78 - EVALUATION OF THE CONSUMPTION OF OXYGEN (VO2max.) IN BENCH TEST: A LONGITUDINAL STUDY IN STUDENTS OF THE PREPARATORY NUCLEUS OF OFFICIALS OF THE RESERVATION (NPOR) FULL IN THE 16th REGIMENT OF AUTOMATED CAVALRY (RECMEC)

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INTRODUCTION

It is known that the bench test or ascent and descent in steps was created to test, measure and evaluate the cardio-respiratory aptitude of individuals, in a perspective of easy application, economy of time and low cost in the reproduction and maintenance of the instrument besides easy transport. With the evolution of the Sciences of Sports, the ergometer went acquiring new ergonomic characteristics. Among the most expressive ones is the study of Sousa (1997), who based on empiric observations, diagnosed that heterogeneous statures provided levels of different efforts, validating a protocol in agreement with the adaptation of the height of the bench to the stature of the appraised ones. Subsequent experiences, in the application of the tests with this instrument in the dosage of the effort, including the index of VO2max, validating through regression equation the protocol of Sousa (2001), considering; differences not only the aspects anthropometrics, this time the height of the bench was adapted in three different moments during the test, but also physiologic, such as: distinctions among the genders, physical fitness degree that alters the rhythm of the metronome and the time of execution of the test. It is understood each other like this, which this protocol looked for to improve the instrument in two moments of research tends as final product a larger reliability in the prediction of the consumption of maximum oxygen (VO2MAX.).

It is not today that the scientists are interested in the study of the physiologic answers to the exercise. Mainly, when they noticed the positive relationship of the physical fitness with the health. But nowadays, the researchers' great challenge is in unmasking the right dosage of the physical activity for each individual. No by chance, according to Neves and Duarte (2005), that the Institute of research of the physical training of the army (IRPTA) it drifts and it monitors the physical training of the military ones, before and after the missions, aiming at to improve the physical conditioning, optimizing the chances of a better execution in the missions and maintenance of the health of their members.

In relation to the capacity cardiorespiratory, this includes a process of adaptation of the physiologic adjustments of the metabolic demands that crosses the rest needs could develop to maximum levels. Wilmore and Costill (2001) they comment on that many scientists of the sport consider VO2MAX as better representative in the analysis of the aerobic potency in the tests laboratories of resistance cardio-respiratory. In spite of finding a great number of protocols that presents positive and negative points, however the choice of a certain test should necessarily have as orientation some criteria of qualities psychometrics, such as: objectivity, standardization, trustworthy or reliability, validity, viability, discrimination, domain of the technique, historicity and norms (FERNANDES FILHO, 2003).

In the case of choosing for the accomplishment of a laboratorial test, with the use of several instruments, as analyzers of gases, among other, it can be considered of difficult access and great complexity in the handling. However, habitually, the tests of simpler field, as the one of bench, they are used thoroughly. The protocol of race/walk of Jogging, considered of simple applicability it has been mentioned in several publications in military populations and in civilians, there is example of Bridges et al. (2006), rose et al. (2005), respectively with amateur and military soccer players. As for the load, it can be in an only way like the protocol of bench of Kacth and McArdle (1996), or in varied way as the one of Balke (MARINS and GIANNICHI, 1998).

Being like this, this work considered the elaboration of the protocol of evaluation of Sousa (2001) with increment, that it is an originated test and developed mainly with base in different techniques and instruments ruled in the norms and standardizations of ergometrics tests, besides the validation with use of the Brazilian population, and the classification of the appraised ones in three aptitude levels. One cannot stop mentioning that the test has a relative specificity in the gesture of the march, specific movement that interferes in the daily military.

In this context, considering that there is still a shortage of information on longitudinal studies with military, and the need of scientific knowledge of the most characteristic profile of this population, above all in the nuclei of the Northeast of Brazil, the present study has as guide subject: Will it be that the military physical training causes impact on the levels of capacity cardio-respiratory during the period of 9 months when analyzed on instrument ergo-metric bench through ascents and step descents? This way, it is looked for in this study to analyze the impact of the military physical training on the levels of capacity cardio-respiratory during the period of nine months in three different moments.

