

Intensity and fatigue assessment of technical-tactical training caused in u-20 soccer players

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Abstract

Since the current soccer calendar does not provide a timely fashion for proper recovery of athletes, fatigue and recovery have been extensively studied by researchers. What led to the emergence of some instruments for the purpose of provide information and give support to the professionals seeking high performance. The aim of this study was to analyze the intensity of technical-tactical training and fatigue caused in U20 soccer players, through the performance in the lower limbs and session RPE. Players (n = 25) performed the countermovement vertical jump (CMJ) and horizontal (HJ), before and after a technical-tactical training session (TTT), with the intensity being measured by Borg Scale (CR 10). The CMJ did not show significant difference ($p > 0.05$), whereas HJ was higher in the post-TTT compared to pre-TTT ($p = 0.02$). As for session RPE, 92% of players rated the intensity of the TTT as easy to moderate. The results of this study indicate that TTT low intensity does not compromise the power in testing vertical and horizontal jump. It is suggested that besides providing an operationalization of tactical patterns of collective behavior, TTT low intensity training can be used in regenerative or character moments in the sports calendar does not enable complete recovery of players.

KEY WORDS: Soccer; Intensity; Fatigue; Muscle power.

Introduction

Technical, tactical, mental and physiological factors are needed for soccer players achieve optimum levels of performance. According to STOLEN et al.¹ is not necessary to be outstanding in a specific capacity, but it is recommended that athletes have a reasonable level in all of them. The training, as the soccer competitions, induces players to the state of fatigue, which is characterized by transient decrease in functional abilities of the individual evidenced by the maintenance of failure to perform physical valences, such as strength, speed and power².

During the occupation of the player, fatigue may occur by several factors, including oxidative or functional stress, which individually or jointly,

directly or indirectly, may impose limitations on the physical capacity of the soccer player, compromising the sports performance and may cause injuries³. Even associated to the fatigue state amount of muscle glycogen, dehydration, hyperthermia, high blood lactate concentration and high muscle acidity⁴.

The need for knowledge regarding the intrinsic fatigue caused an increase in the number of studies that assessed the levels of physical effort and the physiological demands of soccer players, along with the development of this sport in other aspects⁵⁻⁶. Thus, psychological, motor, physiological and biochemical variables have been used as parameters to quantify intensity ratios and fatigue of a stimulus, be it competitive character or training⁷.

Considering the multiple factors that involves sports, BORIN et al.⁸ cite the importance of fatigue control in training sessions or games, highlighting the importance of pedagogical instruments in assessing the training load. In this sense, the literature has suggested the relationship between the load control with the functional recovery after testing efforts involving jumps⁹⁻¹⁰, the use of rating perceived exertion (RPE)¹¹⁻¹², heart rate¹³, biochemical markers¹⁴, etc.

The RPE is a tool used in order to quantify the sensory interpretations related to the exercise by feedbacking mechanism¹⁵. Moreover, the stimulus generated on muscle, cardiovascular and respiratory system should be interpreted by the individual in order to classify the exercise intensity, which may occur through different types of physical activity and environment¹⁶⁻¹⁸.

According to ROSCHEL et al.¹⁹ jump tests are used in indirect assessments of the power of the lower limbs, using the jump height as evaluative parameter. However, this test can be used as fatigue acute or chronic parameter of physical training.

BORIN et al.²⁰ evaluated the power strenght through the vertical jump in a preparatory period of 7 weeks in professional soccer players, observing a starting average of 44.0 ± 2.15 cm and final result 48.8 ± 2.26 cm. In another study, researches found a performance decreasing on vertical jumps of approximately 4% in indoor soccer players who participated in matches in four consecutive days²¹. On the other hand, by analyzing the vertical jump height before and after a women soccer match, KRUSTRUP et al.²¹ couldn't find any significant difference in the results.

Although currently there are several ways to measure the intensity of fatigue, many of these assessment methods are invasive procedures considered of high financial cost and difficult to apply. However, analyzing the neuromuscular responses before and after a training session with assistment of a psychometric indicator seems to be consistent, taking into account the ease of reproducibility. In this way, the objective this study was analyze the intensity and the fatigue caused in soccer players of the U20 after the technical-tactical training.

Method

Sample

It were included on this study 25 male elite soccer players U-20 belonging to a soccer club of first division from Rio Grande do Sul - Brasil. All players were participating of the training preparation to the 2013 state championship, being ready for the assessment and tests. About the physical characteristics, the individuals presented an average of 19.1 ± 0.8 age; 71.9 ± 9.2 kg body mass; 177.6 ± 8.2 cm stature and $10.3\% \pm 1.1$ of percentual fat body.

