

Soccer only once a week generates excessive cardiac responses

Futebol apenas uma vez por semana gera respostas cardíacas excessivas

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Abstract

Objective – Playing soccer just once a week is common among the millions of Brazilians. However, the cardiovascular stress of such activity is not always known. Thus, the aim of this study was to assess the cardiac response during recreational soccer match and compare with guidelines for acquisition of aerobic fitness. **Methods** – Eighteen sedentary playing soccer once a week (45.8 ± 7 years, 27.4 ± 2.5 kg/m² BMI), participated. The heart rate was measured during a typical game and the highest values (HRpeak) and mean (HRmean) were recorded. For data analysis, descriptive statistics were used. **Results** – HRpeak was 181.6 ± 6.5 bpm⁻¹ which corresponds to $104.3 \pm 2.8\%$ HRmax estimated by age. In turn, the HRmean was 156.3 ± 7 bpm⁻¹ or $89.8 \pm 3.9\%$ HRmax. **Conclusion** – The cardiac response to soccer recreational exceeds the recommended upper limits for aerobic fitness and may be dangerous in sedentary individuals who do only once a week.

Descriptors: Soccer; Stress, physiological; Heart rate

Resumo

Objetivo – Jogar futebol apenas uma vez por semana é comum entre milhões de brasileiros. Entretanto, o estresse cardiovascular de tal atividade nem sempre é conhecido. Assim, o objetivo deste estudo foi analisar a resposta cardíaca durante partida de futebol recreativo e comparar com diretrizes para aquisição da aptidão aeróbia. **Métodos** – Participaram do estudo dezoito praticantes de futebol recreativo, aqui definido como jogar uma vez por semana ($45,8 \pm 7$ anos; $27,4 \pm 2,5$ kg/m² de IMC). A frequência cardíaca (FC) foi mensurada durante jogo típico e os valores mais altos (FCpico) e médio (FCmédia) foram registrados. Para análise dos dados, estatística descritiva foi utilizada. **Resultados** – A FCpico foi de $181,6 \pm 6,5$ bpm⁻¹ o que corresponde a $104,3 \pm 2,8$ % da FCmax estimada pela idade. Por sua vez, a FCmédia foi de $156,3 \pm 7$ bpm⁻¹ ou $89,8 \pm 3,9$ % da FCmax. **Conclusão** – A resposta cardíaca ao futebol recreativo excede os limites superiores recomendados para aptidão aeróbia e pode ser perigosa a sedentários que o fazem apenas uma vez por semana.

Descritores: Futebol; Estresse fisiológico; Frequência cardíaca

Introduction

It is estimated that more than 265 million people play soccer around the world¹, whether amateur or professional leagues, recreational activities or as a form of physical activity. Such popularity makes this sport one of the biggest phenomena of humanity². Nevertheless, many aspects of their practice have yet to be elucidated scientifically.

The practice of regular physical activity has been recognized as an important aspect of the promotion and maintenance of health^{3,4}. However, manipulation of exercise variables such as volume and intensity are key to its beneficial effects can be maximize³. In this sense, the literature has highlighted that the intensity is very important, because if do not stimulate enough underestimated the body's condition and, on the other hand, if it is estimated above may cause damage such as injuries, for example.

Traditionally, oxygen uptake (VO₂) has been used to quantify the intensity of dynamic exercise³. However, the practical use of VO₂ is reduced mainly due to unavailability of equipment to measure it directly. Thus, the use of heart rate (HR) has been conducted to express the intensity of exercise because it has good relationship⁵ with VO₂, including amateur soccer players⁶.

Several studies have shown that the HR response during the soccer, even as a sport of intermittent nature, can be used as a good parameter to quantify the intensity and provide data important for coaches and sport researchers⁶⁻⁹.

Considering the large number of soccer practitioners without professional interest¹ (amateur or recreational), would be need to know the intensity that the game offers to these individuals, mainly sedentary, to assess the positive¹⁰⁻¹¹ or negative¹² consequences of this so common practice in Brazil. Thus, the aim of this study was to assess the cardiac response during recreational soccer match and compare with the guidelines for the improvement of aerobic performance.

