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INTENSITY OF CHILDREN'S SOCCER TRAINING AND ITS RELATIONSHIP WITH DAILY PHYSICAL ACTIVITY RECOMMENDATIONS

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ABSTRACT

The Covid-19 pandemic carried several consequences such as absence of regular physical activity, promoting an increase of weight in children (Pietrobelli et al., 2020). This study aims to compare the intensity of different types of soccer training and the intensity of two teams and finally determine whether football training can reach the RAF values for children. 21 athletes born in the 2010 year (10.4 ± 0.1 years) belonging to two different teams (main and secondary) wore the ActiGraph wGT3X+BT accelerometer during four training sessions (tactical (TT) and simulated game (SG)). The data were analyzed in epoch of 5s and the cut off values were applied according to Crouter (2015). Comparing the two teams, in TT there were differences for all intensities ($p < 0.05$), where the main team achieved higher intensities. In SG, the intensities were more similar. Between training types, the secondary team applied more intensity in SG, spending more time in vigorous intensity ($p = 0.002$). On average, the main team reached about 80% of the RAF, while the secondary team about 60%. Principal Component Analysis showed that the individual intensity applied in one type of training is consistent among trainings, and that children with higher IMC tend to spend more time in light intensity. Football stimulates mostly moderate intensities in the training context and allows athletes to reach about 70% of the RAF. These results show that soccer seems to be a good option as a promotion of physical activity and healthy lifestyles for children.

Keywords: *Accelerometer; Sedentarism; Athletes; Technical tactical; Roleplay game.*

INTENSIDADE DO TREINAMENTO DE FUTEBOL INFANTIL E SUA RELAÇÃO COM RECOMENDAÇÕES DIÁRIAS DE ATIVIDADE FÍSICA

RESUMO

A pandemia de Covid-19 trouxe várias consequências, como a ausência de atividade física regular, promovendo aumento de peso em crianças (Pietrobelli et al., 2020). Este estudo tem como objetivo comparar a intensidade de diferentes tipos de treinamento de futebol e a intensidade de duas equipes e, por fim, determinar se o treinamento de futebol pode atingir os valores de RAF para crianças. 21 atletas nascidos no ano de 2010 (10,4 ± 0,1 anos) pertencentes a duas equipes distintas (principal e secundária) utilizaram o acelerômetro ActiGraph wGT3X + BT durante quatro sessões de treinamento (tático (TT) e jogo simulado (SG)). Os dados foram analisados em EPOCH de 5s e os valores de corte aplicados de acordo com Crouter (2015). Comparando as duas equipas, no TT houve diferenças para todas as intensidades ($p < 0,05$), onde a equipe principal obteve intensidades maiores. No SG, as intensidades foram mais semelhantes. Entre os tipos de treinamento, a equipe secundária aplicou mais intensidade no GE, gastando mais tempo na intensidade vigorosa ($p = 0,002$). Em média, a equipe principal atingiu cerca de 80% da RAF, enquanto a equipe secundária atingiu cerca de 60%. A Análise de Componentes Principais mostrou que a intensidade individual aplicada em um tipo de treinamento é consistente entre os treinamentos e que crianças com maior IMC tendem a passar mais tempo em intensidade leve. O futebol estimula principalmente intensidades moderadas no contexto de treinamento e permite que os atletas atinjam cerca de 70% do RAF. Esses resultados mostram que o futebol parece ser uma boa opção, além de promover a atividade física e estilos de vida saudáveis para as crianças.

Palavras-chave: *Acelerometria; Sedentarismo; Atletas; Técnico-tático; Jogo simulado.*

1 INTRODUCTION

The Covid-19 pandemic brought countless consequences for the population, including changes in diet, sleep and lack of regular physical activity, which promoted an increased weight in children and adolescents (Pietrobelli et al., 2020). During confinement, studies show that 80% of the time for children under the age of 12 was spent in sedentary behavior (Pombo, Luz, Rodrigues, Ferreira, & Cordovil, 2020). It is known that the lack of regular physical activity results in the prevalence of obesity, diabetes, depression, cardiovascular problems and all causes of mortality, including cancer (Mattioli et al., 2020), making it essential to return to regular physical activities, such as sports training, among others.

