61 - WAYS AND PROTOCOLS INDIRECT FIELD FOR PREDICTION OF AXIMUM OXYGEN CONSUMPTION IN INDIVIDUALS PHYSICALLY ACTIVE

LUCIANO P. DRUMNOD;
SILAS BOTELHO;
RÔMULO DA S. MELO
UNIVERSO- Belo Horizonte/MG
lucianopdrumond@gmail.com

INTRODUCTION

In the last decades has highlighted the importance of the acquisition and maintenance of healthy habits in order to improve the quality of life of the population. From there he saw the importance of measuring physical fitness, becoming a common practice and appropriate exercise programs (ACSM, 2003).

Although they seem to be little doubt as to the improvement in health status achieved through a fitness program, these benefits rely on an appropriate exercise prescription with regard to the intensity, duration, frequency and mode (COSTA; WAR, L.; GUERRA, F.; NUNES; PONTES, 2007).

According to Oliveira and Arruda (2000, p. 28):

> Physical fitness is constituted in a key indicator of the level ofindividual and community health, besides having recognized association between physical activity habits, health status and well-being.

One of the most important components of physical fitness are cardiorespiratory endurance (Araújo , 2000) . The cardio component is the ability to perform dynamic exercises involving large muscle groups at moderate and high intensity for prolonged periods , is directly related to the levels of health of an individual and refers to the functional capacity of their systems of absorption, transport , delivery and utilization of oxygen by tissues during exercise (FERNANDES , 2003) .

Maximal aerobic power (VO2max) , defined as the highest rate of oxygen captured , transported and used by the muscles recruited , in combination with other physiological parameters and neuromuscular , provides important information on the ability to perform physical activities long term . This parameter is also crucial for decision making in exercise prescription (SANTOS ; FURTADO ; RIBEIRO ; CABRAL ; NOVAES, 2008).

Currently, the efficiency of the cardiovascular system can be assessed by measuring the maximal aerobic capacity (VO2max) on a single parameter, which allows a comprehensive evaluation of this system instead of examining each of its components (FERNANDES, 2003). Although some equipment to make possible the analysis of VO2max results considered as the gold standard, its applicability in some situations is not feasible due to the high cost of testing (SANTOS; FURTADO; RIBEIRO; CABRAL; NOVAES, 2008).

Consequently , the ultimate test is reserved for clinical assessment , evaluation and research athleticism . A test with submaximal exercise costs less and carries a lower risk , not subjecting levels of physical stress to individuals who could be unnecessary depending on the objectives of the test . Besides offering the advantage of ease of administration , adaptability with respect to space requirements, the possibility of concurrent testing of various individuals and prescription reliable VO2max (ACSM , 2003) . Swain (2000) , cited by Santos ; Furtado ; Ribeiro ; Cabral ; Novaes (2008) considers that the prediction of VO2max from indirect equations has been a practice used for some time in the study of health, fitness and athletic performance . Despite the larger error associated with this strategy, the cost-benefit ratio seems to justify its applicability . Although performance in the race distance can be measured , it does not mean consolidation index need VO2max or substitute for direct measurement of VO2max . Generally , the longer the race , the greater the correlation with VO2max . Based on this observation , it is recommended to test selection with distance of at least 1,600 meters or duration of at least 9 minutes (HEYWARD , 2004) .

The first work addressing exercise test was published by Master and Oppenheimer (1929), using a ladder two steps with the aim of assessing the ability of the heart through the exercise responses of heart rate (HR) and blood pressure (BP) . The work is credited to this description of a protocol for stress testing (Chalela and colleagues, 2003). But the maximal oxygen consumption VO2max was only considered in the protocols of effort since 1955, when the techniques of gas measurements became available (BRAGA and Nunes, 2005). In 1968, Kenneth Cooper, to conduct a field test with American Airmen, described an evaluation procedure for estimating VO2max (Cooper and Storer, 2005). According to Holley and Powers (2000), Cooper test 12 minutes presents a moderately high correlation with VO2max.

The cardiorespiratory endurance VO2max can be predicted accurately from the tests with sub-maximal exercise in individuals who do not require maximum tests . The testing accuracy is improved by the adoption of standardized protocols , choosing an appropriate modality of testing and standardizing the methods of data collection , the test conditions and procedures (ACSM , 2003) . Browse the minimum distance of 2,400 m orrunning for 12 minutes is needed to assess more accurately , by the methods of external tests , the maximum oxygen consumption . As the application of these tests becomes popular , we can acquire interesting information related to fitness levels that will be of immense use to the development of aerobic exercise programs aspiring to raise the general level of physical fitness of men and women of all ages (COOPER , 1972).

