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DO FIVE WEEKS OF PRESEASON CHANGE THE MAXIMUM OXYGEN UPTAKE AND BODY COMPOSITION OF SOCCER PLAYERS?

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ABSTRACT: The aim of the present study was to verify changes in maximum oxygen consumption (VO_{2max}) and body composition in professional soccer athletes after five weeks of pre-season. The sample consisted of male professional soccer players participating of the first division series (A1) of the Pernambucano championship in 2019 (n= 22; age: 24.0±3.6 years). In the pre-season and after five weeks of training was evaluated VO_{2max} through the 1600m test, as well as anthropometric variables. Paired t test was applied to verify the difference between the pre *vs*. post training. There was a significant improvement in the variables analyzed, with a reduction in body mass index (BMI), waist circumference (WC), waist-height ratio (Rcest), body fat percentage and an increase in VO_{2max} after five weeks of specific training for professional football players (<0.05). Five weeks of physical preparation in professional soccer players, it was enough to increase VO2max and reduce body composition variables (BMI, WC, Rcest and athletes' fat percentage).

KEY WORDS: Sport; Soccer; Performance; Professional; VO_{2max}.

CINCO SEMANAS DE PRÉ-TEMPORADA ALTERAM O CONSUMO MÁXIMO DE OXIGÊNIO E A COMPOSIÇÃO CORPORAL DE FUTEBOLISTAS?

RESUMO: O objetivo do presente estudo foi verificar as alterações do consumo máximo de oxigênio (VO_{2max}) e da composição corporal de atletas profissionais de futebol após cinco semanas de pré-temporada. A amostra foi composta por atletas profissionais de futebol do sexo masculino participantes da série A1 primeira divisão do campeonato pernambucano do ano 2019 (n=22; idade**:** 24,0±3,6 anos). Foi avaliado, na pré-temporada e após cinco semanas de treinamento, o VO_{2max} através do teste de 1600m, bem como variáveis antropométricas e um teste *t* pareado foi aplicado para verificar a diferença entre as médias pré vs. pós-treinamento. Houve melhora significativa nas varáveis analisadas com redução no índice de massa corporal (IMC), circunferência da cintura (CC), relação cintura-estatura (Rcest), percentual de gordura corporal e aumento no Vo2máx após cinco semanas de treinamento específico para jogadores de futebol profissional na fase de preparação física inicial (<0.05). Conclui-se que cinco semanas de preparação física em jogadores de futebol profissional foram suficientes para o aumento do VO_{2max} e a redução de variáveis da composição corporal (IMC, CC, Rcest e percentual de gordura dos atletas).

PALAVRAS-CHAVE: Esporte; Futebol; Desempenho; Profissional; Vo2máximo.

INTRODUCTION

Soccer is a very popular sport worldwide. It is estimated that approximately 400 million people, of several age groups, play soccer around the world. Among them, 200 thousand people are professional athletes, most of them male[1].

It is a sport that demands the development and improvement of many physical, technical, tactical, motor and psychological abilities. It also requires an excellent level of physical conditioning, which has direct influence on players' performances during matches and, consequently, on their results[2,3]. That being said, general and specific interventions related to the physical preparation of the athletes are important in professional soccer and pivotal for a team's success, and a poor preparation can cause discrepancies in terms of performance [4,5].

The main physical abilities expected during a soccer match are speed, agility, power, flexibility, muscular strength/resistance and, especially, aerobic / anaerobic capacity6. When it comes to soccer practicing, maximum oxygen uptake (VO_{2max}) can be highlighted, as well as its interdependency in relation to body composition, which presents a direct correlation with soccer athletes' performance[7,8].

Physical evaluation parameters must be trustworthy in their results, with ease of application, highlighting body composition by dividing it into: fat percentage, muscle mass, bone mass, fat mass and residual mass through the skinfold testing[9,5], as well as oxygen uptake through the 1600-m running performance or YoYo-test, indirectly[10,11], or even other tests in an indirect way[12,13].

Cardiorespiratory tests of exercises that are directly associated with professional soccer athletes are safe and valid. Besides, they are a non-invasive procedure that allows estimating the integration of some physiological systems, such as cardiovascular, respiratory and musculoskeletal, with maximum and sub-maximum demands regarding the tests and exercises[14]. Therefore, the VO_{2max}, considered adequate for soccer players becomes crucial for the development level these athletes are expected to achieve[15,11].

