

POTÊNCIA ANAERÓBIA EM JOGADORES DE FUTEBOL DA CATEGORIA DE BASE EM DIFERENTES ETAPAS DE TREINAMENTO: UMA REVISÃO SISTEMÁTICA

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Resumo: Os testes de potência anaeróbia são mais comuns em esportes intermitentes, como o futebol. Em geral, esses testes podem fornecer informações úteis sobre o status do treinamento, processo de reabilitação e maturação nas categorias básicas. O presente estudo teve como objetivo organizar e avaliar os achados sobre testes de potência anaeróbia em jogadores de futebol da categoria base em diferentes temporadas de treinamento, por meio da validade e qualidade dos estudos. O estudo de revisão organizou os estudos selecionados por meio de uma pesquisa em três bancos de dados, e qualificou cada estudo por meio de métodos validados. Após uma triagem, um total de seis estudos foram incluídos para a avaliação. Todos os estudos revelaram qualificação aceitável. Três dos seis estudos demonstraram melhora da potência anaeróbia no meio ou no final da temporada. Três estudos não mostraram alterações ou diminuição da potência anaeróbia no início da temporada (pré-temporada). A conclusão foi que as categorias de base (sub-15 e sub-17) parecem diminuir os resultados em testes de potência anaeróbia no início da pré-temporada.

Palavras chave: sub-15 em futebol; sub-17 em futebol; sub-20 em futebol; avaliação anaeróbia; periodização de treinamento.

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ANAEROBIC POWER IN SOCCER PLAYERS OF BASE CATEGORY IN DIFFERENT TRAINING SEASONS: A SYSTEMATIC REVIEW

Abstract: Anaerobic power tests are more common to be applied in intermittent sports, such as soccer. In general, these tests can give useful information about training status, rehabilitation process and maturation in base-categories. The present study aimed to organize and evaluate the findings about anaerobic power tests in base-category soccer players in different training seasons, through the validity and quality of the studies. The review study organized selected studies through the research in three data bases and qualified each study using validated methods. After a screening a total of six studies were included for the evaluation. All the studies reveled acceptable qualification. Three of the six studies demonstrated improvement of anaerobic power in middle or ending of the season. Three studies showed no changes or decrease of anaerobic power in the beginning of the season (pre-season). The conclusion was that base-categories (sub-15 and sub-17) appear to decrease the results in anaerobic power tests in the beginning of the pre-season.

Key words: sub-15 soccer; sub-17 soccer; sub-20 soccer; anaerobic assessment; training periodization.

Introduction

There is a variety of methods to assess soccer player physical performance¹. Soccer athletes are used to perform aerobic tests in laboratory using incremental aerobic test for VO_{2max} prediction or Wingate test for anaerobic power^{2,3}. Recently, sport scientists have preferred to use field tests to evaluate estimate or directly maximal aerobic capacity (e.g. 30-15 intermittent fitness test, IFT)⁴. The anaerobic power tests are more common to be applied in intermittent sports, such as soccer (e.g. Running anaerobic sprint test, RAST; Counter movement jump, CMJ; YoYo test, etc.)^{5,6,7}. In general these tests can give useful information about training status, rehabilitation process and maturation in base-categories^{8,7,9}. Elevated physiological and psychological stress may represent a challenge for their growth and maturation¹⁰. In the adolescence many physiological aspects changes, such as musculoskeletal, cardiorespiratory, and reproductive systems¹¹. Strength and power are some of the most important physical abilities that determine the winner in soccer¹². Meckel et al.¹³ investigate the relationship between aerobic capacity, anaerobic power and performance in thirty three elite adolescent soccer players. The athletes performed aerobic power test (20.m shuttle run), Wingate anaerobic test for anaerobic power and two different repeated sprint tests. In the results, Wingate test was correlated with the fastest sprint results concluding that anaerobic performance can lead to different stress, reflecting in different physiological capacities, such as the real life in soccer field game. Another tool that already demonstrated to improve performance is the plyometric jump¹⁴. CMJ is capable to improving vertical jump height that is well-correlated with strength, power and agility in youth soccer players¹⁵. These findings could be integrated in either a short- or long-term training plan for youth soccer players aiming talent identification. On the other hand, identify talent in base-category soccer players at an early age is far from being a mechanistic process¹⁶. Team sports such as soccer is harder to make anaerobic assessments when compared with individual sports where there are personal objectives¹⁷.