Instruments

The body mass and stature measures were made on scale and stadiometer (Filizola®, BR). Skinfold thickness was measured with a skinfold caliper (Cescorf®, Porto Alegre, Brasil) in four places (subscapular, triceps, biceps, suprailiac, abd) was used FAULKNER protocol²³. All procedures followed the guidelines proposed by HEYWARD and STOLARKZYK²⁴.

Ethics procedures

Properly informed about the research objectives and procedures they would be submitted, all participants signed a consent term. This study was approved by the Research Ethics Committee of the Centro Universitário Univates (06339913.2.0000.5310) and meets the standards of the Treaty of Helsinki 1996 and the Resolution 466/2012 of the National Health Council.

Data collection procedures

First, the athletes were submitted to a warming up protocol with sprints, running and quick movements, totaling 10 minutes. After this, the players performed the CMJ and HJ before and after TTT, to check the lower limbs power. In addition, we performed assessment intensity of the stimulus through the RPE after the training session.

Technical-tactical training (TTT)

The TTT was performed by general and basic tactical principles, mainly based on three concepts that come of spatial and numerical relations, that follow: 1) not allow the numerical inferiority; 2) avoid numerical equality; and 3) seek to create the numerical superiority²⁵. Thus, TTT emphasized the basic rules that guide the actions of the players in the offensive and defensive phases of the game, trying to stabilize the team organization²⁶.

The coach of the team, jointly by members of the technical committee, applied all exercises performed during the training session. Every players were positioned in a delimited space and oriented about their own tactical position, developing attack and defense situations, followed or not by conclusions. The purpose of TTT was to guide the offensive and defensive tactics drives, and the marking occurred so that there wasn't the interception of the marker.

For the organization of TTT, all players participating simultaneously in the exercises, so that in some specific positions occurred exchanges of players and relays according to the rotation thereof. Players were familiarized with this kind of training. Between the training exercises, the coach guided the actions of the players, allowing occur little breaks so players were not induced fatigue state.

The training session aimed to improve the behavior patterns of the team, being organized in a 60 m long by 40 m field wide and lasted 50 minutes.

Lower limbs power assessment

For the assessment of lower limbs power, were used countermovement jump (CMJ) and horizontal jump (HJ) tests. For performing CMJ, at the beginning of the motion, the players should be with the their knees completely extended and with hands close to the hip. Thus, the player performed a quick knee flexion until approximately 90°, then performed the extent of them seeking to reach the maximum height. For assessing the vertical jumps performance, was used a jump platform Sys Jump (Systware®, BR), which consists of two bars of optical electronic sensors, one being connected to a computer. The system equipment estimates through the flight time, the height of jumps (cm).

In HJ, players performed the jump horizontally in order to reach the maximum distance possible,

freely moving upper limbs, starting the test with parallel feet. The measured distance was the closest starting point of the heel. All tests were performed twice, the highest value being validated and there is an interval of 5 minutes between each trial.

Is very important to detach players were familiar with the tests proposed and during the preparatory period the assessment procedures took place periodically. The tests that occurred slippage of the feet or overstep after landing were invalidated, and all procedures followed the guidelines proposed by MATSUDO²⁷.

Rating perceived exertion assessment

For the assessment of session RPE was used to scale proposed by Borg Scale (CR 10) and modified by FOSTER et al.²⁸, comprising a minimum and a maximum point (1 to 10), and for each stimulus expect a particular response. The values were corresponding to the intensity of the stimulus, and the resting state (0); very, very easy (1); easy (2); moderate (3); a little difficult (4); hard (5 and 6); very difficult (7, 8, 9) and maximum (10).

The players were told that this measure reflects the overall assessment of the entire training session, including physical, psychological and climate components, indicating the intensity of the general session of TTT, being done after 30 minutes of completion. The question asked for the players indicate the intensity of the exercise was: How was your training session?

The players were properly familiarized with the scale in the two weeks prior to data collection, and there was no contact between them the time of indication of the intensity.

Statistical analyses

Data normality was verified by the Kolmogorov-Smirnov test, all of which were considered normal. For the treatment and description of the results, descriptive statistics were used with means and standard deviations, and the comparison between times made through the paired T Test. Data analysis procedures were performed by the statistical package SPSS (Statistical Package for Social Sciences) for Windows, version 20.0. The significance level was set at $p < 0.05$.

Results

The PE of the results revealed that 92% of players rated the intensity of TTT as easy to moderate (index 2 and 3), and 8% of players as a rated difficult (index 4).

The VJ results are shown in FIGURE 1, not indicating significant difference between the two time moments ($p > 0.05$). In relation to HJ (FIGURE 2) the difference between the average was 2.9%, with the same significant ($p < 0.05$).