Considering the above , the present study aimed to correlate the predicted VO2max test in Cooper 12 minutes with those obtained in the Cooper Test of 2.400m , in a group ofindividuals practicing Racing Bodybuilding and with the minimum frequency of three times weekly , for prescribing intensity aerobic training .

METHODS

Subject

Volunteered for this study fifteen individuals, four males and eleven females, aged between 22 and 55 years old, healthy, physically active - not athletes. All subjects performed at least 90 minutes per week of aerobic activities - Race andBodybuilding. Inclusion criteria were selected individuals classified as low risk according to the questionnaire of risk stratification developed by (ACSM, 2003). All subjects consented to participate in this study by signing an informed consent about the procedures, risks and benefits of their participation, as attached documents. Each participant was instructed to properly hydrate and eat meals at least three hours prior to testing, and abstain from exercises during the 24 hours prior to their participation.

Procedures

Data collection was conducted in two separate sessions on the track official athletics 400m . In the first session , volunteers completed consent forms and questionnaire for risk stratification. Underwent anthropometric collection containing mass (Filizola digital scale) and height . After this process the volunteers were ubmetidos protocol Cooper 12 minutes. The subjects were instructed that traveled the greatest distance possible running during the given time of 12 minutes (and MARINS GIANNICHI , 2003) . At the end oftest was calculated the total distance covered in meters and applied to the equationappropriate to estimate the individual's VO2max . After seven days , the individuals2,400 protocol performed Cooper which was conducted in the same trackofficial athletics 400m . The test consisted of measuring time spent by the subject to go through the 2,400 (VIVAQUA and HESPANHA , 1992 , quoted

by MARINS and GIANNICHI , 2003) . Criteria were adopted interrupt stress test without diagnostic purposes apparently healthy individuals suggested by the ACSM (2003) . After completion of the test , the volunteers performed an active recovery (jogging or walking) for at least 4 minutes with the speed of 7km / h also adopted inHeating time of the test.

Statistical Treatment

For sample characterization and disposition of the results was used descriptive statistics (mean ± standard deviation). Verification of differences for the dependent variable VO2max between the two protocols was established by Pearson's correlation.

RESULTS

The evaluation of men and women aimed to collect anthropometric measurements, obtaining the result of the characteristics of the sample: mean age 33 years, mean body mass of 64kg and mean height of 162 cm, as shown in table 1.

After completion of the field tests were made in the Cooper test of 12 minutes, the average result of 1973 meters and obtaining an average VO2max of 33 ml / (kg.min.). In the Cooper test 2400m was obtained the average result of 16 minutes, and a mean VO2max 32 ml / (kg.min). According to table 2 and 3.

Tabela 1. Características da amostra estudada (n=15).

Variáveis	Homens (n=4)	Mulheres (n=11)	Amostra total (n=15)
Idade (anos)	33 ± 8,81	33 ± 12,81	33 ± 11,58
Massa (kg)	73 ± 7,67	61 ± 8,07	64 ± 9,6
Estatura (cm)	169 ± 10,10	160 ± 5,77	162 ± 7,78

Tabela 2. Distância percorrida no teste de Cooper de 12 minutos e tempo final necessário para percorrer 2.400m no teste de Cooper (n=15).

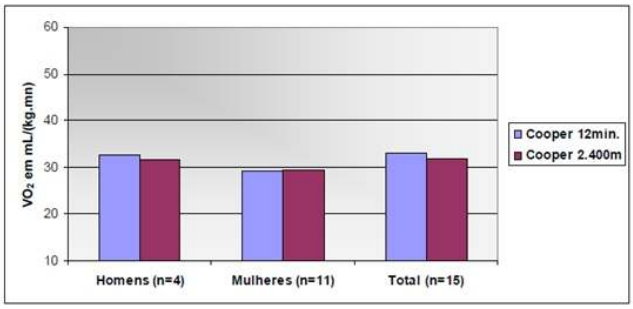
Variáveis	Média ± desvio padrão
Distância (m)	1.973 ± 374,94
Tempo (min.)	16 ± 2,85

Tabela 3. Resultados da predição do $VO_{2máx}$ nos protocolos de Cooper de 12 minutos e de 2.400 metros (n=15).

Variáveis	Média ± desvio padrão
$VO_{2máx}$ mL/(kg.min.) Protocolo 12 min. (Cooper)	33 ± 8,33
$VO_{2máx}$ mL/(kg.min.) Protocolo 2.400m (Cooper)	32 ± 5,78

The result of the correlation coefficient is Pearson's product moment r = 0.88, it means that there is a strong positive correlation between the two protocols used, that is, it is suggested that the two can be used to predict the aerobic capacity (Figure 1).