Thus, the present study aimed to organize and evaluate the findings about anaerobic power tests in base-category soccer players in different training seasons, through the validity and quality of the studies.

Materials and Methods

Procedures

The research was performed on October, 9, 2020. The following database were consulted in our research: Periódicos Capes, Google Scholar and Scielo. Only original manuscripts were

accepted, review study, letters, thesis or case report were not included. The language limitation for the inclusion criteria was Portuguese published from January 2010 to September 2020. In case of do not find the full text, the selected author was contacted to provide the full text, if there was no answer, the selected manuscript was automatically excluded.

Literature research

The literature research was conducted in accordance with the “Preferred reporting Items for Systematic Review and Meta-Analyses” (PRISMA) guideline (see figure 1)¹⁸. In each database, the title, abstract or keywords were used the following terms: “potência anaeróbia” and “futebol”; “potência anaeróbia” and “categoria sub-15”; “potência anaeróbia” and “ categoria sub-17”; “futebol” and “teste anaeróbio”.

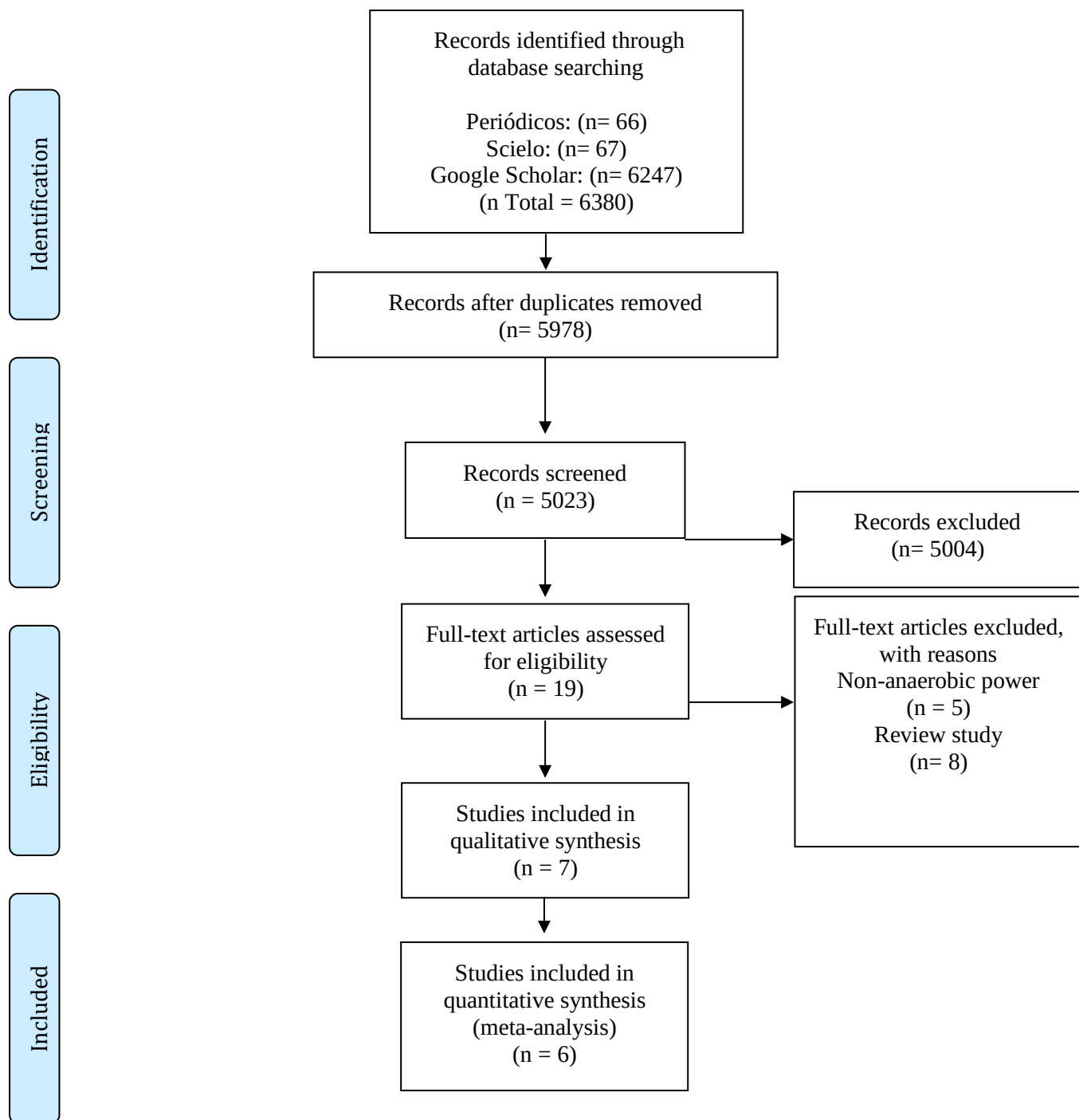


Figure 1 - PRISMA Flow chart of the literature screening. Note: PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Two independent observers (ZOAM; BPLE) reviewed the studies following the “Strengthening the Reporting of Observational Studies in Epidemiology” (STROBE) and then individually decided whether inclusion was appropriate. The STROBE assessment is composed by a *checklist* of 22 items including the score that vary from “0” to “1” (0 = “do not meet the criteria”; 1 = “meet the criteria”), and the total score was the sum of all items, according to the final score

of the study, a classification was conducted following three categories: A – when the study fill more than 80% of the eligibility criteria by STROBE; B- when the study fill between 50% and 79% of the eligibility criteria by STROBE and; C- when the study fill less than 50% of the eligibility criteria by STROBE. Table 1 exposes the score classification of each selected manuscript following STROBE. Concordance between the quality of the evaluators were evaluated again for obtained results using quality scale, calculating the Kappa coefficient, been the divergences resolved for consensus. If needed, a third author (CLMG) evaluated the studies using STROBE as well.

Results

