

The use of the Rating of Perceived Exertion (RPE) scale in monitoring and tracking training loads and its importance in predicting injuries in football players under the age of 18

استخدام مؤشر إدراك الجهد المبذول RPE في مراقبة ومتابعة الاحمال التدريبية وأهميته في توقع الإصابات عند لاعبي كرة القدم اقل من 18 سنة

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Abstract:

The study aimed to determine the foundations of using the Rating of Perceived Exertion (RPE) scale in monitoring and tracking training loads and its importance in predicting injuries in football players under the age of 18. The descriptive method was employed. The results regarding tracking the training loads of injured players indicated the significance of the RPE index in predicting injuries in players under 18 years old, as the Foster index for tracking training loads was used.

Keywords: Rating of Perceived Exertion (RPE); Injuries; Football players under 18 years old

ملخص:

هدفت الدراسة الى معرفة أسس استخدام مؤشر إدراك الجهد المبذول RPE في مراقبة ومتابعة الاحمال التدريبية وأهميته في توقع الإصابات عند لاعبي كرة القدم اقل من 18 سنة، تم الاعتماد على المنهج الوصفي. أسفرت النتائج الخاصة بتتبع الاحمال التدريبين للاعبين المصابين ان أهمية مؤشر RPE في التنبؤ بالإصابات عند اللاعبين المصابين الأقل من 18 سنة حيث تم الاعتماد على مؤشر فوستر للتبع الحمل التدريبي .

كلمات مفتاحية: مؤشر إدراك الجهد المبذول RPE؛ الإصابات؛ لاعبي كرة القدم أقل من 18 سنة

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I -Introduction:

According to the consensus of experts, the training load has been defined as the degree of load placed on the athlete's shoulders because the development and improvement of physical fitness are closely related to the methods and principles used for training loads. Some define training load as the kinetic burden used in training units on the athlete, during the use of those training units (الضمد، 2015، صفحة 11) It depends on: (1) the nature of training activities, (2) load characteristics (volume, intensity, density, and repetition), (3) environmental conditions (temperature, humidity, cold, altitude, pollution), and (4) the physical and mental condition of the athlete. (Lambert & Borresen, 2010, p. 410) Therefore, measuring and tracking the training load for the athlete depends overall on a set of resources and factors that can be provided based on various variables and subjective models (RPE) that regulate the load and maintain its quality in sports practice, thereby minimizing the risks. (Robson-Ansley, p, Gleeson, & Ansley, 2009, p. 1410) It is necessary to approach the trainer and understand the importance of using the perceived exertion scale (RPE) in building training programs for youth categories and how to maintain the readiness of the

Sub-Questions

- 1) Does the coach know the Rating of Perceived Exertion (RPE) scale?
- 2) Does the coach use the Rating of Perceived Exertion (RPE) scale in adjusting the training load?
- 3) Does the coach use the Rating of Perceived Exertion (RPE) scale to predict injuries?

General Hypothesis

- The Rating of Perceived Exertion (RPE) indicator can monitor and track training loads and predict injuries among soccer players under the age of 18.

Study Objectives

- To understand the importance of using the RPE scale among football coaches.

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- To determine the coaches' ability to adjust the training load using the RPE scale.

- To assess the possibility of predicting injuries using quantified training loads measured with RPE.

Definitions and Concepts:

Rating of Perceived Exertion (RPE)

Term: The RPE method (Rating of Perceived Exertion), developed by the American Dr. Carl Foster, is one of the appropriate methods currently used to determine training load of all types (continuous efforts, intermittent efforts, competitions, bodybuilding, speed, etc.). It enjoys scientific credibility in various sports, as players rely on it to rate their individual estimates of the difficulty of each session. At the end of each session after 30 minutes, the lab asks for the player's estimation of the completed session or match. The 360 minutes mentioned prevent the estimation of perceived exertion from being influenced by the previous exercise. (Foster, et al., 2001, p. 112)

The training load is calculated as follows: (Foster c. , 1998, p. 1166)

TL = Duration of the session x RPE (UA)

Procedural definition: It is a scientific method that excels in estimating and tracking the training load. This method relies on the player's estimation and feeling of the exertion exerted during the training session by evaluating the load from 0 to 10 according to the Foster method. This estimation is likely based on the physiological, physical, and psychological state of the player

. Translation

Characterized by ease of understanding and use, it does not require any special equipment or measurement of HR max. or regular reevaluation, as it is a scientifically proven method with very strong correlations (0.75-0.9) between sRPE and TRIMP degree and HR (Toumi & Nouredine, 20121, p. 608)

Injuries

Term: Injuries are mostly the result of stress, whether they are internal injuries (resulting from the intensity of physical activities performed by the athlete or slowness in movement, often attributed to lack of physical fitness or inadequate skill or roughness in play, or returning to practice before full recovery) or external injuries (resulting from falls or blows and usually painful and acute))Hamdan و Abdul Razzaq Salim(117 صفحة ، 2016 ،

According to Zaher (2004), an injury is the impairment of a tissue or group of body tissues due to an external or internal effect that disrupts the function of that tissue.