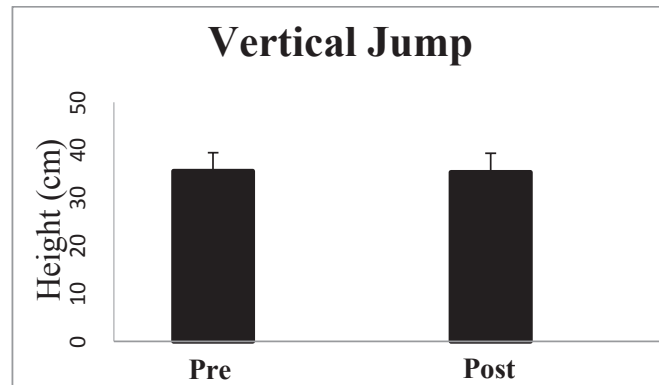


FIGURE 1 - Vertical jump results for the different moments of technical-tactical training.

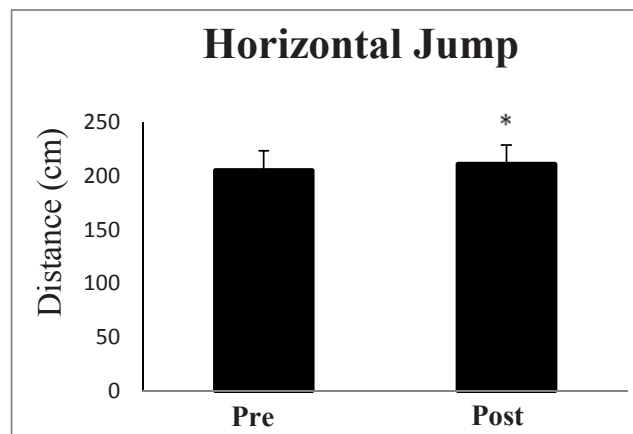


FIGURE 2 - Horizontal jump results for pre and post technical-tactical training.

*Statistical difference
 $p < 0.05$.

Discussion

This study aimed to analyze the intensity and fatigue caused in U-20 soccer players after the technical-tactical training, obtaining the intensity of effort classification using the session RPE and measurement of fatigue through the performance in jumping tests.

The main results of this study indicated that the TTT did not cause a decrease in the power of the lower limbs, on the other hand, there was a significant increase to the results of the HJ between pre and post TTT.

The application of heavy loads with insufficient rest intervals has been suggested as the cause of overtraining and overreaching syndrome in soccer²⁹⁻³⁰. What led to the emergence of some instruments for the purpose of providing information and support to professionals to optimize the training process, reflecting on maximizing the athletes performance. Currently, some tests as physiological markers, hormonal, performance in motor tests, psychological tests, biochemical and immune markers are indicated to perform the control of these phenomenon.

However, it is known that none of them satisfies all the criteria³¹ to be fully accepted.

The soccer calendar, most of the time, does not allow a preparatory period considered ideal to acquire the sports form, though, players must maintain high performance for long periods. Thus, research on the volume control mechanisms and intensity of training sessions and games are considered increasingly important³².

Some researches using the RPE as a tool in order to assess the intensity of training consider that this tool can be used reliably. In assessing the intensity of 479 training units through the heart rate and the RPE, IMPELLIZZERI et al.³³ found significant correlations ($r = 0.50$ to $= 0.85$; $p < 0.01$) and concluded that the RPE can be considered an effective internal load indicator and assist in periodization strategies. In a survey of players in the elite of women's football, ALEXIOU and COURTTS³⁴ found strong correlations ($r = 0.85$; $p < 0.01$) between heart rate through TRIMP method (Impulse Training) and the RPE. However, still found significant correlations between some types of training with predominant characteristics, including technical training ($r = 0.68$ to $= 0.82$), condition ($r = 0.60$ to $= 0.79$) and speed ($r = 0.61$ to $= 0.79$).

The results of our study indicate that the TTT performed did not decrease the performance of the horizontal jump and vertical jump. Our results were against the findings of BRITO et al.³⁵ who reported a decrease of up to 6.4% in the power of the lower limbs in small games. In another study, CLAUDINO⁹ monitored the responses to plyometric training and fatigue generated by the loads applied through the vertical jump, checking an immediate reduction in neuromuscular performance. Still, CORMACK et al.³⁶ found a significant decrease in performance in the vertical jump after an official match in Australian players of first division.

In these studies, it is important to note that in all experiments exercise was characterized as high intensity, which may explain the decrease in power of the lower limbs. In the present study the training intensity was considered low, with 92% of the players indicated index 2 and 3 of RPE.

A research involving different types of training in soccer investigated the external load through GPS equipments and accelerometer in 9 players from Brazilian soccer elite, finding results that indicated a lower external load for tactical training³⁷. In another study of soccer players is reported a lower percentage of maximum heart rate in tactical training regarding

the use of small games, circuit training and interval training³⁸.