Methods

Study design

During the research period the participants practiced their soccer games and usually there was no type of intervention or suggestion by the researchers in relation to physical activity or in the moments immediately before (warm up) or after (cool down).

The games took place on Saturdays in the period from 16h to 18h and lasted 90 min (two times 45 min) with an interval of 15 min, being controlled by the referee and two assistants applying the official rules. The teams were made up of 11 players each and the field had dimensions of 90 meters (length) by 45 meters (width). The teams did not participate in any championship and were chosen by the participants immediately before each meeting and wore vests with different colors. It is noteworthy that the players did not perform warm up and just some players did random stretching.

Data collection lasted six Saturdays, including the period of the first week of September until the second of October. The environmental temperature ranged from 25 to 30°C with relative humidity between 45 and 60%.

Participants

Inclusion/exclusion criteria

To participate in this work, the volunteers should be aged between 32 and 56 years, did not perform any physical activity beyond the formal recreational soccer once a week for at least a year, do not be a goalkeeper in the game, no smoking, no hypertension, or diabetic, not taking food supplements or drugs that could affect the cardiovascular response, attend the "Thirty's Club" of Pederneiras, SP and signing the consent form. Twenty-two individuals have applied

voluntarily to participate, but only eighteen met all criteria and were, thus, selected (Table 1).

Table 1. General characteristic of participants

| Age (years) | Body mass (kg) | Height (m) | Practice recreational Soccer (years) |
|-------------|----------------|------------|--------------------------------------|
| 45.8 ± 7 | 80.6 ± 10.3 | 1.71 ± 0.1 | 1.5 ± 0.1 |

Values are expressed as mean ± standard deviation. N = 18

Measurement of heart rate (HR)

To record the HR values was used HR monitor (Polar® F6 model). Furthermore, the monitor recorded the mean value (HRmean) and the highest HR (HRpeak) during the period that occurred only in the initial 45 minutes of each game. HRmax was estimated by $220 - \text{age}^5$ and this was considered for analysis. Immediately after collection, data were transferred to leaf annotation and computer for later analysis. Samples were collected in three individuals per occasion, thus totaling six Saturdays.

Anthropometric measures

In the first two Saturdays (nine volunteers per day), and at the same place two hours before games, a single author experienced in these types of measures carried out to determine the body mass using digital scale (Filizola®) in height with anthropometer (Sanny®) and subscapular skinfold, triceps, suprailiac and medial calf through caliper (Lange®) to assess body composition, according to the Petroski's protocol¹³. During these measurements, the subjects wore only swimming trunks.

Statistical analysis

We used descriptive statistics (mean, median, standard deviation and maximum and minimum values of the variables). Moreover, the confidence interval was 95%.

Results

The investigated sample had values of overweight¹⁴ BMI = $27.4 \pm 2.5 \text{ kg/m}^2$ and threshold obesity¹⁵ (percentage of body fat of 25.3 ± 5.1). Table 2 shows the values obtained for HRpeak and HRmean during the game. Note that the HRpeak recorded during soccer was higher than the estimated values for HRmax by age. The same happened with the values of HRmean in relation to the percentages indicated in the literature for acquisition/maintenance of aerobic fitness³.

Discussion

The most important evidence of this work is that the soccer played only once a week for sedentary overweight can be regarded as an excessive physical activity in cardiac demand, very intense and inappropriate from physiological point of view. This observation leads us to reflect on potential risks, benefits and solutions for this activity so common in our country.

Despite the physiological problems discussed before we have to consider the fact that many of the recreational soccer players looking for that activity for reasons other than the physical/physiological. Among them, of course socializing and relief from daily hassles

are highlights¹⁶. However, the imminent health risk¹⁷ seems more important than the likely social benefits and psychological that this practice can bring.

The general characteristics of the individuals studied here clearly show some important risk factors for cardiovascular diseases such as age, gender and obesity/overweight¹⁸. These factors associated with sedentary life style makes the participants more prone to these problems. We could not find in the scientific literature the profile of recreational soccer players in Brazil. However, it is very likely that most of this public has profile similar to that found in this work, which signals a public health problem.

