26 - COMPARATIVE OF VO2MÁX AND MVO2MÁX CYCLIST ATHLETS PARTICIPANT IN THE PAN AMERICAN GAMES 2007 MODALIDADE MOUNTAIN BIKE, ACCLIMATED ALTITUDE COMPARED TO THE TEST IN THE SEA.

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Introduction

The mountain bike Santa is rising and is highlighting launching in the national scene of elite athletes who represent Brazil in international competitions. The city of São Bento do Sul, in the northern plateau is contesting relevant national prominence. The topography of the city seems to influence the development of athletes in the mode mountain bike. Thus it is open searches to identify some strength that will prove to be better than the other partners in the state of Santa Catarina.

It is known that the elite cyclists to have a high capacity for oxygen consumption. During the competition the system of transport of oxygen of the cyclist (cardiac output) and consumption (cellular enzymes) are often loaded on the maximum or near maximum (80 to 85% VO_2máx. - GARRETT & KIRKENDALL, 1997). The VO_2 max. (...) decreases with increasing altitude this decrease in VO 2 max. It is due to reduction in the blood concentration of oxygen that occurs will measure the pressure of oxygen decreases with altitude progressive (HOWLEY & FRANKS, 2000).

The objective of this study was to evaluate and compare indirectly maximum oxygen uptake alveolar (VO_2 max.) and the maximum oxygen uptake by the myocardium (MVO_2 max.) an athlete born in the mode mountain bike acclimated will altitude of 838m above the sea that participated in the Pan American Games 2007 in Rio de Janeiro and compares it to the level of the sea. The cities chosen for the survey were St. Benedict South to 838m above sea level and Joinville at sea level, both in the state of Santa Catarina.

The effects of training at altitude are similar to those observed at sea level, as well as the lack of training and the rest excessive accrue benefits acquired (VIVACQUA & HESPANHA, 1994). It is important to note that is not the MVO_2 and VO_2, which provides for how to increase the myocardial blood flow during exercise (THOMPSON, 2004). According to McArdle; Katch & Katch (1998, p. 472) "The training at altitude does not provide any additional benefit in relation to the performance observed at sea level, compared equivalent undertaken at sea level."

Methods

Indirect methods allow an assessment of consumption of oxygen bases in the exercises undertaken by individuals in the laboratory or in the field. These indirect tests for the evaluation of VO_2max testing can be divided into sub-maximum and maximum (AMORETTI & BRION, 2001). It is emphasized that the requirements requested by Resolution No. 196/96 of the National Council of Health on the role of human beings in research were followed.

The choice of the sample for testing occurred due to some pre-set criteria such as: young athlete, 27 years of age, healthy, participating evidence of extreme exhaustion and high duration, experienced maximum tests more than once, not reported any commitment to health in recent months. The athlete was evaluated by the maximum oxygen consumption using the protocol test Astrand maximum cycle, which is applied to 838m above sea level, where the athlete is and realize their training and compared to the same test conducted at sea level.

The tests were conducted in the month of October 2007; In room with temperature of 21 to 24 degrees Centigrade and relative humidity of the air between 40 to 60% there interval of 48 hours between their application, with a view to respect the physiological recovery of cyclist . The calibration was used a bicycle stationary model monark mechanical braking, to the protocol itself. The athlete was stimulated will be pedaling a speed of 60 rpm, and each stage of 3 minutes in length, will each stage plus 50 watts of power. The test was interrupted when the athlete failed to produce work due to the locking of the wheel.

The data were: body weight pre-participation, CF (heart rate) pre, intra-and post-test, PA (blood pressure) pre, intra-and post-test. The VO_2 max The formula was derived using indirect: 12 watts x + (weight x 3.5) proposal Astrand & Rodahl (1987). Parameters inotropic and cronotrópic were followed for the monitoring of physiological behavior buster, ensuring better security to the test the achievement of the maximal oxygen uptake by the myocardium (MVO_2 max.) If given by the formula indirect employment of Hellerstein: (double product x 0.0014 to 6.3 ml) in (O2 100g VE/min).

The product has been obtained using double calculation: (FHmáx. X SBPmáx.) . The VO_2máx alone reflects the functional capacity of the system buster (...) a classification and close to real shows the limit of 40ml/kg/min as the lowest amount of physical capacity for aerobic athletes aged between 20 and 54 years (YAZBEK, 1994). The athlete was accompanied during the period of recovery, noting the behavior athlete, and that all fell to the same parameters found in the pre-participation of the test.

Analysis of the Results

The athlete tested to 838m above sea level (Fig 01) ended the test completing the placement of 350watts, maintained will 60rpm, VO_2máx be obtained on 64.4 ml/kg/min and MVO_2 max. Will O2 100g VE 44 ml/min, tests conducted on the campus of St. Benedict Univille-South-SC. After 48 hours, was tested at sea level with the same climatic conditions of the first test.