The concept of sports training is characterized by a complex process whose main objective is to optimize the sports performance of the athlete / team, through the planning of microcycles, more specifically the content, quantity and magnitude of loads (Ramirez, 2002). In this sense, it is necessary to regularly evaluate the influence of the planned external load on the athletes' internal load to understand if they are receiving the necessary stimulus for the creation of adaptations. The internal load is defined as the biological, physiological and psychological reaction as a result of the external load, using accelerometers, GPS, frequency meters, lactimeters, gas analyzers, subjective effort scales, questionnaires, among others as measurement instruments (Halson, 2014), while the external load is

defined as the athlete's motor and mechanical performance, measured through variables such as power, speed (Buchheit et al., 2017).

The application of consecutive loads without constant control can generate excessive or insufficient adaptations to athletes (Meeusen, Vrijkotte, De Pauw, & Piacentini, 2010). Excessive loads without promoting adequate rest time can cause injuries through overtraining (Meeusen et al., 2010), while insufficient loads may generate detraining and thus promote the loss of already acquired capacities. Thus, it is necessary to manipulate the variables inherent to the stimuli applied to athletes, with each training having a typology mainly divided into 2 groups: informal game and technical/tactical training. Each type of training requires the use of different specific physiological parameters (Coelho et al., 2008), being necessary a specific planning for each type of training to promote the desired adaptations.

The daily recommendations of physical activity (RAF) for children and adolescents from 5 to 17 years old, are 60 minutes of moderate to vigorous intensity, mainly aerobic, at least 3 times a week (World Health Organization, 2020). Playing soccer is a great possibility to achieve these recommendations, since intensity and regular practice promote immense benefits such as reduced resting heart rate as well as systolic and diastolic pressure, improvements in maximum oxygen consumption, decreased fat mass, increase in bone mass, promotion of social interactions, teamwork, stress reduction (Krustrup et al., 2010). In this sense, assessing whether children who practice football reach the minimum intensities in training is essential, in order to be able to recommend football as a way to combat child sedentary lifestyle.

Therefore, this investigation aimed a) To compare the intensity of different types of soccer training; b) Compare the training intensity of two teams in the same level; c) Determine whether football training can reach the RAF values for children. This work is part of a project called COVID-ACTIVE, whose main objective is to assess whether children of different age groups in the post-confinement period are reaching the RAF, assessing the intensity of different sports as well as school Physical Education classes. The results presented here are preliminary and show a part of the data collected so far.

2 MATERIAL AND METHODS

2.1 Participants

The sample consists of 21 athletes from the 2010 level of training schools recruited from a club in Setubal district, divided into two teams (Team A main and Team B secondary) after 1st lockdown of covid-19 pandemic. Table 1 shows the characterization of the two teams according to age, height, and body composition.

Table 1 *- Sample characterization*

Team (n)	Age Years (sd)	Height Cm (sd)	Weight Kg (sd)	BMI Kg/m² (sd)	Fat mass Kg (sd)	Muscle mass Kg (sd)
A - Main (13)	10.5 (0,1)	140.8 (2)	37.2 (1.7)	18.7 (0.5)	7,6 (0,9)	15,6 (0,6)
B - Secondary (8)	10.4 (0.1)	144.1 (3)	42.6 (4.1)	20.2 (1.3)	12,1 (2,6)	16,1 (1,1)

2.2 Procedures

This study is part of a project called COVID_ACTIVE, which aims to determine whether children are complying with the World Health Organization's RAF, assessing the intensities achieved in the context of sports training, school sports and Physical Education classes.

Before starting the collection of the tests, an authorization was signed by the guardians with the knowledge of the club to collect the data for the study. For the collection of data on the body composition of the athletes, they went to the laboratory before the training session, one of the prerequisites of the measures being before physical activity. Safety and care standards for measurements were explained. After collecting these data, the athletes were equipped with the accelerometer on their wrist, with a previous setup at 60Hz, counting values between the beginning and the end of the training session.

The collection of intensity data was made at 4 different times with the two teams (Table 2) according to the type of training, being tactical technical training (TT) the application of exercises that favor the individual technique and individual tactical goals and the game (J) the observation of the athletes performance between the two teams in the step being related to the individual technique/tactic, but also the collective approach to the moves, both training types had the same structure (warm up, principal part, stretches and balance).

Table 2 *- Summary of training sessions and time evaluated*

Team	Measurement	Start time	End time	Training typology
A	1st	18:50 pm	20:00 pm	Technical/Tactical
B				Informal game
A	2nd			Informal game
B				Technical/Tactical

2.3 Instruments

2.3.1 Assessment of body composition

For the assessment of body composition, the Inbody 270 bioimpedance equipment (InBody USA, Cerritos, CA, USA) was used, which, through the transmission of an electrical impulse through the body, determines the subject's body composition. Height was measured using the Seca stadiometer (GmBH & Co, Hamburg, Germany). After this evaluation, children wore the accelerometer and went to practice.