Considering that participants of this study were sedentary and had other risk factors (overweight and obesity), the fact that HRpeak be supra-maximal (greater than the estimated value of 100%) suggests that, in at least one time, this physical activity exposes the practitioner to a cardiovascular intense stress¹². Moreover, the minimum value found in HRpeak was 100% in relation HRmax (Table 2), which reinforces the generalization of this fact.

The HRmean was 156.3 bpm^{-1} which represents approximately 90% from estimated HRmax. Despite not knowing exactly how long the individuals stayed with this request percentage, due to unavailability of the equipment used, we believe that the average value is very high and inappropriate for sedentary individuals with risk factors for cardiovascular diseases^{3,5,12}. Scientific institutions have recommended that the intensity of physical activity should be 60 to 85% of HRmax⁵ and values above 85% are potentially hazardous and can cause undesired cardiovascular events¹².

The HR values relative to maximum (HRmax ± 90%) enrolled in this study are consistent with those reported in young (± 91% HRmax) practicing "reduced games" (3 against 3)¹⁰ and above than found in juveniles ($84 \pm \% \text{ HRmax}$) also playing "reduced games" (5 against 5)⁸ and by the literature of soccer in a wide range of people as elite professionals, academics and recreational activities (± 85% HRmax)⁹.

Whereas that the absolute HR (bpm-1) tends to increase with the duration of exercise¹⁹, mainly due to dehydration and reduction in stroke volume, we can infer that in our study the second half of soccer would generate higher values than the first half, what further overtax the cardiovascular system what is very undesirable in sedentary individuals as the sample used.

Although the equation to predict HRmax ($220 - \text{age}$) present a number of limitations and questions raised about its accuracy, and even his genesis²⁰, it has been widely used and recommended when there is no possibility of obtaining the real value of HRmax⁵. In addition, specifically for the mean age of our study (45.8 years), the more accurate prediction equation for the general population²⁰ is proposed by Inbar and colleagues²¹ ($\text{HRmax} = 206 - (0.68 \times \text{age})$) and would not be very different from the traditional one ($220 - \text{age}$).

Given the nature of our results, we recommend the practice of physical training under professional supervision, in at least two more days of the week, in order to better prepare the body for the stress of soccer. Additionally, adjustments in the official rules would be welcome, for example, lower total time of play, pauses for hydration, the smaller field size and small games. For example, a recent review study clearly shows that the actual physical activity of recreational soccer, with some modifications in the rules, may be useful to promote important and positive adaptations for health in the skeletal muscle, metabolic and cardiovascular systems²², inclusive in the elderly.

Table 2. HR values observed in sedentary practicing soccer (N = 18). CI (confidence interval) of 95%

| | HRpeak (bpm ⁻¹) | HRpeak (%HRmax) | HRmean (bpm-1) | HRmean (%HRmax) |
|--------------------|-----------------------------|-----------------|----------------|-----------------|
| Mean | 181.6 | 104.3 | 156.3 | 89.8 |
| Standard deviation | 6.5 | 2.8 | 7.0 | 3.9 |
| Median | 181.5 | 103.6 | 156 | 90.7 |
| Maximum value | 198 | 108.8 | 172 | 95.4 |
| Minimum value | 170 | 100 | 143 | 80.9 |
| CI for the mean | 178.3 a 184.8 | 102.9 a 105.6 | 152.8 a 159.7 | 87.8 a 91.7 |

Finally, educational activities about risk factors and basic principles of sports training would be appropriate to provide more security in practice.

Conclusion

Our results indicate that the cardiac response (mean and peak) to soccer recreational exceeds the upper limits suggested for obtaining aerobic fitness and cardiovascular safety in sedentary individuals. Furthermore, considering the sedentary lifestyle and the presence of other risk factors in playing soccer once a week, such activity can even be dangerous and counterproductive from a physiological standpoint. However, small changes in the way of game practice and education of players can ensure greater safety and health to the practice of the most popular Brazil's sport.

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