"ENERGY TRANSFER IN SHORT AND LONG DURATION EXERCISES"

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Short Duration Exercise

The major food fuel, during short duration exercise is Carbohydrate. Fats play a minor role whereas, contribution of protein is negligible. The anaerobic system play a predominant role. Major source of ATP is supplied anaerobically by the phosphagen system and the lactic acid system. This does not imply that the aerobic system is not functioning at all. The aerobic system cannot alone supply the required ATP for such high intensity exercises. The question then arises as to what is the limitations of aerobic system in adequately supplying ATP. Answer to this question is probably related to two factors. Firstly, there is a limit of one's maximal rate of oxygen consumption (VO_2max.). Research reveals that the VO_2 max. of trained athlete is 3.0 lit/min. for females and 5.0 lit/min. for males whereas, VO_2 max for untrained female is 2.2 lit/min. and that of male is 3.2 lit/min. It may be noted that, these levels of VO_2 max. is not sufficient to supply, all the ATP during a 100 mts. dash which may require around 8 litres of O_2/100 mts/10 seconds. Secondly, for further increasing the VO_2 max to a higher level, it could take

at least 2 to 3 minutes of exercise because of the time taken for physiological and biochemical adjustments. That means, during short duration and high intensity exercise there would be always an oxygen deficit (the period during which the level of O_2 consumption is below that necessary to supply total ATP required during exercise) and thus the phosphagen system and the glycolytic system are the major sources of ATP. The type of exercise under this classification include the duration upto 2 or 3 minutes. Sprinting activities from 100 mts. to 400 mts event and 800 mts. are nowadays considered an activity with maximum speed especially at the international level.

In such activities the level of blood lactic acid is very high. Research reveal a level of 200 mg% of blood lactic acid levels recorded in competitive track sprint and swimming events. This indicates an increase in twenty times above resting values (10 mg%).

In order to analyse the role of aerobic and anaerobic system, the level of blood lactic acid is to be evaluated. A high level of blood lactic acid indicates a predominant role of the anerobic system whereas, on the contrary if the level is low, lead role is that of aerobic system.

Long Duration Exercise

Activities which are continued for 10 minutes or longer are included in this category. The carbohydrate and the fat are the major sources of fuel. In activities where the duration is 20 minutes, major role is played by carbohydrates whereas, fats contribute to a less extent. In such activities, the level of blood lactic acid is high and not maximal. As the duration of activity further increases to an hour, a stage comes where the store of glycogen is depleted totally, and it is here that fat assumes the major source of fuel for the resynthesis of ATP. The use of fat and glycogen in combined way, depends on the athletes' training state, the fibre type compositions and the initial stores of glycogen. During such exercise, the aerobic system plays a predominant role. The anaerobic system also contributes as a

source of ATP, but it is specially in the beginning of the exercise, before the steady state level of oxygen is achieved and at the end of a competitive race. After 2 or 3 minutes of exercise when the steady state level is achieved, then it is sufficient for the aerobic system to supply the source of ATP. That is the reason why the lactic acid does not accumulate to maximal levels in prolonged activities, due to the presence of oxygen and also at the same time, there is no inhibition in the resynthesis of ATP.

Thus, anaerobic glycolysis is put off after the steady state of oxygen consumption is achieved. The small amount of lactic acid which was accumulated before the onset of steady state remains relatively constant till the end of exercise. But in certain cases, the anaerobic glycolysis may be once again called upon to win a long distance race and this would simultaneously raise the blood lactate levels by the end of the race.

On the other hand, certain athletes may end up race like marathon, with a steady state effort. In such cases too the athletes' experience fatigue without any increase in the blood lactic acid levels (a fatigue factor) is found at the end of the race. Probable reasons that contribute to such fatigue could be:

(a) low blood glucose levels due to the depletion of liver glycogen stores.

(b) the depletion of muscle glycogen which results in local muscular fatigue.

(c) loss of water and electrolytes through sweating, resulting in an increased body temperature.

(d) psychological reasons like monotony, boredom etc.