# 31 - COMPARISON OF CARDIO RESPIRATORY PARAMETERS IN TEST WITH AND WITHOUT THE USE OF THE TREADMILL HANDRAILS

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## INTRODUCTION

These conventional tests, due to the assessment's low cost, become more frequent which means more used to examine the functional capacity of the individuals, evaluating accordingly the cardiovascular responses during the exercise, but on the other hand using indirect methods to determine the maximal oxygen uptake (VO2max) (RONDON, 1998).

A method that allows precise response of VO2max is the ergoespirometric test, once it allows a direct evaluation of the cardio respiratory and metabolic fitness through the measurement of the VO2max and the 1 and 2 ventilatory thresholds (RONDON, 1988, PIRES, SILVA, OLIVEIRA, 2005).

According to Duarte (1978) exercise is accompanied by increased oxygen uptake (VO2). A series of metabolic, respiratory and circulatory adjustments occur to meet the increased metabolic needs of muscles, such as increased heart rate, and consequent increase in oxygen consumption, so "the heart rate has been widely used in the evaluation and prescription of physical activity, for being a parameter of fundamental importance due to the linearity with the volume of oxygen consumed" (FLORES, ROSSI, SANTOS, 2006). However, according to McArdle et al 1998 a variety of factors, including duration, intensity and type of exercise performed influences the values of heart rate and pulmonary ventilation.

The treadmill has front and lateral handrails. When an individual is subjected to a stress test, the National Consensus of Ergometry (1995) recommends the allowance of support on the front rail in order to minimize the possibility of imbalance and falls, however the support on the rails can reduce the energy requirement for certain intensity, enabling the individual to remain longer on the treadmill. Therefore, there is a possibility that the achieved values of maximum oxygen uptake, when analyzed with and without the support on the handrails, are different.

Due to the above mentioned, and to the scarcity of studies comparing the two ergoespirometric tests there is a need for further investigations in order to verify if the test with the support on the front handrail will get a higher value of VO2max.Therefore, this study aimed to compare the cardio respiratory fitness of individuals on the treadmill with and without the use of the handrails of the treadmill.

## MATERIALS AND METHODS

### TYPE OF RESEARCH

The research of this study is characterized as pre-experimental, descriptive and comparative, according to (THOMAS, NELSON, 2002).

### SUBJECTS AND SAMPLE

All subjects were selected by invitation, they should be active and regular involved in a physical activity, for at least 12 months.

In order to select the sample it was adopted initially the following exclusion criteria: voluntary use of drugs that affect test performance, chronic degenerative disease such as uncontrolled hypertension, recent acute myocardial infarction and diabetes, among others; habits as smoking, respiratory compromised; or having any risk factor (NEGRÃO; BARRETTO, 2006).

After identifying these criteria 9 males aged in between 18 and 46 years were selected, which are residents of the metropolitan area of Vale do Aço and signed the Free Informed Consent in which was included all procedures, risks and benefits of the study.

### BODY COMPOSITION

In order to characterize the sample all volunteers were submitted to an anthropometric assessment. For the assessment of body composition it was used the method of body fat estimation, according to the Pollock protocol described by (Guedes, Guedes 2003) composed of three skin folds, chest, abdomen and thigh, with the use of a clinical Sanny adipometer, graduated in millimeters. For the determination of body mass and height a digital scale (Toledo ®) was used with a resolution of 280 50g with a metal stadiometer attached that allows the identification of the Body Mass Index (BMI = kg / m²).

### EXPERIMENTAL PROCEDURE

All volunteers underwent on two ergoespirometric tests, on using the front handrail called the Test with Support (TWS), and the other without the usage of the rail, called Test without Support (TWOS). The tests were applied randomly, following a period of 3 to 7 days break in between one test and the other.

Initially a 3 lead electrocardiogram (ECG) was performed on a Micromed ® digital computerized electrocardiogram in the resting period for the data collection. Then the volunteers performed an ergometric test (ET) on the Inbramed Millennium Super ATL (Inbrasport) treadmill following the Ramp protocol. During the ET the volunteers were continuously monitored by 3 lead ECG. The blood pressure was measured by auscultation every two minutes during the test and at the 1st, 2nd, 4th and 5th minute of the recovery, using a mercury sphygmomanometer. The heart rate (HR) was obtained by the electrocardiograph. During the ET, the exhaled air was collected and analyzed by Aerosport® Teem 100 (USA) computerized gas analyzer. The VO2max was considered as the highest value at the performance peak. The ET was considered ended since the maximum voluntary exhaustion, or if the achieved HR values were higher than the HRmax, VO2max Plateau, R values (respiratory exchange ratio) greater than 1.10 or interrupted due to some limiting symptom. Data were obtained by the ErgoPC Elite system.