MATERIAL AND METHODS

Characterization of the study: it was framed as longitudinal, *FOLLOW-UP* with primary data, analytical, probabilistic.

Population and sample: The universe was of military. The sample consisted of 15 students of the masculine gender with average of 18,7±0,5 year-old age, from the Preparatory Nucleus of Officials of the Reservation (NPOR) of the 16th Regiment of Motorized Cavalry (RMC), residents in the municipal district of Bayeux (PB), all were previously selected by a medical examination for the accomplishment of the Test of Physical Evaluation (TPE) of the Army.

Variable selected for the study: The variables selected for the study were: Test of effort (TE) in seconds, Age (ID) in years, Stature (ST) in meters, Body Mass (BM) in kilograms, heart frequency (HF) in beats per minute, Height of the bench (cm), physical fitness degree (untrained, assets); Rhythm of the metronome (touches / minutes); I make a subjective effort.

Instruments for collection of data: scale analogical anthropometric, estadiometer, monitor of Polar heart frequency A5, table of Borg, Metronome, and automatic electronic ergometer bench of Cirilo, manufactured by Bio - systems with height from 20 to 50 cm according to the Illustration 1 and 2.





Picture 1: electronic bench, screen and microprocessor **Picture 2:** electronic bench traverse vision activated.

Procedures for collection of data: A previous meeting was accomplished in the 16º(RMC), with students of the (NPOR) integral of the respective unit, report of the objectives of the research and signature of the Term of Free and Illustrious Consent (TFIC) according to National Council of the Health Law 196/96 (BRAZIL, 2001) for the voluntary participation of the research. Immediately after, they were made recommendations regarding the regular procedures of the collection. Then, the subjects were guided as for the uniform, the place, schedule and patterns of execution of the evaluation anthropometric and ergometric.

They were measured and dear: 1) the vo2max, through the bench test of Cirilo, using the protocol of Sousa (2001), in three denominated moments: AVL 01, being this after the adaptation phase; AVL 02, was during the basic phase and AVL 03, it took place in the specific phase of the training. Each one of the three evaluations was accomplished in a single morning, in the sequence mentioned previously. As criterion before the test of effort: 1) to accomplish ingestion of light foods 1 to 2 hours before, 2) to begin a session of prolongation for the inferior members; not to smoke; not to ingest alcoholic drink and nor to accomplish physical effort. Criteria of interruption of the test: 1) to reach the limit of HF, using the calculation of Karvonen (220 - age), 2) to lose the ascent rhythm and descent in the bench at least 3 times during the effort or fall without fast recovery, 3) signs of fatigue as muscular fatigue or cyanotic appearance among others.

The test begins with ascents and descents in a height standard of 20 cm, being adjusted in the second moment to a height that provides to the appraised in the ascent of the bench an angular flexing of 45th degrees of the inferior member in execution and, in the last moment, 90th. The time of the test and the rhythm of the ascents and decide were certain for the gender and level of the volunteers' physical fitness, being these: 4 minutes, in a rhythm of 144 t/pm, for population it activates. All the standardization followed the methodology published by Sousa (2001).

Analytic plan: For the formulation of the database the computerized and graphic package, SPSS version 13.0, was used for listing of all the results. It was applied descriptive statistics and maximum inferential, minimum, average, deviation-pattern (DP) and no-parametric test of Friedman. The level of adopted significance was of 5% ($p < 0,05$).