The same athlete ended the test at sea level (Fig. 02) completing the placement of 350watts, maintained will 60rpm and VO_2max on of 64.4 ml/kg/min and MVO_2 max. 48.5 ml of O2 100g VE/min, tests performed at the Academy Coradelli Sports Fitness-Joinville-SC. Except remarks where in the first test, the athlete started the stage during of 400 watts for 12 seconds until the locking of the wheel and stopping, not completing this stage. In the second test, the athlete started the stage of 400 watts during by 33 seconds for the locking of the wheel and stopping, so not completing the stage.

The average values for the maximum oxygen intake for the elite cyclists are among the highest levels recorded; Subject to the male elite if ranged from 67.1 to 77.4 ml/kg/min (GARRETT & KIRKENDALL, 1997). Due to be an elite athlete to athlete and main mode of contesting national and hoped to find a result of VO_2max. At sea level greater than 838m to above sea level. We suspected that their income - if you gave your acclimatization and training in high altitude.

When the control groups were included appropriate, not been proven to live and train at altitude were better than the same training done on the level of the sea (MELLION, 1994). In intra-tracking test was cronotrópic and inotropic physiological

behavior, with no need for any interruption of work early. His recovery cronotrópic and inotropic had physiological behavior

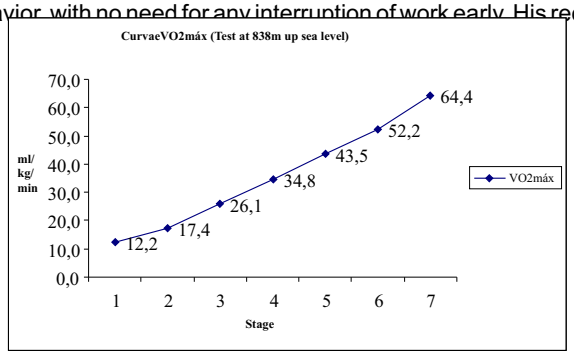

Fig. 01

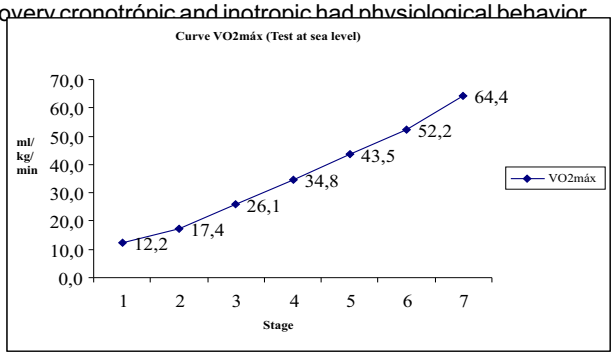

Fig. 02

Conclusion

We conclude that the athlete has no variation in their maximum oxygen uptake will alveolar level (VO_2 max.) Measured indirectly in their environment acclimated will altitude of 838m related to their performance at sea level. His curve of maximum oxygen uptake (VO_2 max) Received no differences between the altitudes where he was evaluated, remaining with the same parameters between the first and second test of 64.4 ml/kg/min.

The athlete remained the same maximum oxygen uptake on the tests, and that their maximum oxygen consumption by the myocardium (MVO_2 max.) Suffered indirectly observed variations in relation to altitude at which it was tested. Analyzing the curve of the maximal oxygen uptake (Fig. 03) by the myocardium (MVO_2 max.) , I noticed that there was a greater uptake at sea level of 48.5 ml O2 100g VE/min. Compared to the test altitude of 838m which were obtained O2 100g VE 44 ml/min. A difference of 4.6 ml O2 100g VE/min, in their co

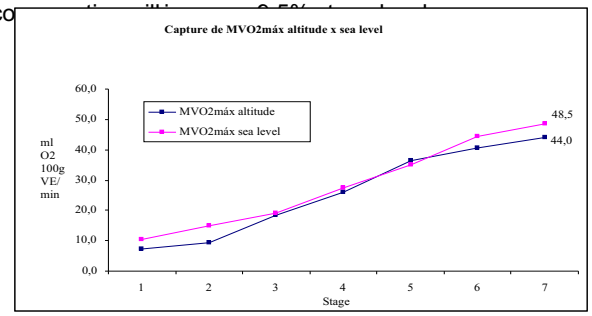

Fig. 03

The athlete got more performance at sea level for the MVO_2 max. Data obtained and evaluated with some corroborating statements found in the literature. According McArdle; Katch & Katch (1998, p. 643) "The aerobic capacity not suffer any measurable change to a higher altitude of 1,500 m. Thereafter, the VO_2max. Suffer a linear reduction of approximately 10% for each increase of 1,000 in altitude. " Aware that tests indirect generate differences in the standard deviation and can be significant in the context in reaching the most accurate, it is so then research the athlete Pan American and its yield using equipment from direct measurement of VO_2max. Need for more acutely their income.