Figure 1. Correlation of the results of the protocols of VO2max estimated Cooper 12 minutes and 2,400.



Discussion

The present study correlated two indirect methods for determining intensity aerobic exercise by predicting VO2max . As limitations of the study we can mention the number of volunteers - 15 people - including four males and eleven females , the level of physical fitness (individuals who perform at least 90 minutes per week of aerobic activities being run and Bodybuilding) , and age group (aged 22 to 55 years) .

The quantification of the intensity of effort is a fundamental right in the aerobic exercise prescription , regardless of the population involved . According to the study presented by Santos , Silva ; Farinatti ; Monteiro (2005) , at least for the purpose of prescribing training results indicate that tests involving the activity the individual is used to perform seem better than the laboratory to determine target zone training . Thus the overvaluation of laboratory tests as the best way to get the intensity of aerobic exercise prescription should be questioned , especially when the training is conducted in field conditions . In practical terms , this means that the field tests , specific activity and actual environmental conditions of training, may represent a more reliable option in determining the relative intensity of the effort .

COSTA , WAR , L. ; WAR , F. ; NUNES ; FERNANDES , (2007) study concluded that the Cooper test 12 minutes did not show good validity for the population studied , both for the determination of maximal oxygen consumption as for prescribing aerobic exercise intensity . Thus , information generated about the state of fitness of the individuals studied , from the results predicted by this test can be considered short of the real situation.

According to ACSM (2003) , can be used multiple protocols for different exercise modalities (track, treadmill , stationary bike and increases in aturas of steps) from the demands of VO2 workload of each selected can be estimated with accuracy. If executed correctly, the tests with submaximal exercises provide valuable information about cardiorespiratory fitness , but have extremely limited diagnostic capabilities and should not be used as a substitute for clinical stress tests or other clinical modalities of treatment or control .

CONCLUSION

Based on these results, it is concluded that the adoption of the Protocol of 12 minutes and 2,400 of Cooper provided no significant difference for the prediction of VO2max. The present study, in relation to

determination of VO2max was the adoption of indirect methods and not a direct measure of the oxygen consumption. Both protocols can be used to exercise prescription, since such strategies are also based on indirect methods, in order to achieve highest accuracy in the conclusion reached is recommended to replication of this study using direct measurement of oxygen consumption.

REFERENCES

1.American College Of Sports Medicine. Diretrizes do ACSM para os testes de esforço e sua prescrição. 6ª Ed. Rio de Janeiro: Guanabara Koogan, 2003.

2.American College Of Sports Medicine. Manual de pesquisa das diretrizes do ACSM para os testes de esforço e sua prescrição. 4ª Ed. Rio de Janeiro: Guanabara Koogan, 2003.

3.ARAÚJO, C. G. S. de. Manual do ACSM para Teste de Esforço e Prescrição de Exercício. 5ª Ed. Rio de Janeiro: Revinter, 2000.

4.BRAGA, A. M. F. W; NUNES, N. Ergoespirometria aplicada à cardiologia. In: NEGRÃO, C. E., BARRETO, A. C. P. Cardiologia do exercício: do atleta ao cardiopata. São Paulo: Manole; 2005; p.128-147.

5.CHALELA, W. A.; MOFFA, P. J. Teste Ergométrico. In: NEGRÃO, C. E. BARRETTO, A. C. P. Cardiologia do Exercício: do atleta ao cardiopata. São Paulo: Manole; 2005; p.92-127.

6.COOPER, C. B.; STORER, T. W. Teste ergométrico aplicações práticas e interpretação. Rio de Janeiro: Revinter, 2005.

7.COOPER, K. Capacidade aeróbia. 2ª Ed. Rio de Janeiro: Fórum, 1972.

8.COSTA E. C.; GUERRA L. M. de M.; GUERRA F. E. F.; NUNES N.;

FERNANDES. L. P. J. Validade da medida do consumo máximo de oxigênio eprescrição de intensidade de treinamento aeróbico preditos pelo teste deCooper de 12 minutos em jovens sedentários. Rev Bras Prescrição eFisiologia do Exercício, v. 1, n. 4, p. 32-39, Jul/Ago, 2007.

9.FERNANDES, J. F. A Prática da Avaliação Física: Testes, Medidas e Avaliação Física em Escolares, Atletas e Academias de Ginástica. 2ª Ed. Rio de Janeiro: Shape, 2003.