The main results are exposed in table 1. The results showed different outcomes, exposing their peculiarities. Asano et al.¹⁹, Figueiredo et al.²⁰ and Silva et al.²¹ demonstrated increase in anaerobic power using wingate, Rast and YOYO Rec 2, respectively. Da Silva et al.²², Souza et al.²³ and Silva et al.²⁴ demonstrated no changes or reduction in anaerobic power using CMJ and RAST.

Table 1 - Characteristics of selected studies following eligibility criteria.

Studies	Year	Title	Methods	Main results	Conclusion
Asano and colleagues ¹⁹	2013	Comparação da potência e capacidade anaeróbia em jogadores de diferentes categorias de futebol	197 professional soccer athletes (males). assessment during competitive pre-season. 3 groups: sub-15 (n=42), sub-17 (n=41), sub-20 (n=86). Wingate test (mean and peak power)	Mean and peak power higher in all categories compared with sub-15 (p<0.001). Sub-20 higher values compared with sub-17 category.	anaerobic mean and peak power are higher in older categories (sub-20) than sub-15 and sub-17.

Figueiredo and colleagues²⁰	2016	Análise do desenvolvimento da capacidade física “potência anaeróbia” durante período preparatório de quatro semanas em jovens futebolistas	17 male athletes pertaining in the categories sub-15 (n=9) and sub-17 (n=8). RAST (mean, peak and minimum power) performed before and after the pre-season.	Sub-15 and sub-17 showed significant results comparing after and before the pre-season in minimum power and mean power.	Mean power was increased in both categories. No changes in peak power suggesting more time of training to observe the positive changes in peak power.
Da Silva and colleagues²²	2012	Níveis de potência muscular em atletas de futebol e futsal em diferentes categorias e posições	Comparison of anaerobic power of lower limbs in sub-17 (n=22), sub-20 (n=20) and professional (n=19) soccer field categories, and sub-20 (n=14) and professional (n=14) futsal categories using CMJ (mean of 3 attempts, in cm). Pre-season	No significant difference between sub-17, sub-20 and professional soccer players in power of lower limbs.	There are no changes between athletes' categories performing CMJ to analyze power.
Silva and colleagues²¹	2017	Potência anaeróbica e distâncias percorridas durante jogos em jovens atletas de futebol nas categorias Sub-15 e Sub-17	Anaerobic power, total distance, high and low intensity in the soccer games. Yoyo REC 2 to analyze anaerobic power. Sub-15 (n=14) and sub-17 (n=17). In-season	Sub-17 category showed higher values of anaerobic power (p = 0.001)	Sub-17 category demonstrated to maintaining the anaerobic power for more time in the game and more distance in the test when compared with sub-15 category.

