Relation between plasma lactate concentration and fat oxidation rates over a wide range of exercise intensities.

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Increasing exercise intensities will induce an increase in glycolytic flux. High glycolytic activity is associated with reduced fat oxidation rates and increased accumulation of lactate. Both lactate and hydrogen ions have been shown to be directly related to the decreased fat oxidation rates. The aim of the present study was to determine whether the exercise intensity at which maximal fat oxidation rates occur coincides with the intensity at which lactate starts to accumulate in plasma. Thirty-three moderately trained endurance athletes performed a graded exercise test to exhaustion on a cycle-ergometer with 35 W increments every three minutes. Expired gas analysis was performed throughout the test and stoichiometric equations were used to calculate fat oxidation rates. The intensity which elicited maximal fat oxidation (Fat (max)) and the intensity at which fat oxidation rates became negligible (Fat (min)) were determined. Blood samples for lactate analysis were collected at the end of each stage of the graded exercise test. The intensity at which lactate concentration increased above baseline (LIAB) and the lactate threshold (LT-D) were determined (D-max method). Fat (max) was located at 63 +/- 9 % V.O (2)max and LIAB at 61 +/- 5 % V.O (2)max and there appeared to be no statistical difference between the two intensities. Fat (max) and LIAB were significantly correlated. Fat (min) and LT-D were also significantly correlated but were located at different intensities (82 +/- 7 and 87 +/- 9 % V.O (2)max respectively). The data of the present study showed that accumulation of lactate in plasma is strongly correlated to the reduction seen in fatty acid oxidation with increasing exercise intensities. The first rise of lactate concentration occurred at the same intensity as the intensity which elicited maximal fat oxidation rates.

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Determination of the exercise intensity that elicits maximal fat oxidation.

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PURPOSE: The aim of this study was to develop a test protocol to determine the exercise intensity at which fat oxidation rate is maximal (Fat(max)). METHOD: Eighteen moderately trained cyclists performed a graded exercise test to exhaustion, with 5-min stages and 35-W increments (GE(35/5)). In addition, four to six continuous prolonged exercise tests (CE) at constant work rates, corresponding to the work rates of the GE test, were performed on separate days. The duration of each test was chosen so that all trials would result in an equal energy expenditure. Seven other subjects performed three different GE tests to exhaustion. The test protocols differed in stage duration and in increment size. Fat oxidation was measured using indirect calorimetry. RESULTS: No significant differences were found in Fat(max) determined with the GE(35/5), the average fat oxidation of the CE tests, or fat oxidation measured during the first 5 min of the CE tests (56 +/- 3, 64 +/- 3, 58 +/- 3%VO(2max), respectively). Results of the GE(35/5) protocol were used to construct an exercise intensity versus fat oxidation curve for each individual. Fat(max) was equivalent to 64 +/- 4%VO(2max) and 74 +/- 3%HR(max). The Fat(max) zone (range of intensities with fat oxidation rates within 10% of the peak rate) was located between 55 +/- 3 and 72 +/- 4%VO(2max). The contribution of fat oxidation to energy expenditure became negligible above 89 +/- 3%VO(2max) (92 +/- 1%HR(max)). When stage duration was reduced from 5 to 3 min or when increment size was reduced from 35 to 20 W, no significant differences were found in Fat(max), Fat(min), or the Fat(max) zone. CONCLUSION: It is concluded that a protocol with 3-min stages and 35-W increments in work rate can be used to determine Fat(max). Fat oxidation rates are high over a large range of intensities; however, at exercise intensities above Fat(max), fat oxidation rates drop markedly.

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