### STATISTICAL ANALYSIS

For the present study the descriptive statistics was used. The data were presented in tables and graphs as mean and standard deviation. To verify the difference between the means the "t" Student test was applied for paired samples with

significance level of p <0.05. The data was processed by SPSS software for Windows 14-0.

**ETHICAL CARE**

Every caution has been taken to ensure the physical and mental integrity of all volunteers, as well as guaranteeing the anonymity of each one. A term of consent was signed by the volunteers.

**RESULTS**

The anthropometric characteristics of the volunteers involved in the study are presented in Table 1.

Table 1 – Physical characteristics of the sample (n=9), expressed by mean and standard deviation

| | Mean | SD |
|---|---|---|
| **Age (years)** | 33,22 | 11,14 |
| **BMI (kg/m²)** | 24,77 | 2,48 |
| **Fat %** | 17,80 | 6,51 |

The cardio respiratory variables of the volunteers involved in the study are presented in Table 2. The data analysis revealed that when ergometric tests with and without support were compared, there was no statistically significant difference (p <0.05) in any of the cardio respiratory variables analyzed. However there was a significant difference on the duration of the tests (p = 0.008), the duration of the TWS was higher than in the TWOS.

Table 2 – Mean and standard deviation of the cardio respiratory variables during the test with support (TWS) and test without support (TWOS) on the handrail in a sample (n=9)

| | *TWOS* | | *TWS* | | *p. Value* |
|---|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** | |
| **HR max (bpm)** | 182 | 13,95 | 185 | 10,69 | 0,25 |
| **$VO_2$max (ml/kg.min)** | 46,67 | 4,34 | 47,91 | 3,99 | 0,18 |
| **LV(ml/kg.min)** | 35,09 | 5,73 | 34,70 | 6,19 | 0,74 |
| **Ve (l/m)** | 96,63 | 16,45 | 95,86 | 18,65 | 0,84 |
| **VeVo2 (ml/kg.min)** | 26,94 | 2,59 | 25,77 | 2,79 | 0,15 |
| **VeVco2 (ml/kg.min)** | 27,00 | 2,00 | 25,77 | 2,79 | 0,23 |
| **Vco2max (ml/kg.min)** | 46,36 | 4,64 | 44,37 | 5,21 | 0,10 |
| **R max (l/m)** | 0,99 | 0,07 | 0,92 | 0,04 | 0,009* |
| **Time (min/sec)** | 0:09:14 | 0:01:14 | 0:11:47 | 0:01:37 | 0,008* |

* p = 0,05 significant difference

**DISCUSSION**

The results of this study reinforce the considerations of the National Consensus of Ergometry, great reference on ergometric tests, which points out that during the tests the handrails may or may not be used, depending on the needs of each individual. But in order to minimize the risk of imbalance and falls the Consensus recommends the use of the rails, enabling greater safety for the individual assessed.

Although no significant difference was observed among the collected cardio respiratory variables in both tests, a significant difference was found at the duration of the test, demonstrating the high correlation between the duration of the test and the changes in the heart rate values throughout its performance, but both coming to similar final cardio respiratory values.

It can be observed in the TWS, that the volunteers in order to reach their maximum effort, remained a longer time on the treadmill, reaching higher values of HRmax and VO2max but without a statistically significant difference in any of the cardio respiratory variables. This suggests that there is a strong correlation between the increased heart rate defined by a higher energy expenditure, resulting in a shorter final test duration, and a controlled increase in the heart rate defined by a lower energy expenditure when compared to the TWOS, considering its final test duration longer, therefore more extensive, reaching both similar cardio respiratory final values. Therefore, in accordance with McArdle (1988), the metabolic need was designated by the exercise intensity produced by the activity performed reaching both tests similar values of the HRmax and VO2max.

The average value of VO2max found in the sample was 46.67 ml/kg.min in a sample with a median age of 33.22 years. If these found results are compared with studies such as (PIRES, 2005), in which the average VO2max was 39.9 ml/kg.min in a sample with a median age of 28.9 years in physically active individuals, it is noticed that the VO2max values found in this study were high, showing that the volunteers are fit and integrated to a fitness program.