According to Fuller et al., FIFA has reached a consensus on defining injuries in football, defining them as "any physical complaint suffered by a player as a result of participation in a football match or training, regardless of the need for medical care or the inability to participate in the game" (Barthelemy, 2019, p. 71)

The causes of accidents and injuries that require immediate first aid are numerous and varied, some are natural and some are self-inflicted or due to negligence or ignorance)Hamdan و Abdul Razzaq Salim(183 صفحة ، 2016 ،

Procedural definition: It is a set of interruptions and disruptions that occur at the level of body tissues as a result of a specific effort (internal, external), leading to the disruption of the integrated functional work of the body.

Previous Research and Studies:

First Study:

Delcroix, Barthélémy, 2019; "Workload and Injuries in Professional Football" (Barthélémy, 2019).

Level of Study: Ph.D. thesis, Faculty of Sports Science and Physical Education, Lille University.

Problem: What is the level of scientific evidence of the correlation between workload and injuries in highly skilled young players in training centers?

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- What is the level of scientific evidence for the relationship between workload and injury rate among professional football players?
- What tools can be used in high-level football to determine workload levels for injury prevention?

Objectives: To list and evaluate the methodological quality of different studies and determine the level of scientific evidence for the correlations between workload and injuries, as well as the tools used to measure workload in high-level football.

Method: To answer the research questions, a methodology was developed to determine the levels of scientific evidence by searching for articles using PubMed and Google Scholar databases, and analysis of published or online accepted articles by December 31, 2018. The search strategy for articles involved combining the words "workload" or "training"; "injury"; "football" in PubMed and Google Scholar databases.

Description of the studies and their scientific quality concerning the relationship between workload and injury rate in highly skilled young football players.

Results: These studies showed a correlation between the absolute increase in external or internal workload and an increased incidence of injuries in high-level football. However, it does not imply a causal relationship between workload and injury occurrence. Although these various studies have shown potential associations between workload and injury levels in young players or professional players, these associations do not mean that workload is an indicator of injury occurrence and alone does not allow for predicting injuries.

The second study

Xavier Roy, 2019; "The Use of Training Load Data by sRPE Method in the Reflective Process of Programming and Regulation of Sports Intervention by Coaches in Quebec University Football" (Roy, 2019).

Level of Study : Ph.D. thesis in Education, University of Quebec, Montreal, Canada.

Problem: This study addressed the problem of some coaches relying on field experience in managing and monitoring the training process in student athletes and how to use information on training loads extracted through the sRPE method to program and adjust sports interventions for coaches in line with the reflective practice principles aimed at integrating field experience and utilizing a self-scale to extract objective information that reflects on programming, modifying, and monitoring training to achieve set goals.

Objectives:

- Understanding how sports coaches determine training loads in the context of balancing high-level sports and studies at the University of Quebec to monitor athlete responses to training and prevent overtraining.
- Proposing a valid and user-friendly methodology (reflective practice) that allows for feeding the thinking process and making optimal decisions with athletes using self-measured sRPE training load data.

Sample: Consists of 26 football student players at the University of Quebec RSEQ team (22 ± 1.72 years, 182.10 ± 4.59 cm, 44.45 ± 17 kg), and 3 coaches.

Method: The first step of the methodological design involves collecting daily CEi data perceived by student athletes after (a) each strength training activity, (b) each technical-tactical training session, and (c) after each match during the 2017 competition period, i.e., from August 12 to November 4, 2017, according to the sRPE method proposed by (Foster, et al., 2001, p. 111)

The second step involves conducting the first individual interview with coaches at the end of the training camp to establish a profile for participating coaches, ascertain their academic background, coaching experiences, clarify their knowledge of training load in general.

Results

- Using RPE allows for quantitative measurement of training loads to improve athletic performance, prevent injuries, and avoid symptoms of overtraining.

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- Relying on reflective practice using sRPE data allows for monitoring, adjusting, and programming training to achieve goals effectively.

Suggestions: It is essential to rely on sRPE not only for quantitatively measuring training loads and understanding the impact of external load on body systems to improve athletic performance and prevent injuries but also to allow coaches to use it as an introduction to the reflective practice in the training process.

