'lila. This was done by distributing the questionnaire to the trainers for their response.

3.5 Exploratory Study: To understand the conditions under which the study or field research would be conducted, the researcher must conduct an exploratory

study to determine the suitability of the study area for field research procedures and to ensure the validity of the instrument used. The researcher also identified any difficulties that might arise before commencing the main study. The researcher undertook a series of procedures aimed at:

- Contacting the technical directors of the teams to inform them about the study topic.
- Reviewing the training program of these clubs.
- Determining the training times and location.
- Establishing contact with the team trainers to gain a clear understanding of these clubs in terms of their pedagogical methods, training facilities, and implemented training programs. The researcher conducted a field visit to these clubs, met with the trainers, and obtained the necessary assistance.

3.6. Research Tools and Methods:

The researcher used various tools to collect data for the study. These tools are crucial in determining the value of the study and the accuracy and objectivity of its results. Therefore, the researcher relied on questionnaires in this study.

3.6.1. The Concept of a Questionnaire:

The term "questionnaire" was coined by specialized Arab translators for the English word "questionnaire." There are various synonyms for it in Arabic, some calling it "istifta'" or "istiqsa'," and others "istiqyan." Regardless of these terms and connotations, it refers to a form containing a set of written statements, paragraphs, or questions that require an individual to answer based on their own understanding or what applies to them.

A questionnaire is defined as a data collection method that relies primarily on a form consisting of a set of questions. This form is sent by mail or delivered to individuals selected for the study so they can record their answers. All of this is done without the researcher's assistance to the participants. (Ali Muammar, 2008, p. 205)

3.3 Statistical Methods Used in the Study:

The statistical methods used form the cornerstone for reaching the results and facts through the highly significant results they provide for the research. Based on all the results obtained in the pre- and post-tests, the researcher can determine the most appropriate statistical methods for the nature of the study, ensuring that all results are interpreted with the necessary statistical significance for each applied statistical test. The following statistical methods were used to verify the study hypotheses:

3.7. Statistical Tools Used:

First: Descriptive statistics measures, which included: (arithmetic mean, standard deviation, skewness, kurtosis, frequencies, and percentages)

Second: Inferential statistics tests, which included the following tests: (Wilcoxon signed-rank test, one-sample t-test, one-way ANOVA, and Hassan's chi-squared test) (The matching). These results were calculated using SPSS software.

4. Analysis and Discussion of Results

4.1. Presentation and Analysis of the General Hypothesis

4.1.1. Presentation of the Differences in the Sample's Answers to the Study Questionnaire

4.1.2. Presentation of the Differences in the Responses to Question 1: Do football coaches rely on a training load planning program during the preparation period?

Table 32 represents the significance of the differences for the proposed alternatives to determine the answers to Question 1: Do football coaches rely on a training load planning program during the preparation period?

Statistical variables	Type of alternatives	Duplicates	Calculated (X2) value	Degree of freedom	Significance level	Probability value SIG
01-Do you rely on a training load planning program during preparation period ?	NO	02	8.067	1	0.05	0.005
	YES	13				
N=15	Confidence level 95%		Statistical decision : There are statistically significant differences			

The table above shows the results of the chi-squared test for the frequencies of the alternatives for the first question, which examines (Do you rely on a training load planning program during the preparation period?) in order to determine the significance and levels of these differences from a statistical perspective. The

calculated value of (X2) was 8.067, which is a statistically significant value considering that the probability value sig (0.000) is less than the significance level of 0.05. Therefore, the researcher acknowledges the existence of statistically significant differences between the alternatives in the answers of the study sample (n=15) with a confidence level and evidential strength of (95%), which proves that the differences have statistical value and are considered in making decisions related to the axis that, along with the other variables, constitutes the necessary statistical decision. The researcher also indicates, based on the existence of statistically significant differences, that they are in favor of the answer for the alternative (yes), and this is because it is the alternative that has the highest frequency of answers from the study sample.

Table 46 presents the differences in the answers to question 12 among football coaches: What methods do you use to quantify the training load?

Table 46 presents the differences in the proposed alternatives for determining the answers to question 12 among football coaches: What methods do you use to quantify the training load?

