LACTATE, PYRUVATE AND THYROID FUNCTION

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HucKabee (1958) has emphasized the value of the increase in the lactate:pyruvate ratio in the arterial blood as an index of tissue anoxia. In the present study this ratio in the peripheral venous blood was used for the same purpose, and the lactate and pyruvate values were considered as an index of hypermetabolism or hypometabolism in hyperthyroid and hypothyroid patients respectively.

Blood samples were obtained from the patients in the morning after an overnight fast (12 hr.) from a forearm vein, without stasis and after prolonged immobilization of the arm. For 1 hr. before the withdrawal of the blood the patients were lying quietly in bed under basal conditions. The blood was always mixed with 0·6 N-perchloric acid within 3 min. of withdrawal; delay beyond 3 min. could cause lower pyruvate and higher lactate values (HucKabee, 1956). Enzymatic Kits supplied by C. F. Boehringer, Mannheim, Germany were used and the instructions of the manufacturer were followed for the measurements. The values were expressed in mg./100 ml. whole blood. A correction of the values was done in the hypothyroid patients as described by HucKabee (1956) and Seibert & Ebaugh (1967), because of the low-packed cell volume in these patients. The lactate:pyruvate ratio was calculated by dividing the values in mg. Previous conversion of the mg. values to moles was not necessary because of the very small difference in the molecular weight between these two anions.

The subjects in this study were 14 healthy students aged between 23–34, 15 hyperthyroid patients aged 31–67 and seven hypothyroid patients aged 45–67 yr., diagnosed as described by Malamos, Daikos, Samara & Koutras (1959).

The pyruvate values found in the controls, 0.77 ± 0.13 mg./100 ml. (mean ± s.d.), were significantly lower than in the hyperthyroid, 1·07 ± 0·27 (P < 0.001) and higher than in the hypothyroid patients, 0·62 ± 0·13 (P < 0·025). The lactate in the controls, 8·13 ± 3·08, was significantly lower than in the hyperthyroid, 12·42 ± 4·85 (P < 0·01), but not significantly different from that in the hypothyroid group, 10·15 ± 1·59. The lactate:pyruvate ratio in the hyperthyroid group, 11·41 ± 2·69, fell within the normal range of 10·66 ± 3·92, while in the hypothyroid subjects the value of 17·08 ± 5·45 was significantly higher than in the previous two groups (P < 0·025 and P < 0·025 respectively). No correlation was found between the lactate and pyruvate in the controls (r = 0·23) and the hypothyroid group (r = −0·08), while a positive correlation was present in the hyperthyroid group (r = 0·83, P < 0·001).

One hour after the i.m. injection of 100 mg. co-carboxylase in the hyperthyroid patients, the lactate fell to 9·88 ± 3·02 and the pyruvate to 0·84 ± 0·17, both values well within the normal range (i.e. no difference from the control group by the t test).

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The fall was significant ($P < 0.025$ for the lactate and $P < 0.005$ for the pyruvate) by the paired $t$ test. No change in the lactate:pyruvate ratio was observed for the group as a whole ($11.83 \pm 3.06$ after the injection). The results in the hyperthyroid patients may be explained by a subclinical degree of vitamin $B_1$ deficiency due to increased metabolic demands.

The similar lactate:pyruvate ratio between normal and hyperthyroid subjects suggests that there is no hypoxia in the tissues of these patients. However, the higher ratio found in this study in the hypothyroid group is suggestive of hypoxia. This is in disagreement with the findings of Graettinger, Muenster, Checchia, Grissom & Campbell (1958), who found in hypothyroidism a normal mean arteriovenous oxygen difference and normal mean oxygen extraction ratios between arterial blood and blood from the pulmonary artery. In our study peripheral venous blood was examined and thus local factors in the myxodematous arm cannot be excluded as a cause of anoxia. The haemoglobin in the hypothyroid subjects in this study was always above $6 \, \text{g.}/100 \, \text{ml.}$ and thus severe anaemia cannot be considered as a factor for the hypoxia observed (Seibert & Ebaugh, 1967).

The use of lactate and pyruvate in the venous blood as a non-specific index of thyroid function is limited by the great overlap between the controls and the thyroid patients. The pyruvate values found in the controls were higher than the normal range given by the manufacturer of the Enzymatic Kits, possibly because of the high carbohydrate intake of the Greek people and the relative youth of the control group in this study.

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REFERENCES