The possibilities of estimating and/or verifying physical aptitude levels in relation to athletes' aerobic and anaerobic capacities are many. Yet, all of them, in general, aim at an association with players' performance16. According to Perrier-Melo et al.[11], indirect tests have been used in sports such as soccer since it is a cost-effective option, besides being easy to be applied. It can also be used with several individuals at the same time.

Once modern soccer demands an excellent level of physical conditioning with several characteristics, professional athletes must be always seeking improvement if they want to remain competitive during a match at its different phases[17]. In light of the foregoing, this study aimed to verify alterations in maximum oxygen uptake and body composition of professional soccer athletes.

METHODOLOGY

SAMPLE

The sample consisted of male professional soccer athletes from the first division series (A1) of the state of Pernambuco's League (Brazil) in 2019 (n = 22; age: 24,0 ± 3,6 years). They agreed to share the data collected during preseason and the beginning of the competition. The data were collected between the last week of December 2018 and the last week of January 2019. All evaluations were performed always in the same period of the day, that is, between 8am and 10am. The 1600-m running performance test was carried out on a 400m running track. Kineanthropometric evaluation, in its turn, was done in a room prepared for it (physical evaluation room).

ETHICAL ASPECTS

All participants signed an informed consent form. This study was allowed by the Research Ethics Committee, under the registration number 212.091, in accordance with the norms and in compliance with the Normative Resolution number 466/2012 by the National Health Council.

INCLUSION AND EXCLUSION CRITERIA

The inclusion criteria adopted to select the participants were the following: being authorized by the club's medical department, belonging to the main team that was going to take part in the competition, not being in any lesion treatment that could stop them from taking part in the procedures adopted by the research. Those athletes whose contracts had pending matters, and those who did not meet all the evaluation stages of the study were excluded.

MEASURES, TECHNIQUES AND INTRUMENTS

MAXIMUM OXYGEN UPTAKE (VO_{2max}) – 1.600 METERS

Taking into consideration that field tests of 1.600m are highly correlated to the direct measure of VO2max (r = 0,81) and good practical applicability, especially in male physically active young adults, according to the sample analyzed, it was used in our research, in accordance with a previous study[10].

In this protocol, the athletes ran for 1.600 meters on a running track, signaled every 400 meters in its total circular area, as fast as they could, for further analysis of their average speed (1.600Vm) and consequently estimate (km/h) meters per minute and the VO_{2max}. Estimate of the maximum uptake was achieved through the following equation: VO_{2max} (mL.kg–1.min–1) = [0,177*1600Vm(m. min–1)] + 8,10110.

ANTHROPOMETRIC VARIABLES

The data were collected at the beginning of the physical preparation phase, preseason, and at the end of the 5th week of specific soccer practicing, aiming at the enhancement of the athletes' aerobic capacity and anthropometric variables. Body mass (kg) was verified with a Tech Line digital platform scale, model Tec-Silver, manufactured by Tech Line, with an accuracy level of 0,1 kg. The athletes' height was measured by using a Physical metal stadiometer, manufactured by Terrazul, single model, with an accuracy level of 0,1 cm, for further calculation of the body mass index (BMI). Their waist circumference (cm) was verified at the midpoint between the costal arch and the iliac crest, with a non-elastic Cescorf measuring tape, in order to check the waist-height ratio (Rcest). The athletes were barefoot, standing in upright position with their arms down, heels together and toes pointing outward at approximately 60º. We also analyzed the following skinfolds in (mm): pectoral, abdominal and medial thigh, always on the right side. The measuring was done by taking turns in duplicate, for estimating body fat percentage, and the areas to be measured were marked with a ballpoint pen. We used the index finger and the thumb of the left hand as tweezers for separating the adipose (subcutaneous) tissue from the muscular tissue, placing the caliper jaws at approximately 2cm below the area pinched, with the jaws perpendicularly to the skin. We allowed 02 seconds for reading the measure, and used a Cescorf caliper (manufactured in Porto Alegre – Brazil), with an accuracy level of 0,1 mm. The mean value was considered for the estimate of body density according to Jackson and Pollock's (1978)18 predictive equation. Fat percentage was calculated according to Siri's (1961) formula = (4,91 / density – 4,5) × 100. We used a validation equation of the Cescorf device, and it was estimated by using a Lange device, which allowed us to minimize the errors, as exposed by Okano et al. (2008)[19].