10.HEYARD, V. H. Avaliação Física e Prescrição de Exercício: Técnicas Avançadas. 4ª Ed. Rio de Janeiro: Artmed, 2004.

11.MARINS, J. C. B.;GIANNICHI, R. S. Avaliação Física e Prescrição de

Atividade Física: 3ª Ed. Guia Prático. Rio de Janeiro: Shape, 2003.

12.OLIVEIRA, P. R. D. e ARRUDA, M. D. Crescimento, desenvolvimento e aptidão física. Campinas, SP: CODESP, 2000; 04-30.

13.POWERS, S. K.; HOWLEY, E. T. Fisiologia do exercício: teoria e aplicação ao condicionamento e ao desempenho. 3ª Ed. São Paulo: Manole, 2000.

14.SANTOS, A. L. dos; SILVA, S. C.; FARINATTI, P. de T. V.; MONTEIRO, W. D. Respostas da freqüência cardíaca de pico em testes máximos de campo e laboratório. Rev Bras Med Esporte, v.11, n. 3, Mai/Jun, 2005.

15.SANTOS, T. M. dos; FURTADO, L. F. L.; RIBEIRO, L. G.; CABRAL, L. F.; Novaes, J. da S. Comparação entre as modalidades de caminhada e corrida napredição do consumo máximo de oxigênio. Rev Bras Med Esporte, v. 14, n. 5, p.412-415, Set/Out, 2008.

16.VIVACQUA, R.e HEPANHA, R. Ergometria e reabilitação em cardiologia. Rio de Janeiro: Medsi, 1992 citado por MARINS, J. C. B.;GIANNICHI, R. S. Avaliação Física e Prescrição de Atividade Física: 3ª Ed. Guia Prático. Rio de Janeiro: Shape, 2003.

RUA JOAO PINHEIRO 139,
BAIRRO SANTO ANTONIO
VESPASIANO - MG , Brasil.
CEP: 33200000

WAYS AND PROTOCOLS INDIRECT FIELD FOR PREDICTION OFAXIMUM OXYGEN CONSUMPTION IN INDIVIDUALS PHYSICALLY ACTIVE

ABSTRACT

The measurementofphysical fitness Of individual swith the focus on their functional classification has been studied since 1918 ,when it was performed the first stress test . There is a wide variety of exercise tests to predict VO2 max performed in the field. The aimof this study was correlate the values of maximu moxygen consumption(VO2max) , obtained in two protocol sindirect sub – field maximum . Protocols were used Cooper 12 minutes and2,400 ,seeking the possibility of using the results in prescribing exercise intensities for physically active individuals - not athletes . The sample consisted of 15 subjects(four male andeleven female) physically active , with 33 ± 11.6 years of age, 71 ± 26.1 body mass , 155 ± 28.2 cm in height . The protocols used were performed in all subjects ,with an interval between one and a not her one week. Besides descriptives tatistics ,we used the Pearson correlation . The result of the correlation coefficientis Pearson's product moment r = 0.88 , it means that there is a strong positive correlation between the two protocols used , or suggested that both protocols can be used to predict the aerobic capacity, . Based on the results presented it is concluded that the administration of these field protocols showed no significant difference for the prediction of maximum oxygen consumption , not interfere in the subsequent decision decision to prescribe aerobic training intensity .

KEYWORDS: stress test, field test; adult; oxygen consumption;

VOIES ET PROTOCOLES INDIRECTE SUR LE TERRAIN DE PREVISION DE LA CONSOMMATION D'OXYGÈNE MAXIMUM DE PERSONNES PHYSIQUEMENT ACTIFS

RÉSUMÉ

La mesure de la condition physique des individus en mettant l'accent sur leur classification fonctionnelle a été étudiée depuis 1918 , quand il a été effectué le premier test de stress. Il ya une grande variété de tests d'effort pour prédire Vo2max effectué sur le terrain . L'objectif de cette étude était corréler les valeurs de con sommation maximale d'oxygène (VO2max), obtenu en deux protocoles indirect maxima lessous- terrain. Protocoles ontétéutilisés Cooper 12 minutes et 2400 , larecherche de la possibilité d'utiliser les résultats de la prescription des intensités d'exercice pour les personnes physiquement actives - pas des athlètes . L'échantillon était composé de 15 sujets(quatre hommes et onze femmes) physiquement actifs , avec 33 ± 11,6 années d'âge, 71 ± 26,1 masse corporelle, 155 ± 28,2 cm de hauteur. Les protocoles utilisés ont été effectués chez tous les sujets ,avec un intervale entre une et l'autre d'une semaine. En plus des statistiques descriptives ,nous avons utilisé la corrélation de Pearson . Le résultat du coefficient de corrélation est le moment produit de Pearson r = 0,88 , cela signifie qu'il ya une forte corrélation positive entre les deux protocoles utilisés , ou suggéré que lesdeux protocoles peuvent être utilisés pour prédire la capacité aérobie . Surla base des résultats présentés , il est conclu que l'administration de ces protocoles surleterrain n'a pasmontré de différence significative pour la prédiction de la con sommation maximale d'oxygène , pas interférer dans la décision ultérieure décision de prescrire l'intensité de l'entraînement aérobie.