RESULTS AND DISCUSSION

The anthropometric analysis of body mass 68,9±6,5kg and stature 1,75±5,8m; they showed compatible values with a good nutritional condition. Concerning the VO2 max. The sum of the three evaluations presented a medium value of 38,21 ml/kg.-1, compatible value to a conditioning inside of reasonable parameters for the American Association of the Heart (AAH) for a good acting following the classification mentioned by Marins and Giannichi (1998). In study published by Ribas and Ribeiro (2003), with 26 pilots of helicopters of the Brazilian army, already physically assets, a vo2max, 57,69±4,45 ml/kg.-1 was observed in the first group and the second 46,58±4,45 ml/kg.-1. Both groups presented a superior aerobic potency to the present study, probably for the pilots' need to have of a larger aptitude with the objective of supporting the stress of combat flights, without speaking of treating of an elite group that has years of training, visa to do part of the permanent cash of the Brazilian army. While the students of NPOR; they don't have been twelve months of training and most of the futures officials is not absorbed for the army and the ones that are, they are just for some years, seen the same ones do not part of the permanent cash of the army.

Table 01: Distribution of the descriptive values of average, deviation-pattern (DP), minimum and the students' of the Preparatory Nucleus of Officials of the Reservation maximum (NPOR) (N=15)

Variable	Average ± DP	Minimum	Maximum
Age (years)	18,7±0,5	18,00	19,00
Stature (m)	1,75±5,8	1,69	1,85
Body Mass (kg)	68,9±6,5	57,9	79,40
VO_2 max. (ml/kg.$^{-1}$) (Ó 3testes)	38,21±1,43	33,86	40,31
HF (bpm) (Ó 3 testes)	175,2±13,4	133,00	196,0

The Table 2 exposes the measures of the consumption of oxygen measured in three moments: April-July-October of 2005. It is noticed that the values presented significant differences ($p=0,005$), with a decrease of the students' of AVL 03 performance compared with AVL 01. Such fact is justified; in the period of AVL 01, the students had already concluded the adaptation phase and in AVL 03, they were in the specific phase of their weapon. Since in the period of adaptation of the individuals usually come less capable than in elapsing of the other phases, such fact can be considered one of the inclinations of the present work, tends in view that trained individuals possess less won than the no.

In a study of Sousa et al. (2006), in students of NPOR of the same institution in 2004, using similar instrument and protocol presented an average in VO2max in AVL 01 of 47,14 ml/kg.-1 and after 3 months, in AVL 02 it was of 47,08 ml/kg.-1. classified of good physical fitness. It is noticed that, when compared with this study, that such difference in the aptitude levels can have relationship with variables no controlled by the study: motivation degree, stress level, hours of sleep, genetic predisposition, and feeding, socioeconomic level to the results of the aptitude. And in spite of the interest and the instructor's concern in the periodization of the training. This determines that even in a standardized training the acting answers suffer interferences of another varied not measured in the study.

Other studies of Dias et al. (2005), with 28 military men of the Brazilian army, from 19 to 20 years of age, incorporate in the 1st Group of Antiaircraft Artillery, they presented a VO2max of 51,90 ml/kg.-1, a result similar to this, was in the Southeast of the country published by Neves and Duarte (2005), involving a sample of 313 military assets, it was adopted as procedure for evaluation involving three interventions, denominated AVL. The same ones presented a VO2max: AVL 01 55,9; AVL 02 57,9 and AVL 03 54,0. One of the peculiarities of the collection was that AVL 01 preceded to the training of peace Force and compared with AVL 02, powder-training, presented a significant improvement in the military of the study, in the body composition and in TPE, except for IMC and RCQ. In AVL3 there were aptitude decrease and increase of the variables anthropometrics, that it was accomplished in the return of the mission characterized as des-trainings. The study corroborated so that the discoveries in what refer to the aptitude decrease among evaluations followed powder-intervention of physical training, as well as that the military training in spite of certain peculiarities and

systemizations, it can be differed of area for area.