2.3.2 Assessment of intensity

The training intensity was assessed with the ActiGraph wGT3X + BT accelerometer (Pensacola, FL, USA) sensitive to movements performed up to 8g in magnitude (1g = 9.81 m/s − 2) (Syed et al., 2020). Children wore the accelerometer in their non-dominant wrist during 4 training sessions, 2 for principal team and 2 for team B.

3 Data Analysis

The data was downloaded at 60s and reintegrated in an epoch length of 5s. The cutoff values to determine the intensity were as follows (in counts / 5s): Sedentary: <305, Light: 306-817, Moderate:

818-1968 and vigorous:> 1969 (Chandler et al., 2015). The time in minutes at each intensity was calculated using the Actilife v6.13.4 program, in which a time filter was also applied between the start and end time of the training, in such a way that all athletes had a total of 70 minutes of activity accounted for.

The statistical analysis of the data was performed using the IBM SPSS Statistics version 27.0 software. First, the normality of the distribution was verified with Kolmogorov Smirnov test, as well as the homogeneity of the variances. An independent t test was used to compare the duration at each intensity between teams and the paired t-test to compare the duration at each intensity of the types of training within the same team. A Principal Component Analysis was applied to verify similarities between variables. In cases where the distribution was not considered normal, where Kolmogorov-Smirnov and Levenne test were not significant, non-parametric statistics were used.

4 RESULTS

According to comparisons between the types of training and the teams (Table 3), when comparing the intensity of tactical technical training (TT) between the two teams, it is observed that there are significant differences in all intensities, in which the main team (A) obtains more time at Vigorous intensity (p = 0.002) and consequently less time at lower intensities, namely Sedentary (p = 0.010), Light (p = 0.022) and Moderate (p = 0.015). When comparing the game training (J) between the teams, no significant differences were found in any of the intensities.

Regarding the comparison within the same team about the intensity in different types of training (TT and J), it is shown that only team B, for the levels of Light, Moderate and Vigorous intensity presents significant differences, where the duration in the Light intensities and Moderate was higher in TT (p = 0.027; p = 0.015 respectively) but during J training, athletes spent more time in Vigorous intensities (p = 0.007) as shown in Table 3.

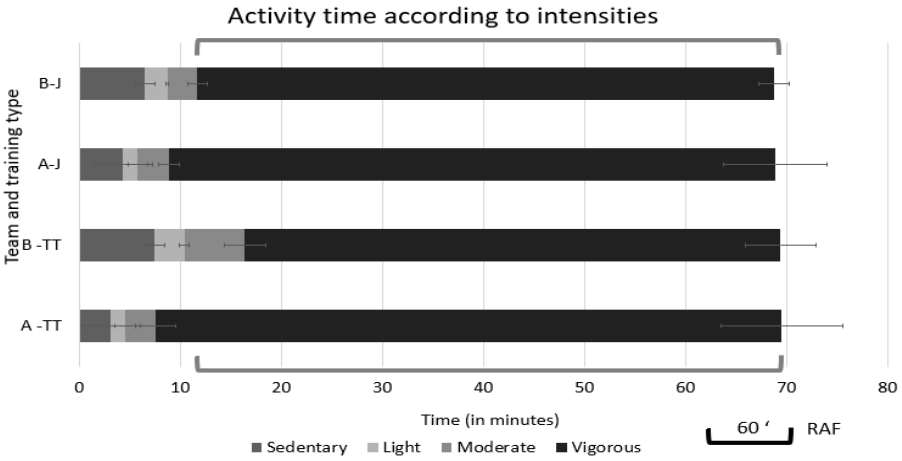
Table 3 *- Comparisons between training types and teams*