II. Study Methods and Tools

Methodological Procedures

Pilot Study

We conducted a pilot study before the field study aimed at adjusting all study variables through the organizational process and field application of the indicator, ensuring the appropriateness of the work environment and the sample suitability for the study

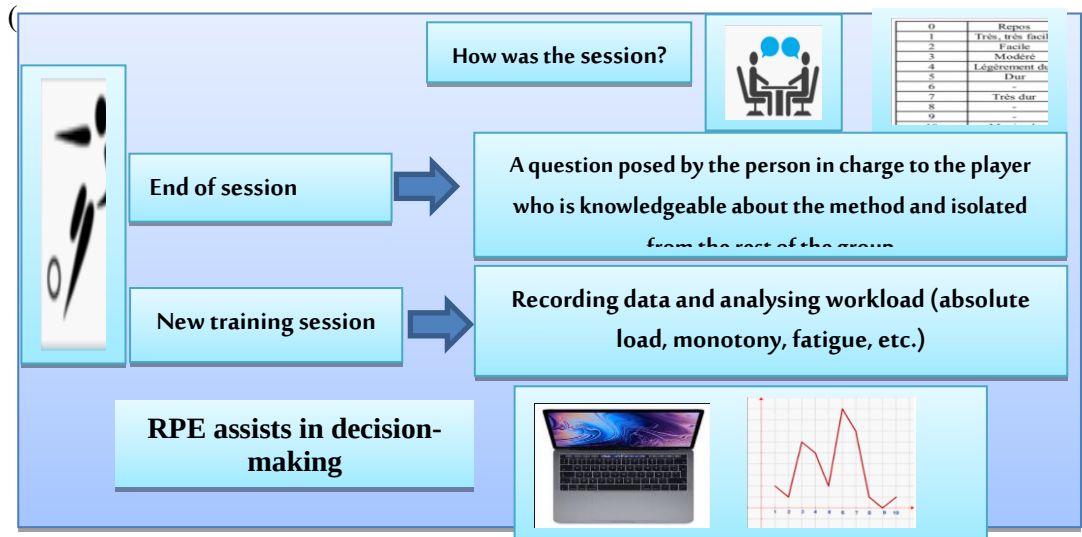
Table 1: RPE scale by Borg and the average by Foster.

Training description	The grade
Rest	0
Very light exercise	1
Light exercise	2
Moderate exercise	3
Somewhat strenuous exercise	4
Intense exercise	5
	6
Very strenuous exercise	7
	8
	9
Maximale	10

(Barthelemy, 2019, p. 38)

Scientific Basis of the Scale: The validity of the sRPE scale results was confirmed during continuous and intermittent training on an ergocycle and during basketball training sessions by Foster et al. (2001), comparing them with workload specified by the TRIMP method of Banister as a benchmark or criterion. In football, the validity and reliability of sRPE scale results were verified (Impellizzeri, Marcora, Rampinini, Mognoni, & Sassi, 2005, p. 749) compared to Banister's TRIMP method ($r = 0.50 - 0.85$; $p < 0.01$). Additionally, the validity of the sRPE method was also confirmed among female football players compared to workload specified by Banister's TRIMP method.

Figure 1: Description of using sRPE in the training process according to recommendations by Foster et al. (2001)



(Barthelemy, 2019, p. 40)

Key Study Features: After outlining the pilot study and gathering all information about the research topic and its alignment with the research sample, during the main study, specific injured players were selected during the training period. All data on the perceived exertion index for these players were collected, analyzed within the research framework.

Statistical Tools: The study relied on weighted means, standard deviations, and the Pearson correlation coefficient.

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III .Analysis of results and their discussion

Table 2: Represents the sequence of training loads for the first player who suffers from injuries

Week 5	Week 4	Week3	Week 2	Week 1	The days
550	600	630	600	600	Sunday
600	400	400	750	400	Monday
800	720	720	200	600	Tuesday
0	0	0	0	0	Wednesday
600	600	360	550	750	Thursday
0	0	0	0	0	Friday
700	700	490	800	250	Saturday
3250	3020	3000	3000	2500	CEH
464	431	428	428	357.1	CEJm
143.2	177.	188	284	339	Standard
	5				Deviation
3.24	243	2.27	1.51	1.05	Monotony
10530	7338.6	6803	4526	2629	Constraint
					Index
-7280	-4318.6	-3803	-1526	-129	Fitnes
		-370			Fraicheur

Weekly Pregnancy Weight / Standard Deviation	Monotony
Monotony x Training Load	Constraint
Training Load – Fatigue	Fitnes

Monotony Index = Weekly average of daily training loads / Weekly standard deviation of daily training loads (using Pearson's standard deviation).

When calculating the monotony index, if the value is less than 2, we say that the athlete's condition is normal and there is no risk of injury. However, if the monotony index exceeds a value of 2, it means that caution is necessary as there is a risk of the athlete getting injured.

Constraint Index "La contrainte": The "constraint" index is associated with negative adaptations to training load and serves as an indicator of the risks of excessive work or overtraining. If the pressure exceeds the training load, the athletes' performance ability is affected.