Table 02: Medium values of the three applied tests in the students of the Preparatory Nucleus of Officials of the Reservation (NPOR) and value p made calculations by the test of Friedman (N=15)

VARIABLE	MEDIUM ± DP	VALUE P
VO_2 max. (ml/kg.$^{-1}$) (AVL 01)	38,34±1,68	
VO_2 max. (ml/kg.$^{-1}$)(AVL 02)	38,34±0,68	0,005*
VO_2 max. (ml/kg.$^{-1}$) (AVL 03)	37,96±1,74	

* p <0,05 (significant)

CONCLUSION

Based on the results obtained in the present study, it is ended that, independent of the moment of evaluation, the military of NPOR in 16th RMC presented a reasonable level of physical conditioning for the health, considering the capacity cardiorespiratory, for the vo2max, although, no satisfactory for the specific needs of the troop during the investigated period. As for the period of the interventions, the difference no significant of AVL 01 and AVL 02, is attributed to the fact of both they be in the basic phase, in other words, they were already maintaining the aerobic capacity of the military physical training (MPT) in comparison with AVL 03; that it was measured in the specific phase, moment this that presents a significant decrease of the physical activity giving place to the technical training of specific instruments in the cavalry weapon. Added that notices that the regionalization, motivation and the priority that the responsible instructor emphasizes to the physical training; it can influence directly in the acting.

New studies are recommended, to evaluate the volunteers before the initiation of the military physical training, in the finish of the phase of adaptation, middle of the basic phase and I finish of the specific phase for us to analyze with more precision the effects of the (MPT) in the next groups of students for a better adaptation in the period in a more profitable way, besides relating to the health. It also suggests the inclusion of another varied such as, muscular force/resistance, flexibility, profile of plasmatic lipoproteins and an analysis more perfected in the indicators of the body composition, as well as an attendance in the evaluation of the pattern of alimentary ingestion of the military ones in the period of the formation.

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EVALUATION OF THE CONSUMPTION OF OXYGEN (VO2MÁX.) IN TEST OF BANK: A LONGITUDINAL STUDY IN STUDENTS OF THE PREPARATORY NUCLEUS OF OFFICIALS OF THE RESERVATION (NPOR) FULL IN THE 16TH REGIMENT OF AUTOMATED CAVALRY (RECMEC)

ABSTRACT

The aim of this study is to measure the VO2max in ascent and descent bench test in three moments, during the officials' of the reservation preparatory course. Methodology: it's an applied research, longitudinal, analytical, and probabilistic. The sample consisted of 15 active men, average of age 18,07±0,5 years old. The stature was measured (m), body mass (kg), heart frequency of effort (HFE) it was controlled the phases, increment of the height of the bench (cm), number of touches per minute (t/m) ascent and descent rhythm of the ergometric bench and time of execution. The individuals used a cardiofrequencimeter of the Polar mark A5 in

the gauging of CF and the Table of Borg in the subjective control of the effort. The ergometric test applied was the Test of electronic bench of Cirilo (TEBC) in three different moments (3 months of interval): AVL 01, AVL 02 and AVL 03 of the year 2005. The used statistics was descriptive of average, deviation-pattern, maximum and minimum and inferential through the test of Friedman for repeated measures. The significance level was p <0,05, the software SPSS version 10.0 was used. Results: first, it was obtained an average of VO2max of 38,34±1,68 ml/kg/min, in the second 38,34±0,68 ml/kg/min and in the third 37,96±1,74 ml/kg/min, having significant differences just in the third moment (p=0,005) with decrease of the performance. Conclusion: The level of capacity cardiorespiratory was classified in reasonable in the 3 moments of test for the index of VO2max, with decrease in the third moment, and it was not characterized a satisfactory way for the specific needs of the troop during the investigated period, if compared the levels of this capacity with other studies in military. New studies are recommended, trying to evaluate the volunteers in different phases of the physical and tactical training, for more accurate analyses of the impact of the program.

Key - words: Ergometrics, Step Test, Military, Aptitude cardiorespiratory.