All processes that involved data collection were executed by only one evaluator, who is skilled and has experience in physical evaluation with relative Technical Error of Measurement (%TEM) intra-evaluator of 90%, calculated by the equation described by Silva et al.[20].

Chart 1. Training protocol

Week	Methodology (volume, intensity, frequency, duration)	Practical Activities
1	*Physical preparation with emphasis on general aerobic and anaerobic aspects.* A 45-minute session, 3 times in the first week, for 15 minutes at each station, with a 2 to 3 minute-break for recovery / hydration.	Exercise stations (circuit); Traction exercises (using a belt, with the help of a colleague, plus Superman exercise); Plyometrics (hurdling with obstacles of several heights).
2	*General Physical Preparation.* A 75-minute session, 3 times in the second week, for 15 to 20 minutes at each station, with a 3 to 5 minute-break for recovery / hydration.	Soccer skills (with a ball); Moving throughout the stations; Agility and coordination exercise (stairs); Power exercises (plyometrics, sprint and traction).
3	*General Physical Preparation.* Two workout sessions for the great muscle groups, with 10 to 15 repetitions, a 90-second break for recovery. An 80-minute session, 4 times with 15 to 20 minutes at each station, a 2 to 3-minute break.	Strength training (workout); Core exercises; Calisthenic workout stations; Circuit of exercise in the sand; Specific soccer practice (positioning and shooting).
4	*General Physical Preparation.* A 60-minute session, 3 times with 20 minutes in a proposed situation, a 3-minute break for recovery/hydration, and for explaining the next stage.	Stations of ball exercises plus variation working; Technical / tactical aspects and situations faced in a match; Training session and match systems; Training match.
5	*General Physical Preparation.* Two workout sessions involving the main muscle groups, with 10 to 12 repetitions, 90-second breaks for recovery between the series. 60-minute sessions, 3 times, with 15 to 20 minutes at the stations and 2 minutes for resting, hydration and general guidelines.	Strength training (workout); Exercises stations (circuit); Technical / tactical aspects, and training session; First official match in the competition. .

STATISTICAL ANALYSIS

A descriptive analysis was carried out with mean and standard deviation. In order to test the normality of the data, we used Shapiro Wilk test, and a paired t test was applied to check the difference among pre vs post training means. We adopted a significance level of $p<0,05$. For effect size we used the software SPSS 22.0 with scores of 0.0-1.9, without effect, 0.2-0.49 for small effect, 0.5 – 0.79 for medium effect and >0.8 for large effect

.

RESULTS

Table 1 presents the general characteristic of the athletes before and after the intervention of the anthropometric variables and of maximum oxygen uptake, indicating a significant decrease in total body mass pre vs post intervention ($p<0,05$). There was significant improvement ($p<0,05$) of the variable analyzed with a reduction in the body mass index, waist circumference, waist-height ratio, body fat percentage and an increase in VO_{2max} after five weeks of specific training for professional soccer players ($p<0,05$).

Table 1. General characteristics of the athletes before (PRE) and after (POST) intervention of the anthropometric variables and of the maximum oxygen uptake (n=22)

Variables	PRE	POST	ES
Age (years)	24,0 ± 3,6	24,0 ± 3,6	---
Height (m)	1,8 ± 0,1	1,8 ± 0,1	---
Body mass (kg)	76,2 ± 10,1	73,6 ± 9,2*	0,264
BMI	24,07±2,65	23,23±2,25*	0,342
CC	79,89±5,88	77,80±5,14*	0,378
Rcest	44,96±3,20	43,78±2,73*	0,397
% fat	14,14±4,04	13,03±3,76*	0,284
VO_{2max} (ml.kg.min)	57,18±3,37	60,29±3,22*	0,944

*P<0,05 in relation to the PRE. BMI: body mass index; CC: waist circumference; RCest: waist-height ratio; Vo2max: maximum oxygen uptake. Es: Effect size.

