VO2MAX AND TEAM SPORTS PERFORMANCE

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VO2MAX AND REPEATED SPRINT ABILITY

Because of the intermittent, repetitive and high intensity character of the plays encountered during team sports, it is often believed that a high aerobic power (i.e.: VO2max) plays an important role in enhancing the repeated sprint ability.

Although this may seems surprising, recent sport science research shows a poor relationship between VO2max and the recovery capacity between repeated sprints. Furthermore, some studies point the fact that for athletes having a similar VO2max, significant recovery capacity differences exist following maximal effort. This is the reason why, some authors consider VO2max as a poor indicator of repeated sprint performance capacity (Cooke et al., 1997).

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If we consider the most recent studies, only a poor to moderate relationship ($r<.50$) exists between VO2max and the capacity to produce short, maximal and repeated efforts. These studies point the fact that the repeated sprint ability rely more of enhanced anaerobic metabolisms and strength/power related fitness (relative strength, rate of force development, power, strength-endurance, etc) than on those of the aerobic metabolism (VO2max, anaerobic threshold, running economy).

For example, a recent study has examined the effects of hypoxia on repeated sprints performance (the oxygen concentration in ambient air has been reduced from 20.9% to 13%). Results from this study shows that even in a reduced oxygen intake environment, maximal power outputs equal or inferior to 60s were unaffected. These authors concludes that repeated sprint performance rely more on anaerobic pathways than on aerobic power and efficiency (Weyand et al, 1999).

A New-Zealand study (Keogh, 1999) demonstrates that VO2max is not a factor that elite and sub-elite rugby players. Discriminant factors were strength and power related qualities. In addition, Singaporians researchers (Aziz et al., 2000) have established that VO2max is moderately correlated with overall performance time, as measured during repeated maximal sprinting (8x40m). These authors concludes that VO2max explain only 12% of the repeated sprint performance and that VO2max improvement will only have a minor impact when performance rely on repeated maximal sprinting.

**VO2MAX AND COMBAT EFFORTS**

In contact team sports such as US football or rugby union athletes must often produce powerful and repeated isometric or quasi-isometric muscular contractions for several seconds (during which the muscle contracts powerfully without lengthening or shortening). During isometric or quasi-isometric contractions are - even if the contraction intensity is about 10% of the maximal isometric strength- a blood vessels occlusion occurs within the contracted muscle groups (Murthy et al., 1997). This phenomenon prevent the blood flow to bring oxygen to the cells and the removal of the ATP combustion by-products. This situation, if lasting more than a few seconds, provoke a quick rise in muscular fatigue and an important decrease in muscle performance capacity (ie: when a player wrestle with an opponent or during the push phase of a scrum).

When the powerful contraction cease, the blood flow is re-enabled, oxygen brought back to the cells and metabolites quickly removed.

Because of the quick repetition of these powerful isometric or quasi-isometric muscular contractions that often occurs in contact team sports, muscular fatigue is a limiting factor of performance. In addition, since blood flow is reduced during these efforts, VO2max (oxygen consumption) is rarely solicited during these efforts or during the recovery phase following these efforts. The limited role of VO2max in wrestling activities is illustrated by a study demonstrating that elite and sub-elite wrestlers cannot be discriminated on the base of their VO2max (Horswill, 1989).
VO2MAX AND OVERALL ACTIVITY DURING A GAME

Although recent research results decrease the importance of VO2max and aerobic components in team sports performance, a weak aerobic component is a limiting factor in performance as well. Therefore, if an high VO2max is not a guarantee of performance in repeated sprints or wrestling efforts, VO2max must be developed to an optimum level in order to allow the athlete maintain a high activity level during the whole game without demonstrating excessive fatigue.

CONCLUSION

From the latest sports-science studies it seems that once aerobic power has been developed to an optimum level, further improvement in VO2max will have minimal effects on performance (Aziz et al., 2000).

Development of VO2max can be performed successfully within a few weeks with repeated sprint and/or sports-specific activities with or without ball (Finn, 2001).

An overemphasis on VO2max and aerobic endurance development (unless a player demonstrates important weaknesses in that area) may provoke excessive fatigue, reduce muscle mass and reduce the training time devoted to the optimum development of neuromuscular, technical or tactical qualities. This can be extremely prejudicial to match performance and should be avoided.

REFERENCES

- Finn, C,: Effects of High-Intensity Intermittent Training on Endurance Performance; Sportscience 5(1), sportsci.org/jour/0101/cf.html, 2001
• Serresse O; Lortie G; Bouchard C; Boulay MR: Estimation of the contribution of the various energy systems during maximal work of short duration; Int J Sports Med 1988 Dec;9(6):456-60
• Siff et Verchoshansky; Supertraining, Sports Support Syndicate, USA, 1996