Training type	**Team**	**SED H:m.s (sd)**	**p *value***	**LI H:m.s (sd)**	**p *value***	**MO H:m.s (sd)**	**p *value***	**VIG H:m.s (sd)**	**p *value***
TT	A	0:03.05 (0:03.09)	**0,010***	0:01.38 (0:01.28)	**0,022***	0:03.10 (0:02.42)	**0,015***	1:02.05 (0:06.33)	**0,002***
	B	**0:07.42 (0:01.18)ª**		**0:03.06 (0:00.56)ª**		**0:06.03 (0:02.42)ª**		**0:53.07 (0:03.51)ª**	
J	A	0:04.27 (0:03.40)	0.089	0:01.44 (0:01.12)	0.152	0:03.15 (0:00.59)	0.841	1:00.25 (0:05.14)	0.094
	B	0:06.54 (0:01.22)		0:02.16 (0:00.18)		0:03.15 (0:00.59)		0:57.34 (0:01.54)	
p value	A - TT x A - J	0.168		0.839		0.657		0.325	
	B - TT x B - J	0.237		**0.027*ᵇ**		**0.015*ᵇ**		**0.007*ᵇ**	

ª significant differences for team A (p< 0.05)
* ᵇ significant differences between TT and J (p < 0.05)
SED - Sedentary; LV - Light; MO - Moderate; VIG – Vigorous
TT – Technical Tactical training; J – Informal game

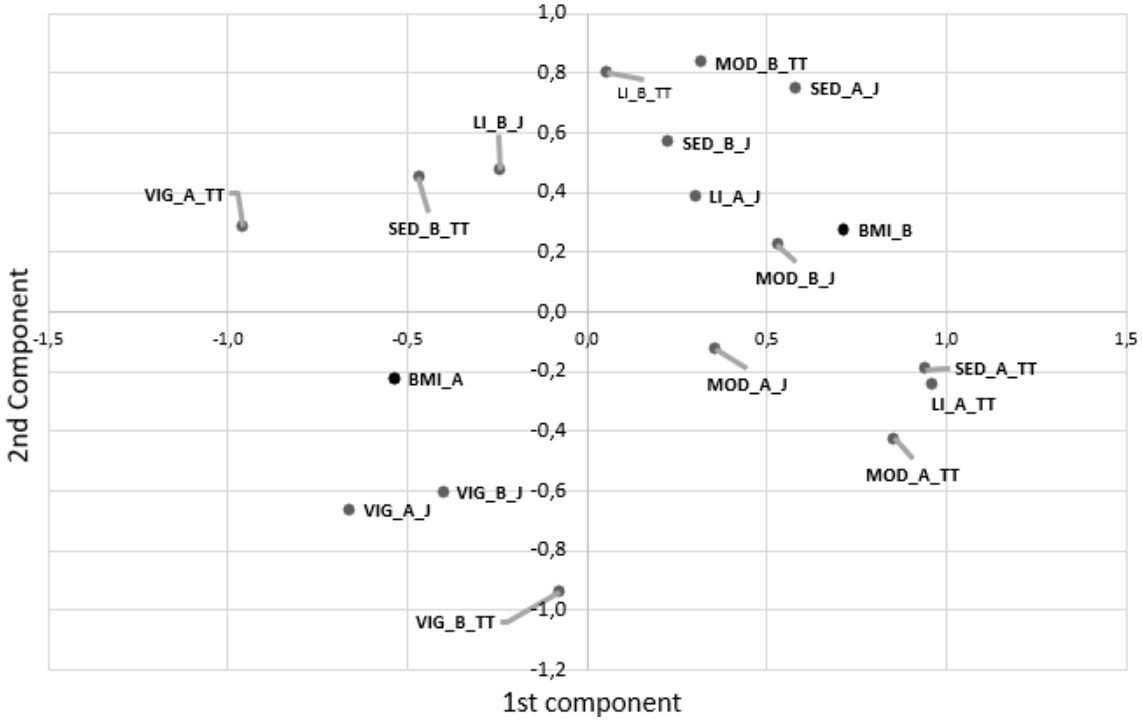
The analysis of the total training time showed that, regardless of the type of training and the team analyzed, the athletes spent an average of at least 59 minutes in moderate to vigorous intensities (Figure 1). Both types of training and regardless of the team, reached the RAF values at least 2 times/week (Figure 1).

Figure 1 *– Relation between RAF and the intensities applied in the different types of training between the two teams*



Principal Component Analysis were applied to show similar behaviors between the groups related to BMI higher and lower indexes (figure 2) the right side shows lower intensities regardless of training type and team and high BMI and left side shows more vigorous intensities and lower BMI.