Thus, low-intensity training have no negative impact on the acute physical performance and may even have small increments. In our study the HJ showed an increase of 2.9%, and corroborated by different studies³⁹⁻⁴². COLEDAM et al.³⁹ found that the active warm up in youth soccer players had an effect on the performance of agility and vertical jump, noting an increase in physical capacity values. In another similar study, COLEDAM and SANTOS⁴⁰ to verify the results of the acute effect of warm up on specific soccer exercises performed in small games, identified an increase in functional abilities in agility, with and without the ball. However, these investigations were designed to analyze the effect of warm up performed with low intensity exercise, so that could be evaluated its contribution to the performance of physical abilities.

The warm up is characterized by exercise which has the main function of preparing the body for subsequent activities, affecting elevation of body temperature and thus decreasing the stiffness. In addition, the benefits of warm up can help to maximize the performance of functional capabilities such as improving coordination and thereby facilitating the realization of explosive movements, facilitation of nerve transmission and the increased blood flow soft tissue⁴³⁻⁴⁴.

We know that the transient fatigue is characterized by transient decrease of functional abilities, being evidenced by the failure to maintain the performance of the strength and speed¹. However, we can see that the results of this study indicate that the TTT provided an improvement in functional abilities players, under the hypothesis that the TTT acted as a warm up so that there was an improvement in the results of physical tests, especially in HJ showed significant results.

Since the TTT characteristics of this study did not result in performance degradation in vertical and horizontal jump tests, it is suggested that this type of training can be a tool to assist in the physical recovery of the players. Concerning the recovery of players, REILLY and EKBLOM⁴⁵ emphasize the importance and the difficulty of this process happen in full, highlighting the prudent training program aimed at transient reduction of physical capacities and essentially tactical training.

From the point of view of the tactical team performance, the coach can use the activity to develop the principles of the game model it adopted

to optimize the training process and maximizing the athletes performance. Through the general and basic tactical principles, encouraging behavioral patterns during the game phases so regularities intended to be observed during matches, outlining the path and the steps to be taken by the players, who will give life to them through their actions autonomous⁴⁶.

Regarding the physiological dimension of load control and recovery of the players, the opposing situations, balls disputes and complexity of the exercise should be handled, seeking the regulation of intensity of the same, avoiding physical and tactical fatigue⁴⁷. One of the limitations the study is the absence of a physiological control/biochemical exercise intensity, as these could be correlated with the performance and generated fatigue, and are compared with the intensity by RPE.

Appropriate care in prescribing training aimed at physical recovery should be taken with caution,

seeking to maintain the intensity of the workout so that will not cause extreme fatigue to players. Thus, excessive physical contact, and the repetition of some engines too gestures should be avoided, such as the conclusions or long passes. In this sense, these workouts can be performed at specific times, such as in regenerative character training or at times when the sports calendar does not enable full recovery of the players.

The results of this study demonstrate that the technical-tactical training conducted by the general and fundamental tactical principles corresponds to a low intensity and does not compromise the physical fitness values in soccer players. In a practical order, it is suggested that this type of training can be used to aid the physical recovery of the players and to develop the principles of the game model adopted by coach, guided by behavioral patterns during the game phases.

Resumo

Avaliação da intensidade do treinamento técnico-tático e da fadiga causada em jogadores de futebol da categoria sub-20

Visto que o calendário atual do futebol não disponibiliza um tempo hábil para a devida recuperação dos atletas, fadiga e recuperação têm sido amplamente estudadas por pesquisadores. O que levou ao surgimento de alguns instrumentos com o propósito de fornecer informações e dar suporte aos profissionais visando a alta performance. O objetivo deste estudo foi analisar a intensidade do Treinamento Técnico-tático e a fadiga causada em jogadores de futebol da categoria sub-20, através do desempenho em testes de salto vertical e horizontal e da percepção subjetiva de esforço da sessão (PSE da sessão). Os jogadores (n = 25) realizaram o salto vertical contra movimento (SCM) e horizontal (SH), antes e após a uma sessão de Treinamento Técnico-tático (TTT), sendo a intensidade avaliada pela Escala de Borg (CR 10). O SCM não apresentou diferença significativa ($p > 0,05$), enquanto que o SH foi maior no Pós-TTT em relação ao Pré-TTT ($p = 0,02$). Quanto a PSE da sessão, 92% dos jogadores classificaram a intensidade do TTT como sendo de fácil à moderada. Os resultados deste estudo indicam que o TTT de baixa intensidade não compromete a potência nos testes de salto vertical e horizontal. Sugere-se que além de proporcionar a operacionalização dos padrões de comportamento táticos coletivos, o TTT de baixa intensidade possa ser utilizado em treinamentos de caráter regenerativo ou em momentos que o calendário esportivo não possibilite a recuperação completa dos jogadores.

PALAVRAS-CHAVE: Futebol; Intensidade; Fadiga; Potência muscular.

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