DISCUSSION

This study aimed to verify if five weeks of physical training specifically planned for professional soccer athletes could improve their maximum oxygen uptake estimated by the 1600-m running performance test and body composition variables (BMI, CC, Rcest and body fat percentage). Considering our findings, it is evident that both VO^{2max} and the anthropometric / body composition variables had significant improvement after the intervention period ($p<0.05$), as well as the high size effect (>0.9) for the VO2max, despite the small sizes effect (0.2 – 0.4) for the body composition variables.

Similarly to our results, Reis et al. (2018)[21] evaluated soccer players' maximum oxygen uptake (Cooper test – 12 minutes on a 400m running track) and body composition (skinfolds). According to Pantaleão and Alvarenga, (2008)[22], the models of periodization in soccer are specific and in common with each phase and/or period of a team's preparation.

Regarding the first variable, studies have been reporting how important VO_{2max} is when it comes to performance in professional soccer due to the requirements imposed on athletes during matches in which aerobic and anaerobic characteristics are present[16,17]. Professional soccer athletes have been demonstrating that, if one wants to keep a high level of athletic performance, VO_{2max} is a dependent variable, with an average between 55 to 60 ml.kg min. Some specific-position athletes can have a higher maximum oxygen uptake compared to others because of the needs imposed by the roles they play[23].

According to Silva et al.[24], a systematic review showed that, regardless of where soccer is played, the aerobic component is pivotal. The authors point that the average of VO_{2max} estimated by several direct or indirect tests approaches 55 a 68 ml.kg.min, values that are similar to those we found. In our investigation, at the initial stage, we verified 57,2 ml.kg.min. As for the end of the 5th week of training, there was a significant increase to 60,3 ml.kg.min, as shown in Table 1.

VO_{2max} characteristically represents how satisfactory an athlete's aerobic physical conditioning is. Thus, it is necessary to adopt training strategies in order to improve or maintain the capacity to capture, transport and use oxygen. Our findings demonstrate that only five weeks of intervention aiming at the improvement of the athletes' aerobic capacity were significantly efficient[12].

Another study that corroborates our results is one by Silva et al.14, in which the authors evaluated 198 professional soccer athletes who were divided into groups according to their positions (goalkeepers, defenders, full-backs, midfielders and strikers). The average VO_{2max} was 62 ml.kg.min, with minimum values of 58, and maximum of 64 ml.kg.min.

Considering body composition variables, in our study, body composition also presented significant reduction at the end of the 5th week of training focusing on the athletes' performance (14,14 ± 4,04% pre vs 13,03 ± 3,76% post). This body fat percentage is considered to be within the average level for soccer players according to González-Mendoza et al.8 and Reinke et al.[25].

Conversely, in a study by Gonçalves et al.[26], the authors evaluated 12 professional soccer players and found an average of 10,8 ± 1,5%, which is inferior to that of our experiment regarding body fat percentage. However, the BMI was similar in both investigations (23,4 ± 1,2 Kg/m2 vs 23,2 ± 2,2 Kg/m2, respectively). In a study by Rosa[27], the researcher also found a result that is similar to those of the aforementioned studies. The study evaluated 76 athletes (38 professional players and 38 under-20 players / aged from 17 to 35), and the BMI had an average of 23,9 kg/m2 and 23,0 kg/m2, respectively.

In a study by Prado et al.[28], the researchers evaluated 118 soccer athletes from the first and second divisions of the State of São Paulo's League, whose age was 23 years on average. The authors used skinfold testing to estimate body fat percentage, and they obtained an average of 13 to 15%, results that corroborate ours.

Our investigation faced some limitations. For instance, we did not compare the improvement of the variables analyzed among the athletes' positions. Moreover, their dietetic control was not a concern. Nevertheless, it is important to highlight that the results of our research are relevant for coaches and physical trainers, since there was, in only five weeks, significant improvement of the VO_{2max} (large size effect) and significant decrease in the body composition variables, despite the small effect size.