Souza and colleagues²³	2012	Relação entre o desempenho no running-based anaerobic sprint test (Rast) e a altura do salto vertical, salto horizontal e agilidade em futebolistas	Sub-17 category (n=11). Two days of anaerobic power analysis resting 48 hours between tests. RAST, vertical, horizontal jump and agility tests were correlated. Pre-season	Peak power was observed in the first and second sprints in RAST test, only.	Although the higher levels of anaerobic power in the first and second set of RAST test, there was no difference between the two sets. RAST test can be considered a consistent test for anaerobic power.
Silva and colleagues²⁴	2013	Análise da potência muscular de atletas de futebol da categoria juniores em diferentes momentos da temporada de competição	Peak power (CMJ) in different training plan phases (end of the in-season, pre-season and after pre-season). Junior athletes (n=17; age: ± 17.8 years). The best of three CMJ attempts was used to establish the peak power.	Decreases in height (cm) in CMJ comparing after pre-season with in-season and pre-season. No decreases in power (w/kg) in CMJ	There are no significant changes in peak power comparing the selected seasons.

Note: RAST, running-based anaerobic sprint test; CMJ, counter movement jump; cm, centimeter; YOYO REC 2, YOYO recovery 2; w/kg, watts per kilos.

Table 2 exposes the score of each study following STROBE criteria. All the studies demonstrated low level of bias through the missing data.

Table 2 - Valuation, score and classification of each study following STROBE criteria.

STROBE CRITERIA			
Studies	Score (points)	% Score	Classification
Asano and colleagues (2013) ¹⁹	19	86.3	A
Figueiredo and colleagues (2016) ²⁰	20	91.0	A
Da Silva and colleagues (2012) ²²	20	91.0	A
Silva and colleagues (2017) ²¹	19	86.3	A
Souza and colleagues (2012) ²³	19	86.3	A
Silva and colleagues (2013) ²⁴	19	86.3	A

The figure 2 shows the relationship between the use of anaerobic power tests and the respective study.

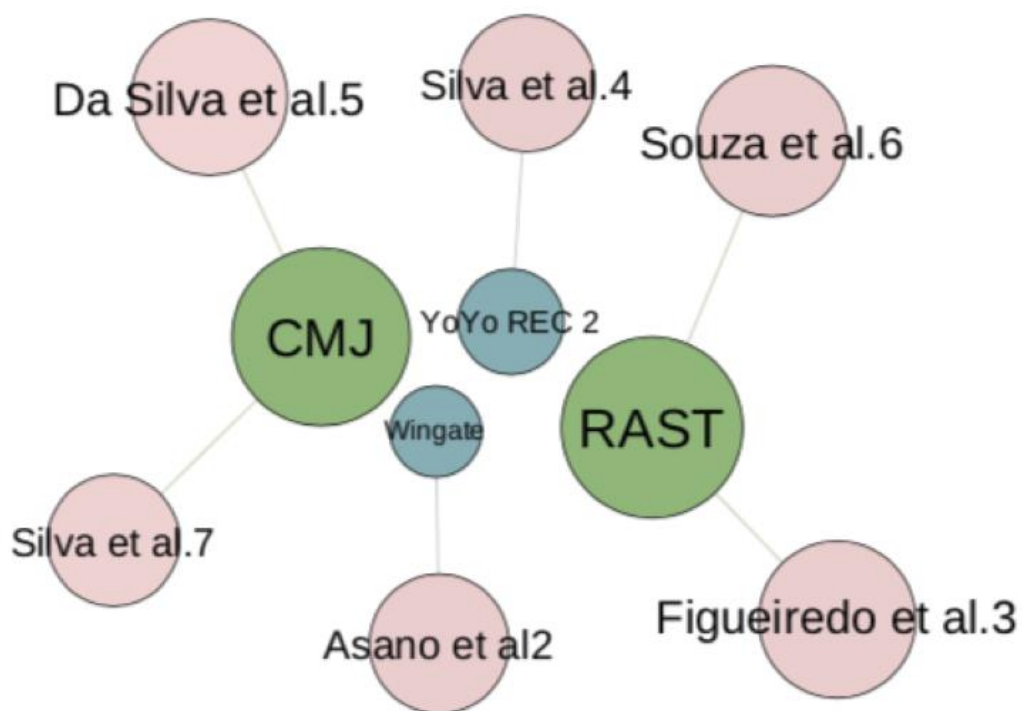


Figure 2 - Relationship between anaerobic power tests and studies. Note: CMJ, counter movement jump; RAST, running-based anaerobic sprint test.