EVALUATION DE LA CONSOMMATION D'OXYGENE (VO2MAX.) DANS EPREUVE DE BANQUE: UNE ETUDE LONGITUDINALE DANS ETUDIANTS DU NOYAU PREPARATOIRE DE FONCTIONNAIRES DE LA RESERVATION (NPOR) PLEIN DANS LE 16E REGIMENT DE CAVALERIE AUTOMATISEE (RECMEC)

RESUME

Le but de cette étude est mesurer le VO2máx dans montée et épreuve du banc de l'origine dans trois moments, pendant les fonctionnaires de la réservation cours préparatoire. **Méthodologie:** c'est une recherche appliquée, longitudinal, analytique, et probabiliste. L'échantillon a consisté en 15 hommes actifs, moyenne d'âge 18,07±0,5 ans. La taille a été mesurée (m), masse du corps (kg), fréquence du coeur d'effort (HFE) c'était contrôlé les phases, augmentation de la hauteur du banc (centimètre), nombre de touchers par minute (t/m) montée et rythme de l'origine du banc de l'ergometric et temps d'exécution. Les individus ont utilisé un cardiofrequencimeter de la marque Polaire A5 dans le jaugeage de CF et la Table de Borg dans le contrôle subjectif de l'effort. L'épreuve de l'ergometric appliquée était l'Épreuve de banc électronique de Cirilo (EBEC) dans trois moments différents (3 mois d'intervalle): AVL 01, AVL 02 et AVL 03 de l'année 2005. Le statistique usagé était descriptif de moyenne, déviation modèle, maximum et minimum et inférentiel à travers l'épreuve de Friedman pour les mesures répétées. Le niveau de la signification était p <0,05, le logiciel SPSS que la version 10.0 a été utilisée. **Résultats**: en premier, il a été obtenu une moyenne de VO2máx de 38,34±1,68 ml/kg/min, en la seconde 38,34±0,68 ml/kg/min et dans les troisièmes 37,96±1,74 ml/kg/min, avoir des différences considérables seulement dans le troisième moment (p=0,005) avec baisse de la performance. **Conclusion:** Le niveau de cardiorespiratory de la capacité a été classé dans raisonnable dans les 3 moments d'épreuve pour l'index de VO2max, avec baisse dans le troisième moment, et il n'a pas été caractérisé de chemin satisfaisant pour les besoins spécifiques de la troupe pendant la période enquêtée sur, si a comparé les niveaux de cette capacité avec les autres études dans armée. Les nouvelles études sont recommandées, en essayant d'évaluer les volontaires dans les phases différentes de la formation physique et tactique, pour analyses plus exactes de l'impact du programme.

Mot - clés: Ergometric, Épreuve du Pas, Militaire, cardiorespiratoire de l'Aptitude.

EVALUACIÓN DEL CONSUMO DE OXÍGENO (VO2MÁX.) EN LA PRUEBA DE BANCO: UN ESTUDIO LONGITUDINAL EN LOS ESTUDIANTES DEL NÚCLEO PREPARATORIO DE OFICIALES DE LA RESERVACIÓN (NPOR) LLENO EN EL 16 REGIMIENTO DE CABALLERÍA AUTOMATIZADA (RECMEC)