The table above shows the results of the chi-squared test for the frequencies of

Statistical variables	Type of alternatives	Duplicates	Calculated (X2) value	Degree of freedom	Significance level	Probability value SIG
What methods do you use to quantify the load training ?	Heart rate method (HR)	4	3.267	2	0.05	0.071
	Rate of Perceived Exertion (RPE)	11				
	Blood analysis method	00				
N=15	Confidence level 95%		Statistical decision : There are no statistically significant differences			

the alternatives for question twelve, which examines (what methods do you rely on to quantify the training load) in order to determine the significance of these differences and their levels from a statistical perspective. The calculated value of (X2) was 3.267, which is a non-statistically significant value, considering that the probability value sig (0.071) is greater than the significance level of 0.05. Therefore, the researcher acknowledges that there are no statistically significant differences between the alternatives in the responses of the study sample (n=15). Accordingly, the researcher indicates, based on the type of alternative (heart rate method - subjective perception of effort method - blood analysis method), that their frequencies did not reach the significance of differences in order to determine the main objective of the study sample.

4.1.3.1. Presenting the results of the differences in the answers to question number 20 among football coaches: Compare the planned training load with the completed training load.

The table represents the significance of the differences for the proposed alternatives to determine the answers to question number 20 among football coaches: Compare the planned training load with the completed training load.

Statistical variables	Type of alternatives	Duplicates	Calculated (X2) value	Degree of freedom	Significance level	Probability value SIG
The planned training load is compared with the completed training load for:	Detecting the fatigue indicator	4	8.400	2	0.05	0.015
	Diagnosing and adjusting the training program	10				
	Correcting the exercise	01				
N=15	Confidence level 95%		Statistical decision : There are statistically significant differences			

The table above shows the results of the chi-squared test for the frequencies of the alternatives for question twenty, which examines (the planned training load is compared with the completed training load for :) in order to determine the significance and levels of these differences from a statistical perspective. The calculated value of (X2) reached 8.400, which is a statistically significant value considering that the probability value sig (0.015) is less than the significance level of 0.05. Therefore, the researcher acknowledges the existence of statistically significant differences between the alternatives in the responses of the study sample (n=15) with a confidence level and evidential strength of (95%), which proves that the differences have statistical value and are considered in making decisions related to the axis that, along with the other variables, constitutes the necessary statistical decision. The researcher also indicates, based on the existence of statistically significant differences, that they are in favor of the response for the alternative (diagnosing and modifying the training program), and this is because it is the alternative that has the highest frequency of responses from the study sample.

Discussion of Results

4.1.2. Discussion of the General Hypothesis:

"The majority of coaches do not systematically quantify and utilize training load."

A coach's scientific knowledge in quantifying, standardizing, utilizing, and employing training load is one of the most important factors in the success of a training program and the improvement of athletic performance. Using a training load appropriate for the player is crucial in modern football training to adjust the training program, detect fatigue indicators, and avoid overload. In the first

section of the questionnaire, which deals with training load planning, the researcher indicates that the failure of most coaches to utilize training load data stems from their neglect of scientific principles in planning training load programs during the preparation and competition periods. This is compounded by the random distribution of training loads across the weeks of training during these periods. Most coaches rely on field experience and disregard the scientific aspects of distributing training loads, such as intensity and volume, and lack knowledge of modern methods for quantifying training load. This can lead to the failure of the planned training load program during the preparation and competition periods, preventing coaches from adjusting the training program, detecting fatigue indicators, and avoiding injuries. This highlights the importance of relying on a planning program to distribute training load weeks according to practical principles for the requirements of modern football. This is confirmed by the study by Taheri and Aboura (2020), which recommended the necessity of understanding the element of planning training programs, as it is the fundamental step towards achieving athletic success. It also emphasized the importance of not neglecting training programs and staying informed about all new developments in the field of scientific training design and planning. Furthermore, in the second section, concerning the application of completed training load data, the researcher pointed out that most coaches do not focus on quantifying training load on a daily or weekly basis, nor do they rely on modern methods for quantifying and standardizing training load. Instead, they depend on field experience. Although some reliable and inexpensive methods for quantifying training load exist, requiring no equipment, such as the Rate of Perceived Exertion (RPE) method, which has been confirmed by numerous studies, many coaches do not adopt or use this method for quantifying training load. They rely on their field experience, and consequently, the coach is unable