All in all, as a practical application, the results of our study show that five weeks of specific soccer training (pre-season) were enough to increase oxygen uptake and reduce anthropometric variables. 45 to 80-minute sessions of exercises in stations, as well as strength exercises (workout) with 10 to 15 repetitions and 60 to 90 seconds for recovery, plus tractions exercises led to improvements in the soccer players' physical aptitude.

CONCLUSION

Based on the results of this study, we can affirm that the intervention consisting of a 5-week training (1 week focusing on aerobic and anaerobic aspects, 2 weeks for general physical preparation and 2 for specific physical preparation) resulted in improvements in maximum oxygen uptake and anthropometric variables / body composition of professional soccer athletes.

REFERENCES

1. Pedrinelli A, Cunha-Filho GAR, Thiele ES, Kullak OP. Estudo epidemiológico das lesões no futebol profissional durante a Copa América de 2011, Argentina. Rev Bras Ortop. 2013;48(2):131-6.

2. Ribeiro F, Matos DG, Aidar FJ, Matos JAB, Marins JCB, Silva AJ, Reis VM. Características Cineantropométricas de Jogadores de Futebol Profissionais de Minas Gerais: Comparações em Diferentes Posições. Rev. Bras. Ciênc. Saúde. 2011; 9(30):9-16.

3. Oliveira L, Holanda VSB, Brito-Gomes JL, Pontes NEC, Souza GG, Aniceto RR, Pérez-Gómez J. Are there any differences in the agility performance tests among goalkeepers depending on the type of surface? A crossover study. Hum Mov. 2019; 20(4):59-67.

4. Koundourakis NE, Androulakis NE, Malliaraki N, Tsatsanis C, Venihaki M, Margioris AN. Discrepancy between exercise performance, body composition, and sex steroid response after a six-week detraining

period in professional soccer players. PLoS ONE. 2014;9(2):e87803.

5. Perrier-Melo RJ, Gusmão VJAG, Oliveira LIGL, Brito-Gomes JL, Oliveira SFM, Costa MC. A frequência de treino semanal pode interferir no condicionamento atlético de jogadoras de futebol? – Rev. Bras. do Esp. Coletivo. 2017;1(1): 29-32.

6. Sousa S, Rodrigues EQ, Cintra-Filho DA. Relações entre composição corporal e desempenho anaeróbio em jovens futebolistas. Rev. Bras. Cien e Mov. – 2013; 21(4):121-6.

7. Rossetto A, Laux RC, Zanini D, Zawadzki P. Características Antropométricas e da Composição Corporal de Jovens Jogadores de Futebol. Rev. Bras. de Fut. e Futebol, São Paulo. 2017;9(34):308-13.

8. González-Mendoza RG, Gaytán-González A, Jiménez-Alvarado JÁ, Villegas-Balcázar M, Jáuregui-Ulloa AA, Torres-Naranjo F, López-Taylor JR. Accuracy of anthropometric equations to estimate DXA-Derived skeletal muscle mass in professional male soccer players. Jour. of Spor. Medicine. 2019;(1-6):ID4387636.

9. Petreça DG, Junior EDB, Becker E. Comparação da composição corporal de atletas profissionais de futsal e futebol de campo. Rev. Bras. de Fut. e Futebol, São Paulo. 2017;9(33):180-9.

10. Almeida JÁ, Campbell CSG, Pardono E, Sotero RC, Magalhães G, Simões HG. Validação de Equações de Predição em Estimar o Vo2max de Brasileiros Jovens a Partir do Desempenho em Corrida de 1.600m. Rev Bras Med Esporte. 2010;16(1): 57-60.

11. Perrier-Melo RJ, Barbosa RR, Brito-Gomes JL, Oliveira SFM, Fortes LS, Costa MC. Análise comparativa da potência aeróbia máxima em jogadoras de futebol de acordo com as posições do sistema de jogo. *ConScientiae Saúde.* 2018;17(4):463-8.

12. Batista MB, Cyrino ES, Milanez VL, Silva MJC, Arruda M, Ronque ERV. Estimativa do consumo máximo de oxigênio e análise de concordância entre medida direta e predita por diferentes testes de campo - Rev Bras Med Esporte. 2013;19(6): 404-9.