It must be emphasized that the mean value of R obtained in TWS were 0.90 representing a value which is 10% lower compared to the average value reached by the TWOS, which reached Rmax of 1.00. The value of R is the ratio of VCO2 and VO2, and its result proportional to the value of cardio respiratory variables (ROBERGS; ROBERGS, 2002). Considering the above mentioned this difference indicates that in a possible comparison of the values of Rmax in both tests, the cardio respiratory capacity would proportionally increase, possibly occurring a significant difference in cardio respiratory capacity when comparing the two tests.

Facing the found results, and the possibility to develop future studies in which mathematical calculations are applied in order to verify VO2max, i.e. tests that use indirect protocols, it is suggested that it is possible a significant difference of the cardio respiratory variables considering that the duration of test is a variable used in this calculation. The results obtained in this study are in agreement with (SILVA, 2005) who conducted a study aiming to compare and to establish the relationship between Individual Anaerobic Threshold (IAT), Individual Glucose Threshold (IGT) and Maximum Velocity (Vmax), 3km Mean Velocity in physically active non-athletes from indirect and direct tests protocols, and found that there was no significant difference between the cardio respiratory variables collected.

In the current study, the sample was a limitation factor, consisted of only 9 individuals, which is certainly not very wide. However, it must be highlighted the fact that the volunteers in the TWS have not reached their maximal effort values (Rmax). It is then expected further researches with wider samples, and further comparisons with studies involving indirect protocols.

**CONCLUSION**

The results of this study indicate that there was no statistically significant difference in any of the analyzed cardio respiratory variables, despite the time in TWS has been longer than the TWOS. Therefore reinforcing the recommendations of the National Consensus of Ergometry, which gives the individual subjected to the test, the option to use the handrail or not. It is recommended that further studies should be carried out with wider and more specific samples, allowing greater control of the maximum effort value of the individuals (Rmax), and also comparing tests in which indirect protocols are used.

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**COMPARISON OF CARDIO RESPIRATORY PARAMETERS IN TEST WITH AND WITHOUT THE USE OF THE TREADMILL HANDRAILS**

**ABSTRACT**

The National Consensus of Ergometry recommends the use of the front handrail in order to minimize any possibility of imbalance and falls during the assessment of cardio respiratory fitness, however, holding on this rail can reduce the energy expenditure during the activity allowing the person to remain longer on the treadmill, reflecting the possibility of achieving higher VO2max values when compared to the test without using the rail, allowing different final values of VO2max. Therefore this study aimed to compare the cardio respiratory fitness of persons on the treadmill with and without the assistance of the handrails. The sample consisted of 9 male volunteers with the average age of 33 years, practicing regular physical activity, residents of the metropolitan area of Vale do Aço. All volunteers were submitted to both ergoespirometric tests on a Inbramed Millennium Super ATL (Inbrasport) treadmill following a ramp protocol, one using the front handrail (TWS) and the other without the use of the front handrail (TWOS). For the present study it was used descriptive statistics and to check the difference among the average results the "t" Student test was applied on paired samples with significance level of $p < 0.05$. There was not a significant statistical difference in any of cardio respiratory varies collected in both tests, but there was a significant difference on the duration of the test. It is concluded that the use of the rail during the test did not affect the cardio respiratory variables, despite of the time TWS was more extensive than in the TWOS.

**KEYWORDS:** treadmill, cardio respiratory capacity, ergoespirometric test

**COMPARAISON DES PARAMETRES DE CARDIORESPIRATOIRE DANS LES TESTS AVEC ET SANS L'UTILISATION DES RAMPES TREADMILL**

**RÉSUMÉ**

Le Consensus national de Ergométrie recommande l'utilisation de la main courante avant afin de minimiser tout risque de déséquilibre et tombe lors de l'évaluation de la condition physique cardio-respiratoire, cependant, la tenue sur ce rail permet de réduire la dépense énergétique au cours de l'activité permettant à la personne de rester plus longtemps sur le tapis roulant, en raison de la possibilité d'atteindre des valeurs plus élevées VO2max par rapport à l'essai sans utiliser le rail, ce qui permet différentes valeurs finales de VO2max. Par conséquent, cette étude visait à comparer l'aptitude cardio-respiratoire des

personnes sur le tapis roulant avec et sans l'aide des mains courantes. L'échantillon était composé de 9 volontaires de sexe masculin avec un âge moyen de 33 ans, la pratique régulière d'une activité physique, les résidents de la région métropolitaine de Vale do Aco. Tous les volontaires ont été soumis à deux tests sur un ergoespirometric ATL Inbramed Millennium possible (Inbrasport) tapis roulant suivant un protocole de rampe, une main courante en utilisant le front (SSC) et l'autre sans l'utilisation de la première rampe (deux). Pour la présente étude, il a été utilisé des statistiques descriptives et de vérifier la différence entre la moyenne des résultats du test "t" Student a été appliqué sur des échantillons appariés avec un niveau de signification de p <0,05. Il n'y avait pas de différence statistiquement significative dans l'un des cardio-respiratoire varie recueillies dans les deux essais, mais il y avait une différence significative sur la durée de l'essai. Il est conclu que l'utilisation du rail pendant le test n'a pas d'incidence sur les variables cardiorespiratoires, en dépit du temps TWS a été plus importante que dans les deux.

