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# ERGOSPIROMETRY IN HIGH PERFORMANCE SPORTS

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In sport activities where aerobic metabolism is one of performance determining factors, there is a constant search for improved methods and variables to be used for athlete evaluation. Current state-of-the-art recognizes aerobic significance both to classical aerobic activities, such as cycling, triathlon and long races and the so-called intermittent sports, like collective and racket sports and combats. The latter are generally called alternate aerobic-anaerobic sports.

For a long time, based on basic publications[1,2], there has been a growing interest in using maximum oxygen consumption ($VO_2$max) as the single integrating variable of aerobic activities. From the discussion that started in the seventies about the significance of $VO_2$max genetic assessment and the problems of performance discrimination in homogenous groups, investigation of other variables has started, notably abut metabolic/ventilation transition thresholds (TT) and sub-maximum oxygen consumption ($VO_2$sub), the latter as an "economy of movement" indicator" [3].

In many cases, in the daily routine of physical evaluation and training prescription programs, prejudice about $VO_2$max and respective use in ergometry with athletes was exaggerated. Right now the value of ergospirometric evaluations by other variables is not challenged. It is agreed that such variables led to a considerable development of the understanding of the path to be followed for pedagogical training decision making. However, in the light of current knowledge, we must go back to the discussion about the significance of $VO_2$max for athletes, once the use of TT and $VO_2$sub is already sufficiently consolidated.

Taking the example of marathoners, several authors discussed the fact that great champions had been successful in their careers despite a lower than expected high performance $VO_2$max. The most frequently mentioned examples are former Australian world record breaker Derek Clayton (2:08:38)[4], with 69.7 $ml \cdot kg^{-1} \cdot min^{-1}$ and Swedish Hjell-Erik Stahl (2:10:38)[5] with 66.8 $ml \cdot kg^{-1} \cdot min^{-1}$. Yet, as Mark Twain once said: "Few things are harder to put up with than the annoyance of a good example"[3].

> *In the light of the current knowledge, it is necessary to reactivate the discussion on the importance of $VO_2$max for athletes, since the use of LT and $VO_2$sub is already highly consolidated.*

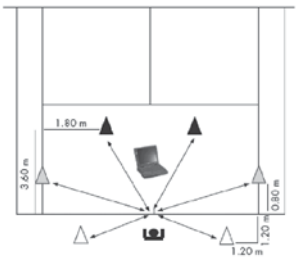
It must always be emphasized that a high $VO_2$max is a "membership card" allowing athletes to enter the elite of leading medium and long duration performers[3]. For example, one of the most elegant studies on the subject was conducted with Kenya athletes in 1995 by Dr. Bengt Saltin's group[6], evidencing that several teenager athletes in that country have a $VO_2$max of approximately 80 $ml \cdot kg^{-1} \cdot min^{-1}$ at sea level and between 65 - 70 $ml \cdot kg^{-1} \cdot min^{-1}$ when assessed in altitude. When younger ones were evaluated, the most active (non-athletes) who walked or ran constantly presented values approximately 30% above those of their Scandinavian counterparts. Thus, it seems that the success of these athletes comes not only from cultural and behavioral aspects, but from "training" starting at lower ages, resulting in additional high $VO_2$max values.

Considering that $VO_2$max evolution is lower than TT changes, $VO_2$max should be preferred for the process of finding and selecting sport talents for long duration. This is in line with the current model, in which we check the evolution of athletes who transit from

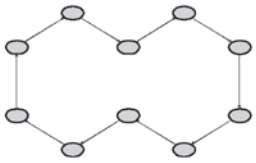
shorter to longer long distance races, and the analysis of high level performance data shows that the best racers are those presenting the various high performance determining aspects[7]. Continuing, we can say that athletes with higher $VO_2$max, TT and lower $VO_2$ sub are able to work at a higher percentage of their $VO_2$max[7].

> *Major investment was in field of test application studies, where VO2max was measured in more specific activities through the use of a portable gas analyzer.*

Recently the most significant investment made by our Evaluation Service targeted research on the application of field tests, with $VO_2$max determination in more specific activities using portable gas analyzers. For CENESP/UNIFESP evaluations, following the model used by sport physician Jacobo Vazquez (CBHD) and studies conducted by professors João Dubas and Rafael Fachina (CEFE), they were introduced, for example, in the evaluation of Brazilian Pan American and Olympic elite, changes to tests like the Girard[8] (figure A) with tennis players and Probst[9] (figure B) tests with handball athletes.




A.



B.

The purpose of these tests was to enable further introduction of activities reflecting a specific muscle involvement and standards of movement that are specific to these sports, with assessment of the ergospirometric variables generally obtained in the lab. In the near future we intend to present field alternatives for other Pan American and Olympic sports, with investment in applied research.

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