13. Perim RR, Signorelli GR, Araújo CGS. Stability of relative oxygen pulse curve during repeated maximal cardiopulmonary testing in professional soccer players. Braz J Med Biol Res. 2011;44(7):700-6.

14. Silva CGS, Castro CLB, Franca JF, Bottino A, Myers J, Araujo CGS. Ponto Ótimo Cardiorrespiratório em Futebolistas Profissionais: Uma Nova Variável Submáxima do Exercício – Inter. Jour. of Cardio. Sciences. 2018;31(4):323-32.

15. Manna I, Kranna GL, Dhara PC. Effect of training on physiological and biochemical variables of soccer players of different age groups. Asian Jour. of Spor. Medicine. 2010;1(1):5-22.

16. Oliveira SFM, Oliveira LMFT, Brito-Gomes JL, Melo RJP, Costa MC, Guimarães FJSP. Comparação de Dois Testes Indiretos Anaeróbicos em Futebolistas Profissionais e Suas Correlações com o Desempenho Aeróbico. Rev Bras Ciênc Esporte. 2017;39(3):307-13.

17. Voltarelli FA, Fett CA, Coelho CF, Ravagnani FCP. Consumo Máximo de Oxigênio em Atletas de Futebol por Meio de Diferentes Métodos. Rev Bras Med Esporte. 2011;17(6):385-8.

18. Jackson A, Pollock ML. Generalized equations for predicting body density of men. Journal of Nutrition 1978, 40(3):497-504, https://doi.org/10.1079/BJN19780152.

19. Okano AH, Carvalho FC, Cyrino ES, Gobbo LA, Romanzini M, Glaner MF, Reichert FF, Avelar A. Utilização do adipômetro Cescorf para estimativa da gordura corporal relativa a partir de equações validadas com o adipômetro Lange. R. da Educação Física/UEM. 2008;19(3):431-6.

20. Silva DAS, Pelegrini A, Pires-Neto CS, Vieira MFS, Petrosky EL. O Antropometrista na busca de dados mais confiáveis. Rev Bras Cienantropom Desempenho Hum. 2011;13(1):82-5.

21. Reis DF, Junior MLS, Rotta PHB, Marcelo HI, Aleixo PH, Santos LS, Mendes EM, Filho MAA, Garcia TA, Ozaki GAT, Zanuto EAC, Castoldi RC, Camargo RCT, Filho JCSC. Análise do consumo máximo de oxigê-

nio e da composição corporal em atletas de futebol da categoria sub-20. Colloquium Vitae. 2018;10(Especial 5):112-8.

22. Pantaleão D, Alvarenga RL. Análise de modelos de periodização para o futebol. http://www.efdeportes.com/ Revista Digital – Buenos Aires, 2008;13(119):1/1.

23. Barbalho MSM, Novoa HJD, Amaral JC. Consumo máximo de oxigênio (Vo2) em atletas de futebol profissionais de diferentes posições de jogo. Rev. Bras. de Fut. e Futebol – São Paulo. 2017; 9(32):37-41.

24. Silva JF, Dittrich N, Guglielmo LGA. Avaliação aeróbia no futebol. Rev Bras Cienantropom Desempenho Hum. 2011;13(5): 384-91.

25. Reinke S, Karhausen T, Doehner W, Taylor W, Hottenrott K, et al. The influence of recovery and training phases on body composition, peripheral vascular function and immune system of professional soccer players. PLoS ONE. 2009;4(3):e4910.

26. Gonçalves LS, Souza EB, Oliveira EP, Burini RC. Perfil antropométrico e consumo alimentar de jogadores de futebol profissional. Rev. Bras. de Nutri. Esportiva – São Paulo. 2015;9(54):587-96.

27. Rosa, ASP. Comparação do perfil antropométrico: peso, altura e imc de atletas do Santos futebol clube profissional e sub-20. Rev. Bras. de Fut. e Futebol - São Paulo. 2011;3(8):123-6.

28. Prado WL, Botero JP, Guerra RLF, Rodrigues CL, Cuvellos LC, Dâmaso AR. Perfil antropométrico e ingestão de macronutrientes em atletas profissionais brasileiros de futebol, de acordo com suas posições. Rev Bras Med Esporte. 2006; 12(2):61-5.