MOTS-CLÉS: test, essai sur le terrain du stress, des adultes, la consommation d'oxygène;

MEDIOS Y PROTOCOLOS DE CAMPO INDIRECTOS PARA LA PREDICCIÓN DE CONSUMO MÁXIMO DE OXÍGENO EN INDIVIDUOS FÍSICAMENTE ACTIVOS

RESUMEN

La medición de la condición física de los individuos con el foco en su clasificación funcional ha sido estudiada desde 1918 , cuando se realizó la primera prueba de esfuerzo. Hay una amplia variedad de pruebas de esfuerzo para predecir VO2 máx lleva a cabo en el campo . El objetivo de este estudio fue correlacionar los valores de consumo máximo de oxígeno(VO2 max) , obtenido en dos protocolos indirectos máximos sub - campo . Protocolos fueron utilizados Cooper 12 minutos y 2400 ,en busca de la posibilidad de utilizar los resultados en la prescripción de intensidades de ejercicio para las personas físicamente activas - no atletas. La muestra estuvo conformada por 15 sujetos(cuatro varones y once mujeres) físicamenteactivos, con 33 ± 11,6 años de edad , 71 ± 26,1 masa corporal , 155 ± 28,2 cm de altura. Los protocolos utilizados se realizaron en todas las asignaturas ,con un intervalo entre una y otra de una semana. Además de la estadística descriptiva , se utilizó la correlación de Pearson. El resultado del coeficiente de correlación es producto momento de Pearson r = 0,88 , que significa que hay una fuerte correlación positiva entre los dos protocolos utilizados , o sugirió que ambos protocolos se pueden usar para predecir la capacidad aeróbica , . Basándose en los resultados presentados se concluye que laadministración de estos protocolos de campo no mostró diferencias significativas para la predicción del consumo máximo de oxígeno , no interfiere en la posterior decisión decisión de prescribir la intensidad del entrenamiento aeróbico.

PALABRAS CLAVE: prueba, prueba de campo de esfuerzos; adulta, el consumo de oxígeno;

CORRELAÇÃO ENTRE PROTOCOLOS INDIRETOS DE CAMPO PARA A PREDIÇÃO DOCONSUMO MÁXIMO DE OXIGÊNIO EM INDIVÍDUOS FISICAMENTE ATIVOS

RESUMO

A mensuração da aptidão física dos indivíduos com o enfoque na suaclassificação funcional é objeto de estudo desde 1918, quando foi realizado oprimeiro teste de esforço. Existe grande variedade de testes ergométricos paraa predição do VO2máx realizados em campo. O objetivo do presente estudo foi correlacionar os valores do consumo máximo de oxigênio (VO2máx), obtidos emdois protocolos indiretos sub-máximos de campo. Foram utilizados osprotocolos de Cooper de 12 minutos e de 2.400m, visando à possibilidade deutilização dos resultados na prescrição de intensidades de exercícios paraindivíduos fisicamente ativos – não atletas. A amostra foi constituída por 15indivíduos (quatro masculinos e onze femininos) fisicamente ativos, com 33 ±11,6 anos de idade, 71 ± 26,1 de massa corporal, 155 ± 28,2 cm de estatura.Os protocolos utilizados foram realizados em todos os indivíduos, com intervalo entre um e outro de uma semana. Além da estatística descritiva, foi utilizada aCorrelação de Pearson. O resultado do coeficiente de correlação produtomomento de pearson foi de r = 0,88, isso significa que existe uma fortecorrelação positiva entre os dois protocolos utilizados, ou seja, sugere-se queos dois protocolos podem ser utilizados para predizer a capacidade aeróbia.Com base nestes resultados apresentados conclui-se que a administraçãodestes protocolos de campo não apresentou diferença significativa para apredição do consumo máximo de oxigênio, não interferindo na posterior tomada de decisão para a prescrição de intensidade de treinamento aeróbio.

PALAVRAS-CHAVE: Teste de esforço; teste de campo; adulto; consumo deoxigênio;