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COMPARATIVE OF VO_2MÁX AND MVO2MÁX CYCLIST ATHLETS PARTICIPANT IN THE PAN AMERICAN GAMES 2007 MODALIDADE MOUNTAIN BIKE, ACCLIMATED ALTITUDE COMPARED TO THE TEST IN THE SEA LEVEL.

ABSTRACT:

The literature points to studies on the behavior of the body in the consumption of oxygen at altitude and that individual can benefit from that difference in relation to its performance. This study aimed to assess and compare general will indirectly maximum oxygen uptake alveolar (VO_2max.) and maximum oxygen uptake by the myocardium (MVO_2 max.) An athlete born in the mode mountain bike acclimatization wills altitude of 838m above the sea that participated in the Pan American Games 2007 in Rio de

Janeiro and compares it to the level of the sea. The sample for the test was, due to the following criteria: Young athlete with 27 years of age, healthy, participating evidence of extreme exhaustion and high duration, experienced maximum tests more than once, not reported any commitment to health in recent months. The athlete was evaluated by the maximum oxygen consumption using the protocol test Astrand maximum cycle, which is applied to 838m above sea level, where the athlete is and realize their training and compared to the same test conducted at sea level. The results of that test were the athlete remained the same maximum oxygen uptake relative to 64.4 ml / kg / min in testing, and that their maximum oxygen consumption by the myocardium (MVO_2 max.) Suffered indirectly observed variations on will altitude at which it was tested. Analyzing the curve of the maximum oxygen consumption by the myocardium (MVO_2 max.), I noticed that there was a greater uptake at sea level of 48.5 ml O_2 100g VE/min. Compared to the same test will altitude of 838m, which was obtained O_2 100g VE 44 ml/min. the difference of 4.6 ml O_2 100g VE/min, increasing their consumption to 9.5% at sea level. The athlete received significant performance at sea level. KEY-WORDS: VO_2Max, Altitude, Cyclist.

COMPARATIFS ET DE VO_2MÁX MVO$_2$MÁX CYCLISTE ATHLÈTES PARTICIPANT AUX JEUX PANAMERICAINE 2007 MODALIDADE VÉLO DE MONTAGNE, ACCLIMATÉ ALTITUDE, COMPARÉ À L'ESSAI DANS LE NIVEAU DE LA MER.

RESUME:

La littérature des points à l'étude sur le comportement de l'organe de la consommation d'oxygène en altitude et que l'individu peut bénéficier de cette différence par rapport à ses performances. Cette étude visait à évaluer et à comparer volonté générale indirectement maximale d'oxygène alvéolaire (VO_2max.) et le maximum d'oxygène par le myocarde (Homme2 maximum). Un athlète né dans le mode VTT acclimatation testaments altitude de 838m au-dessus de la mer qui ont participé à la Jeux panaméricains 2007, à Rio de Janeiro et les compare au niveau de la mer. L'échantillon pour l'essai a été, à cause de la base des critères suivants: Jeune athlète à l'âge de 27 ans, en bonne santé, en participant preuve d'une extrême fatigue et de haute durée maximum de l'expérience des tests plus d'une fois, pas signalé aucun engagement pour la santé au cours des derniers mois. L'athlète a été évaluée en fonction du maximum de la consommation d'oxygène en utilisant le protocole d'essai maximale Astrand cycle, qui est appliqué à 838m au-dessus du niveau de la mer, où l'athlète et de concrétiser leur formation et leur rapport à la même test effectué au niveau de la mer. Les résultats de cet essai ont été l'athlète resté le même maximum d'oxygène par rapport à 64,4 ml /kg de poids/min en essais, et que leur consommation maximale d'oxygène par le myocarde (Homme2 maximum). Subies indirectement variations observées sur l'altitude à laquelle se Il a été testé. L'analyse de la courbe de la consommation maximale d'oxygène par le myocarde (Homme2 maximum), J'ai remarqué qu'il y avait une plus grande absorption au niveau de la mer de 48,5 ml de O_2 100g VE/mn. Par rapport à la même test altitude de 838m, qui a été obtenue O_2 100g VE 44 ml/mn. La différence de 4,6 ml de O_2 100g VE/mn, en augmentant leur consommation de 9,5% au niveau de la mer. L'athlète a reçu de performance significatifs au niveau de la mer.

MOTS-CLES: VO_2Max, Altitude, Cyclistes.