The index is calculated using the following formula:

Constraint Index = Weekly Load x Monotony Index

When calculating the constraint index, if the value is less than 3000, we say that the athlete's condition is normal and there is no risk of injury. If the constraint index falls between 3000 and 4000, caution is advised to prevent the athlete from getting injured. If the value is greater than 4000, there is a high risk leading to overtraining.

Classification	Variables
Normal State	0 to300
Risk of Injury	300 to400
Risk of Overtraining	400to mor

Fitness Index: Fitness represents the current performance ability of the athlete and is calculated using the following formula:

$$\text{Fitness Index} = \text{Weekly Load} - \text{Constraint Index}.$$

The fitness index reflects the athlete's condition after a week of work, determined by subtracting the weekly load from the constraint index. If the result approaches zero (greater than 1000-), we say that the athlete's fitness level is good and they have the ability for good performance. However, if the result deviates significantly from zero (less than 1000-), we say that the athlete is experiencing fatigue or exhaustion and does not have a good performance ability.

Referring to table number (2), which shows the sequence of training loads for a football player who got injured and was absent for more than 68 days, we observe that the average loads in the first and second weeks were moderate, ranging from (2500-3000). As for the fourth and fifth weeks, the loads increased to reach (3020-3250), indicating high training loads.

Table 3: Represents the sequence of training loads for the second player

Week 5	Week 4	Week3	Week 2	Week 1	The days
810	600	600	720	720	Sunday
720	630	720	810	810	Monday
720	720	720	600	720	Tuesday
0	0	0	0	0	Wednesday
600	720	600	720	810	Thursday
0	0	0	0	0	Friday

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720	720	630	810	810	Saturday
3570	3390	3270	3660	3870	CEH
510	484.28	467.14	522.85	552.85	CEJm
353.69	334.25	323.04	364.08	379.81	Standard Deviation
1.44	1.44	1.44	1.51	1.45	Monotony
5140.8	4881.6	4708.8	5526.6	5611.5	Constraint Index
-1570.8	-1491.6	-1438.8	-1866.6	-1741.5	Fitness
Weekly Pregnancy Weight / Standard Deviation			Monotony		
Monotony x Training Load			Constraint		
Training Load – Fatigue			Fitness		

Weekly Pregnancy Weight		Training Load	
to 700	from 1500	Light Load	
to 1500	from 1900	Moderate Load	to 00 from 200
to 1900	from 2500	Heavy Load	to 200 from 350
From more than 2500		Very Heavy Load	to 350 from 700
			Very Heavy Load

IV – Discussion

Through the results obtained in table 3, which illustrate the sequence of training loads for the injured football player who was absent for more than 68 days, it is apparent that the average loads in the weeks were as follows: moderate and reached (552.85, 522.85, 467.14, 484.28, 510), reflecting high and exhausting loads.

These results can be explained through the perceptual indicators provided by the players, which may not necessarily reflect their true sense of difficulty. This aligns with Coutts et al. and Impellizzeri's findings that the RPE scale allows for monitoring workload, is simple, free, and quick to use, verified for use in football (FM, Rampinini, Coutts, Sassi, & Marcora, 2004, p. 1046). These results affirm the possibility of quantitatively measuring training loads using the sRPE scale. Hence, it can be said that the monthly training load level for the players of Al-Akhderiya and Shabab Bourj Menayel for the 2021/2022 football season is high, leading to player injuries.

Many articles (Van Mechelen, 1992; Junge & Dvorak, 2000; Brooks & Fuller, 2006) recommend using the injury incidence index instead of absolute injury

counts to estimate injuries quantitatively. According to the National Institute of Statistics and Economic Studies (INSEE), the injury incidence index is defined as the number of new cases of diseases observed during a specific period. In football, the injury incidence index is defined as the number of new injuries during a time period based on the number of players observed.

In our study, training load was measured using the perceived exertion scale RPE, focusing on it as one of the best methods to measure training load in football, unlike other load control methods that require the use of advanced and expensive devices to assess players. Measuring and regulating training load reduces the risk of physical fatigue, sports injuries, enhances performance, and improves efficiency in resisting fatigue.

V. Conclusion

In conclusion, this study has certain limitations, including the sample size being limited to injured players, and the follow-up duration of training load being only a month. Hence, further studies and research are required to control research variables more effectively and achieve more accurate and credible results.

In light of the study results, we have reached a set of future suggestions and hypotheses, aiming to assist professionals in the field of sports training. These include relying on the RPE scale to measure training load for football players, using the RPE scale to avoid fatigue and sports injuries, and reaching the team's highest level. Conducting further studies comparing the results of the RPE scale with other metrics is also recommended

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