Discussion

This review describes the evidence from anaerobic power tests in base category soccer players on the positive and/or negative effects of different training season. The conclusions of six included studies were partially contradictory. Only two studies reported significative increase in anaerobic power^{20,21}. The results of our analysis are inconclusive due each included study investigated a specific season of training plan. However, anaerobic power seems not to change positively in pre-season, mainly in sub-20 category. The results of Asano et al.¹⁹ demonstrated that the sub-17 category performing Wingate test, that is considered the gold standard for anaerobic power assessment, showed lower values of peak and mean anaerobic power compared with sub-20 category, in pre-season. Maturation is an important analyze parameter for athletes. While talent selection is based on many aspects of performance in base category, assessment data, mainly anaerobic assessment data are important to determine whether already the base-category athletes are improving their physiological abilities, individually. Base-category athletes that are more physiological prepared have more chances to successful play professional²⁵. One tool that is very common to use in base categories is the RAST test. RAST can be considered a useful in-field test to evaluate anaerobic power. Figueiredo et al.²⁰ found increases in mean power comparing post- and pre-season performing RAST in sub-15 and sub-17 soccer athletes. This study found a performance gain in anaerobic performance comparing post- and pre-season in 27% and 9.9% over sub-15 and sub-17 base categories. In a study evaluating anaerobic test in base categories demonstrated a difference of 0.85w/kg favoring sub-17 category²⁶. It is important to mention that this study not specified the training season the athletes were, and it is a limitation of the study. It is common to observe substantial changes in anaerobic performance in lower base categories due to maturation change more quickly. The study of Souza et al.²³ found no changes in anaerobic power performing RAST two days in sub-17 category in pre-season. The first two sets of RAST showed increased levels of power comparing with the subsequent sets. Another tool that can evaluate anaerobic power is the CMJ, considered a consistent method for analysis of performance and fatigue in lower limbs. Two of the selected studies used this tool to evaluate anaerobic power^{24,22}. The study of Silva et al.²² compared sub-17, sub-20 and professional soccer players performing CMJ. The

study did not find any significance in the values between groups. These results strengthen the findings of Figueiredo et al.²⁰ demonstrating that sub-17 category seems to be more matured than sub-15 category. A sign of maturation is the levels of testosterone in young male athletes. It has been suggested that testosterone is responsible for the increases in strength and power in male individuals at puberty²⁷. The peak of testosterone is consolidated between 20 and 30 years old²⁸. The difference in strength tends to decrease gradually at age between 15 and 35 years old²⁹. The study of Silva et al.²⁴ found no changes in peak power but decreases in height of CMJ (-5.8%) comparing different seasons in base-category. These findings corroborate with Hakkinen et al.³⁰ who found that athletes that come after training interruption may disrupt the power and strength. Silva et al.²¹ compared anaerobic power in two soccer categories, sub-15 and sub-17 using YoYo REC test. The sub-17 athletes performed longer distances and higher power than sub-15 athletes, besides these findings the study did not demonstrate any differences in sexual maturation between the groups. Krustup et al.³¹ demonstrated that anaerobic power is associated with running development in interval training and total distance traveled. In resume, two of the selected studies investigate anaerobic power using CMJ, two used RAST, one used Wingate and one used YoYo REC 2 test. All of these assessments have been used for different athlete levels in different sports^{5,32,33,34}. The present study classified the studies with concordance of STROBE, getting the highest score of study quality (score "A"), considered acceptable studies.

Conclusion

We concluded with low evidence that base-categories (sub-15 and sub-17) appear to decrease the anaerobic power through RAST, CMJ, YoYo REC 2 and Wingate tests in the beginning of the pre-season. Sub-17 category has similar anaerobic power compared with sub-20 category. Moreover, RAST, CMJ, Wingate and YoYo REC 2 tests may be introduced in different training seasons to evaluate the anaerobic power. This review can guide strength and conditioning coaches to understand and evaluate better soccer field base-categories.

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