COMPARATIVO DE VO_2MÁX Y MVO2MÁX ATLETA CICLISTA PARTICIPANTE EN LOS JUEGOS DE 2007 PANAMERICANA MODALIDAD DE BICICLETAS DE MONTAÑA, ACLIMATADAS EN ALTURA EN COMPARACIÓN CON LA PRUEBA EN EL MAR.

RESUME:

La literatura indica que los estudios sobre el comportamiento del cuerpo en el consumo de oxígeno en la altitud y esa persona pueden beneficiarse de esa diferencia en relación a su desempeño. El objetivo del estudio fue evaluar y comparar general indirectamente la captación máxima de oxígeno alveolar (VO_2max.) y la captación máxima de oxígeno por el miocardio (MVO_2 máx.) Un atleta nacido en la modalidad de bicicletas de montaña de aclimatación voluntades altitud de 838m por encima del mar que participaron en la Juegos Panamericanos del 2007 en Río de Janeiro y la compara con el nivel del mar. La muestra para la prueba, debido a los siguientes criterios: atleta joven con 27 años de edad, sano, participando pruebas de agotamiento extremo y de alta duración, con experiencia máxima pruebas más de una vez, no se informa de ningún compromiso con la salud en los últimos meses. El atleta fue evaluado por el consumo máximo de oxígeno utilizando el protocolo de prueba Astrand ciclo máximo, que se aplica a 838m sobre el nivel del mar, en el que el deportista es y darse cuenta de su formación y en comparación con el mismo ensayo realizado en el nivel del mar. Los resultados de este ensayo fueron la atleta se mantuvo la misma la captación máxima de oxígeno en relación con 64,4 ml de /Kg/min en los ensayos, y que su consumo máximo de oxígeno por el miocardio (MVO_2máx.) Sufrido indirectamente, las variaciones observadas en altitud a la que se hizo un teste. El análisis de la curva del consumo máximo de oxígeno por el miocardio (MVO_2 máx.), Me di cuenta de que había una mayor absorción a nivel del mar de 48,5 ml de O_2 100g VE/Min. En comparación con la misma prueba de 838m de altitud, que se obtuvo de O_2 100g VE 44 ml/min,. La diferencia de 4,6 ml de O_2 100g VE/m, el aumento de su consumo a un 9,5% en el nivel del mar. El atleta recibió gran rendimiento en el nivel del mar.

PALABRAS-CLAVE: VO_2Máx, Altitud, Ciclista.

COMPARATIVO DO VO_2MáX. E MVO$_2$MÁX. EM ATLETA CICLISTA PARTICIPANTE DOS JOGOS PAN-AMERICANOS 2007 MODALIDADE MOUNTAIN BIKE, ACLIMATADO á ALTITUDE COMPARADO AO TESTE AO NíVEL DO MAR.

RESUMO:

A literatura aponta para estudos sobre o comportamento do organismo no consumo de oxigênio em altitude e que indivíduos podem ser beneficiados com essa diferença em relação á sua *performance*. Este estudo teve como objetivo geral avaliar e comparar indiretamente á captação máxima de oxigênio alveolar (VO_2 máx.) e captação máxima de oxigênio pelo miocárdio (MVO_2 máx.) de um atleta catarinense na modalidade *mountain bike* aclimatado á altitude de 838m acima do nível do mar que participou dos Jogos Pan-americanos 2007 na cidade do Rio de Janeiro e compará-lo ao nível do mar. A amostra para o teste se deu devido aos seguintes critérios: atleta jovem com 27 anos de idade, saudável, participante de provas extremas de exaustão e alta duração, vivenciou testes máximos mais de uma vez, não relatou qualquer comprometimento de saúde nos últimos meses. O atleta foi avaliado pelo consumo máximo de oxigênio utilizando o protocolo de teste máximo cicloergômetro Astrand, sendo este aplicado á 838m acima do nível do mar, onde o atleta reside e realiza seus treinamentos e comparado ao mesmo teste realizado ao nível do mar. Os resultados obtidos com teste foram que o atleta manteve a mesma captação máxima de oxigênio relativo de 64,4 ml/kg/min nos testes realizados, sendo que seu consumo máximo de oxigênio pelo miocárdio (MVO_2 máx.) observado indiretamente sofreu variações em relação á altitude em que foi testado. Analisando a curva do consumo máximo de oxigênio pelo miocárdio (MVO_2 máx.), observamos que houve uma maior captação ao nível do mar de 48,5 ml O_2 100g VE/min. comparado ao mesmo teste á 838m de altitude, onde foi obtido 44 ml O_2 100g VE/min. Uma diferença de 4,6 ml O_2 100g VE/min, aumentando o seu consumo á 9,5 % ao nível do mar. O atleta obteve significante *performance* ao nível do mar.

PALAVRAS-CHAVE: VO_2 Máximo, Altitude, Ciclista.