RESUMEN

El objetivo de este estudio es medir el VO2máx en la ascensión y prueba de banco de descenso en tres momentos, durante los oficiales de la reservación el curso preparatorio. **Metodología:** es una investigación aplicada, longitudinal, analítico, probabilística. La muestra consistió en 15 hombres activos, promedio de edad 18,07±0,5. La estatura era mensurada (m), masa corporal (kg), frecuencia cardiaca de esfuerzo (FCE) se controló las fases, incremento de la altura del banco (cm), número de toques por minuto (t/m) la ascensión y ritmo de descenso del banco del ergometric y tiempo de ejecución. Los individuos usaron un cardiofrequencimetro de la marca Polar A5 en el aforo de FC y la Mesa de Borg en el mando subjetivo del esfuerzo. La prueba del ergometric aplicada era la Prueba de banco electrónico de Cirilo (PBEC) en tres momentos diferentes (3 meses de intervalo): AVL 01, AVL 02 y AVL 03 del año 2005. La estadística usada era descriptiva de promedio, desviación-modelo, máximo y mínimo e ilativo a través de la prueba de Friedman para las medidas repetidas. El nivel de importancia era p <0,05, el software SPSS que versión 10.0 fue usada. **Resultados:** primero, se obtuvo un promedio de VO2máx de 38,34±1,68 ml/kg/min, por el segundo 38,34±0,68 ml/kg/min y en el tercio 37,96±1,74 ml/kg/min, teniendo las diferencias significantes simplemente en el tercer momento (el p=0,005) con la disminución de la actuación. **Conclusión**: El nivel de capacidad cardiorrespiratoria era clasificado en razonable en los 3 momentos de prueba para el índice de VO2máx, con la disminución en el tercer momento, y no se caracterizó una manera satisfactoria para las necesidades específicas de la tropa durante el período investigado, si comparó los niveles de esta capacidad con otros estudios en el ejército. Se recomiendan nuevos estudios, buscando evaluar los voluntarios en fases diferentes del entrenamiento físico y táctico, para análisis más exactos del impacto del programa.

Palabras - Claves: Ergometria, Prueba del Paso, Ejército, Aptitud cardiorrespiratorio.

AVALIAÇÃO DO CONSUMO DE OXIGêNIO ($VO_{2máx.}$) EM TESTE DE BANCO: UM ESTUDO LONGITUDINAL EM ALUNOS DO NUCLEO PREPARATóRIO DE OFICIAIS DA RESERVA (NPOR) LOTADOS NO 16º REGIMENTO DE CAVALARIA MECANIZADA (RECMEC)

RESUMO

O objetivo deste estudo é de mensurar o $VO_{2máx}$ em teste de subida e descida de banco em três momentos, durante o curso preparatório de oficiais da reserva. **Metodologia**: trata-se de pesquisa aplicada, longitudinal, analítica, probabilística. A amostra constou de 15 homens ativos, média de idade 18,07±0,5 anos. Mediu-se a estatura (m), massa corporal (kg), freqüência cardíaca de esforço (FCE) e controlou-se os estágios, incremento da altura do banco (cm), número de toques por minuto (t/m) ritmo de subida e descida do ergômetro banco e tempo de execução. Os indivíduos utilizaram um cardiofreqüêncímetro da marca Polar A5 na aferição da FC e a Tabela de Borg no controle subjetivo do esforço. O teste ergométrico aplicado foi o Teste de banco eletrônico de Cirilo (TBEC) em três momentos distintos (3 meses de intervalo): AVL 01, AVL 02 e AVL 03 do ano de 2005. A estatística utilizada foi descritiva de média, desvio-padrão, máximo e mínimo e inferencial por meio do teste de *Friedman* para medidas repetidas. O nível de significância foi de p<0,05, sendo utilizado o software SPSS versão 10.0. Resultados: No primeiro momento obteve-se uma média de $VO_{2máx}$ de 38,34±1,68 ml/kg/min, no segundo 38,34±0,68 ml/kg/min e no terceiro 37,96±1,74 ml/kg/min, havendo diferenças significativas apenas no terceiro momento (p=0,005) com diminuição da *performance*. **Conclusão**: O nível de capacidade cardiorrespiratória foi classificado em razoável nos 3 momentos de teste pelo índice de VO_{2max}, com diminuição no terceiro momento, e não se caracterizou de forma satisfatória para as necessidades específicas da tropa durante o período investigado, se comparado aos níveis desta capacidade com outros estudos em militares. Novos estudos são recomendados, buscando avaliar os voluntários em diferentes fases do treinamento físico e tático, para análises mais precisas do impacto do programa.

Palavra chave: Ergometria, *Step Test,* Militares, Aptidão cardiorrespiratória.