Figure 2 *– Principal component analysis*



Legend: SED_A_TT – sedentary intensity, team A, technical/tactical training type; SED_B_TT - sedentary intensity, team B, technical/tactical training type; SED_A_J - sedentary intensity, team A, informal game training type; SED_B_J - sedentary intensity, team B, technical/tactical training type; LI_A_TT – light intensity, team A, technical/tactical training type; LI_B_TT - light intensity, team B, technical/tactical training type; LI_A_J - light intensity, team A, informal game training type; LI_B_J - light intensity, team B, technical/tactical training type; MO_A_TT – moderate intensity, team A, technical/tactical training type; MO_B_TT - moderate intensity, team B, technical/tactical training type; MO_A_J - moderate intensity, team A, informal game training type; MO_B_J - moderate intensity, team B, technical/tactical training type; VIG_A_TT – vigorous intensity, team A, technical/tactical training type; VIG_B_TT - vigorous intensity, team B, technical/tactical training type; VIG_A_J - vigorous intensity, team A, informal game training type; VIG_B_J - vigorous intensity, team B, technical/tactical training type; BMI_A – body mass index team A; BMI_B – body mass index team B.

5 DISCUSSION

This investigation aimed to: a) Compare the intensity of different types of soccer training; b) Compare the training intensity of two teams in the same step; c) Determine if football training reaches RAF values for children.

Our results showed that the intensity of the two teams in the TT and J training, it was observed that within the type of TT training, there are significant differences between team A and team B ($p < 0.05$) for all intensity levels, which does not happen between teams in Game training. These results can be explained since it is possible due to the competitive nature of the Game type training, the athletes of team B reach intensities close to team A, while in TT training this is not the case. Furthermore, these differences can be justified by factors such as the type of coach, the proposed planning, the athletes previous experience, lower levels of physical fitness and even in relation to the body composition data of the subjects of team B (Table 1) that influence the applied intensity external loads. This factor may explain some of the results found regarding the intensities of this team, showing that children with higher levels of body fat apply less intensity in training, spending more time in intensities of sedentary level (Sacheck et al., 2011).

Regarding the comparison of the intensity of the types of training within the same team, it is shown that only team B presents significant differences in the two types of training, where the game training has more vigorous intensities than the tactical technical training. Although both types of training contribute to the improvement of physical aptitudes for the practice of soccer (Karahan, 2020) these can be influenced by the physical traits of the athletes, thus giving this difference (Cvetković et al., 2018).

Regarding the fulfillment of the Daily Recommendations of Physical Activity, the athletes had about 90% of the training time in moderate to vigorous intensities in these two days, regardless of the type of training and the physical condition of the team. Thus, it can be said that the athletes reached the RAF in these days, contrary to what was demonstrated by Sacheck et al. (2011) and Ridley et al. (2018) who concluded that only up to 50% of the RAF was achieved in organized sports. This is probably due to the character of the training evaluated in these studies (recreational soccer) and to the application of different cut-off values of the intensities. Despite this, studies show that football, when played regularly, promotes numerous health benefits for children (Krustrup et al., 2010; Sarmento et al., 2020).

According to principal component analysis, it is showed that the individual intensity applied in one type of training is consistent among trainings, and that children with higher IMC tend to spend more time in sedentary and light intensity.

Children with higher BMI tend to spend more time at sedentary and light intensities regardless of the type of training, while children with lower BMI tend to spend more time at vigorous intensities, but whether it's a tactical technical training or game, children tend to behave similarly in both types of training (i.e. children with a tendency to keep at vigorous intensities in TT also maintains this behavior in J). According to Sacheck et al. (2011) children with higher levels of body fat apply less intensity in training, spending more time in intensities of sedentary level, as shown in our study by this analysis.

This study has limitations, namely related to the number of training sessions that were evaluated as well as the collections that were made only in one age group and one club. These limitations are mainly due to the second confinement, which started during the data collection period, which has higher to prevented further collections in the different groups mentioned. Despite this, the results presented are important because they demonstrate that, even though the sample was only in 4 training sessions (two for each team), in all of them the children reached the minimum RAF values, thus showing that the practice of football can be an excellent tool in combating child sedentary lifestyle.

6 CONCLUSIONS

The results of this study show that soccer training for 10-year-olds has mostly vigorous intensities and that athletes reach at least 2 days of the RAF recommended time intensities by the World Health Organization for this age group in training days. These results show that football can be a sport that, with regular practice, can bring numerous benefits to children's physical and mental health, which are so necessary in this pandemic period reducing sedentary daily time and providing a good way to exercise in higher intensity levels. Further investigation in needed to fully understand how these variables influence children's activity.

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