**MOTS-CLÉS:** tapis roulant, la capacité cardio-respiratoire, test ergoespirometric

**COMPARACIÓN DE LOS PARÁMETROS CARDIO RESPIRATORIO EN PRUEBAS CON Y SIN EL USO DE LA MÁQUINA PARA CORRER LAS RAMPAS**

**RESUMEN**

Ergometría Nacional de Consenso recomienda el uso de la barandilla antes para minimizar cualquier riesgo de desequilibrio y cae en la evaluación de la aptitud cardiorrespiratoria, sin embargo, agarrándose a la barandilla reduce el gasto de energía durante la actividad permitiendo a la persona a permanecer más tiempo en la cinta, debido a la posibilidad de alcanzar valores más altos en comparación con la prueba de VO2max sin utilizar el carril, lo que permite diferentes valores finales de VO2max . Por lo tanto, este estudio tuvo como objetivo comparar la aptitud cardiorrespiratoria de las personas en la cinta con y sin el uso de las barandillas. La muestra estuvo conformada por nueve voluntarios varones con una edad media de 33 años, la actividad física regular, los residentes del área metropolitana de Vale do Aco. Todos los voluntarios se sometieron a dos pruebas en ergoespirometric Millennium ATL Inbramed posibles (Inbrasport) siguiendo un protocolo de rampa pasamanos cinta utilizando la parte frontal (SSC) y el otro sin el uso de la primera rampa (dos). Para este estudio, se ha utilizado la estadística descriptiva y comprobar la diferencia entre la media de la prueba "t" se aplicó a muestras de sus pares con un nivel de significación de p <0,05. No hubo diferencias estadísticamente significativas en ninguno de los cambios cardio-respiratorias recogidas en ambos ensayos, pero no había una diferencia significativa en la duración de la prueba. Se concluye que el uso del ferrocarril para el ensayo no tiene efecto en las variables cardiorrespiratorias, a pesar del tiempo TWS era más importante que ambas.

**PALABRAS CLAVE:** cinta de correr, cardio-respiratoria prueba ergoespirometric

**COMPARAÇÃO DE PARÂMETROS CARDIORRESPIRATÓRIOS EM TESTE NA ESTEIRA COM AUXILIO E SEM AUXILIO DA BARRA DE APOIO**

**RESUMO**

O Consenso Nacional de Ergometria recomenda para a avaliação da aptidão cardiorrespiratória que o individuo utilize do apoio à barra frontal, afim de minimizar qualquer possibilidade de desequilíbrio e quedas, entretanto esse apoio pode diminuir o gasto energético para a atividade permitindo que o avaliado permaneça mais tempo na esteira, refletindo possibilidade de se alcançar maiores valores de VO2máx quando comparados ao teste sem apoio, possibilitando valores finais de VO2máx distintos. Portanto o presente estudo teve como objetivo comparar a aptidão cardiorrespiratória de indivíduos na esteira ergométrica com e sem auxílio da barra de apoio. A amostra foi composta por 9 voluntários do sexo masculino com idade média de 33 anos, praticantes de atividades físicas regulares, residentes da região metropolitana do Vale do Aço. Todos os voluntários foram submetidos aos dois testes ergoespirométricos na esteira ergométrica Inbramed Millennium Super ATL (Inbrasport), seguindo o protocolo em Rampa, um utilizando o apoio da barra frontal (TCA) e outro sem o apoio da barra frontal (TSA). Para o presente estudo foi utilizada estatística descritiva, e para verificar a diferença entre as médias foi aplicado o teste “t” de Student para amostras pareadas com nível de significância p<0,05. Não se obteve diferença significativa em nenhuma das variáveis cardiorrespiratórias coletadas em ambos os testes, porém no tempo de duração do teste verificou-se diferença significativa. Conclui-se que a utilização do apoio durante o teste não influenciou as variáveis cardiorrespiratórias, apesar do tempo do TCA ter sido mais extenso que no TSA.

**PALAVRAS-CHAVE:** Esteira Ergométrica, Capacidade Cardiorrespiratória, Teste Ergoespirométrico