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8 Stress causes increased urinary excretion of thyroid hormones

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Contradictory results are reported in the literature about the connection between thyroid function and stress. We were interested in the change of free triiodothyronine (T_3) and thyroxine (T_4) in serum as induced by stress: Therefore, the urinary excretion of both hormones was measured [1] in helicopter pilots on the day of a flight and [2] in soldiers with experimentally provoked motion sickness (coriolis effect).

Methods: The urine of helicopter pilots ($n = 11$) was obtained from 6 collecting periods on a control day and on a day with two flights. In the other experiment, male subjects ($n = 35$) were exposed on a rotation chair and motion sickness was provoked by the coriolis effect. A total of 9 blood samples was drawn before, immediately after and 15 to 20 min subsequent to the rotation. Urine was obtained from 15 hours before to 21 hours after the rotation in 4 collection periods. The determination of T_3 and T_4 was carried out on sephadex columns, on which the extraction, the incubation with specific antibodies and the separation of antibody bound and free hormone was performed [1]. The determination of the catecholamines was performed with the method of *Weil-Malherbe* [2]. The control 24-h excretions were $1.70 \pm 0.40 \mu\text{g } T_3$ and $1.44 \pm 0.51 \mu\text{g } T_4$ (mean + SD, $n = 20$), the mean excretions of epinephrine and norepinephrine were $5.77 + 1.76 \mu\text{g}$ and $15.25 + 5.38 \mu\text{g}$ (SD, $n = 10$), respectively. The percent increase of the hormone excretions in relation to the night periods was calculated for all urines.

Results: Already before the helicopter flight (expectation), but not during the flight of the experienced pilots, the percent increases of urinary T_3 ($42 \pm 14\%$, mean \pm SE) and T_4 ($86 \pm 21\%$) were statistically significant ($p < 0.005$) as compared to the control day. In the experiment with motion sickness (Fig. 1), the period of rotation showed percent increases of T_3 ($121 \pm 26\%$, $p < 0.01$) and of T_4 ($268 \pm 59\%$, $p < 0.025$), which were significantly different from normal excretion. Simultaneously, the epinephrine excretion increased to $219 \pm 41\%$ and norepinephrine to $180 \pm 57\%$. Likewise, the excretions of T_3 ($p < 0.01$) and T_4 ($p < 0.05$) were elevated in the collection period after the rotation. The T_4 levels in serum and the T_3 -uptake tests ($n = 11$) showed no response to motion sickness, although the basal TSH-levels ($n = 13$) decreased continuously to 45% ($p < 0.025$). Rotation without provocation of the coriolis effect caused no change in thyroid hormone excretion.

Conclusions: Stress situations (expectation, motion sickness) lead to an increased excretion of T_3 and T_4 in the urine. In spite of the unchanged total thyroxine levels in serum, this situation effects a suppression of TSH.

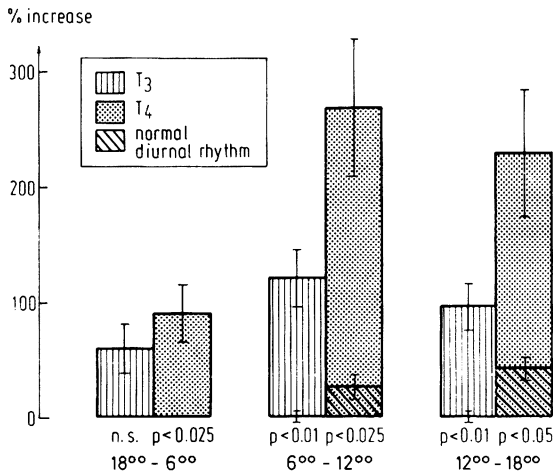


Fig. 1: Percent increase (mean + SE) of T_3 and T_4 excretion in urine observed in control subjects ($n = 11$) and subjects ($n = 35$) with experimentally provoked motion sickness and the significance of differences to the normal diurnal variation. The increase is related to the night period (18.00—6.00); the rotation experiment was at 9.00 a.m.

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