to detect fatigue indicators and adjust the training program accordingly. The use of modern methods for quantifying training load, such as heart rate monitoring (HR), global positioning systems (GPS) devices, and lactate level gauges, helps in precisely adjusting and regulating training load. This allows for the accurate measurement of internal indicators such as average heart rate(HR), heart rate reserve (HRR), and maximam heart rate (HRmax), as well as external indicators like distance traveled, maximum speed, acceleration, and deceleration. Thanks to these methods, coaches can assess a player's physical condition, detect fatigue, prevent injuries, and adjust training programs according to players' physical state and match schedules.

Furthermore, in the third section, which compares planned and completed training loads, the researcher emphasized that many coaches do not quantify the load of completed training sessions and compare it with the daily or weekly plan. This is due to the reasons mentioned in the first section regarding program planning for training load, as the majority of coaches do not... They rely on a special program for planning the training load and they rely on randomness in distributing the load over the weeks of the training program, as well as the reasons he mentioned in the second axis, which is related to employing the completed training load, as many trainers do not rely on scientific methods in quantifying the training load, as well as not using technological means to quantify the training load. The researcher also noted that most trainers cannot know the physical condition, the mobilization state, predict injuries, and the recovery process by employing the data of the training load. Consequently, the trainer does not benefit from this data in discovering the fatigue indicator and falling into the phenomenon of overload, and thus falling into injuries, as well as diagnosing and modifying the training program through the micro training cycle.

Finally, the acceptance of the hypothesis is determined that the majority of trainers do not benefit from employing the data of the training load.

5. Study Results:

The primary objective of presenting, analyzing, and discussing the findings, drawing conclusions, and identifying the objectives achieved is to determine the statistical and methodological foundations for interpreting the results. All discussions regarding the data and statistical information are summarized in the following conclusions:

- The majority of coaches do not systematically quantify training load and utilize this data effectively.

6. Conclusion:

The main objective of this study is to understand the current state of training load quantification in terms of load planning for training programs and the reliance on scientific methods for quantifying training load, whether internal or external. It also examines the extent to which modern methods are used in the quantification process. This allows for understanding the athlete's physical condition, detecting fatigue levels, and thus preventing injuries and overload. Furthermore, it facilitates the adjustment and diagnosis of the training program and allows for the optimal distribution of training load through its components—intensity, volume, and rest—throughout the sports season, both during preparation and competition. Therefore, the coach's scientific knowledge of understanding and utilizing these elements through quantification plays a positive role in improving the athlete's performance. The research concluded that the current state of training load management for under-21 football coaches in Algeria is characterized by a lack of scientific methodology and organization.

The results showed that most coaches do not plan training loads meticulously, nor do they adequately utilize objective data, nor do they regularly compare planned and actual training outcomes. This situation negatively impacts the effectiveness of training programs and increases the risk of injuries and delays player development. Therefore, the research highlights the urgent need to develop training load quantification practices by promoting scientific awareness and providing appropriate equipment for coaches.

7. Suggestions and Recommendations:

- Adopt training load planning programs based on scientific methodologies that meet the requirements of modern football during the season and stay informed about the latest developments in modern sports planning.
- Utilize scientific methods for quantifying training load, such as the heart rate method (Edwards), the Rate of Perceived Exertion (RPE) method, and the lactate level analysis method.
- Utilize modern technological tools for quantifying training load, such as the Polar Team 2 device, heart rate monitoring (HR) , global positioning systems (GPS) devices, and lactate level measurement tools. These tools help in accurately adjusting and quantifying training load, allowing for the identification of both internal and external indicators. Thanks to these tools, coaches can assess players' physical condition, detect fatigue levels, prevent injuries, and make necessary adjustments. The training program is tailored to the players' physical condition and the match schedule.

- Specialized physical trainers are employed for the under-21 teams in the first division professional league.
- Training courses are conducted for coaches to enhance their knowledge by introducing them to the latest techniques and technologies in physical conditioning in general, and specifically in training load management.

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