ABSORPTION OF I^{131} BY THE THYROID GLAND IN ATHLETES DURING PHYSICAL EXERTION

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It has been reported in the literature that certain nonspecific stimuli causing a state of "stress" in the organism lowered the absorption of I^{131} by the thyroid gland [1, 5-12]. We also know that severe physical exertion caused manifestations of depression of thyroid function in experimental animals [1, 3, 4, 13, 14]. It would be interesting to know to what extent physical exertion in athletes modifies the normal activity of the thyroid gland. The elucidation of this problem would give an indirect answer to another question: is physical exertion in athletes a stimulus giving rise to Selye's "stress" reaction [4].

EXPERIMENTAL METHOD

The investigation was conducted on 16 healthy athletes, aged between 20 and 24 years, qualified in light athletics and in grades I to III of proficiency. At the moment of investigation, six subjects were inadequately trained, while the rest were in form. As a first step, all the athletes received a general medical examination (in accordance with the method adopted by the sector of athletic medicine of the Central Research Institute of Physical Culture), supplemented by special endocrinological investigations. No abnormality of thyroid function was observed, but two of the young subjects were found to have juvenile goiter of the first or second degree. The history showed that none of these subjects had been treated with iodine or bromides before the investigation.

The thyroid function was investigated twice in each athlete. The first investigation was carried out in accordance with the following plan. The fasting subject was given a drink of 5-10 ml distilled water containing 1-2 mCi of radioactive iodine (NaI^{131} without carrier). The tumbler was rinsed three times with distilled water, and this the subject also drank. The athletes then ran a 3000 m race on an indoor track and completed a series of running exercises. Two hours from the time of taking the I^{131}, the first measurement of absorption of isotope by the thyroid gland was made. In addition, the level of radioactivity in the thyroid gland was measured after 4, 24, and 72 h. During this period the athletes carried out no training exercises.

The radioactivity was measured with an AMM-4 counter coupled to a B-2 apparatus. The concentration of isotope in the thyroid was expressed as a percentage of the dose of I^{131} injected.

Two weeks after the first investigation, in all the athletes a second determination of the pattern of I^{131} absorption by the thyroid gland was made. On this occasion administration of I^{131} was not followed by exertion. When the radioactivity in the thyroid gland was measured, the residual level of the isotope after the first administration was taken into account. The results of the investigations were analyzed by the statistical method described by M. L. Belen'kii [2].

EXPERIMENTAL RESULTS

In 14 athletes the absorption of I^{131} during the first 2 h of the first determination (after physical exertion) was lowered than at subsequent measurements (without physical exertion), and in two (those with juvenile goiter) it was higher.

On the average, the level of absorption of I^{131} in a period of 2 h in the experiment with physical exertion was half that in the experiment without physical exertion (see table). The differences between the values were statistically significant (see figure).

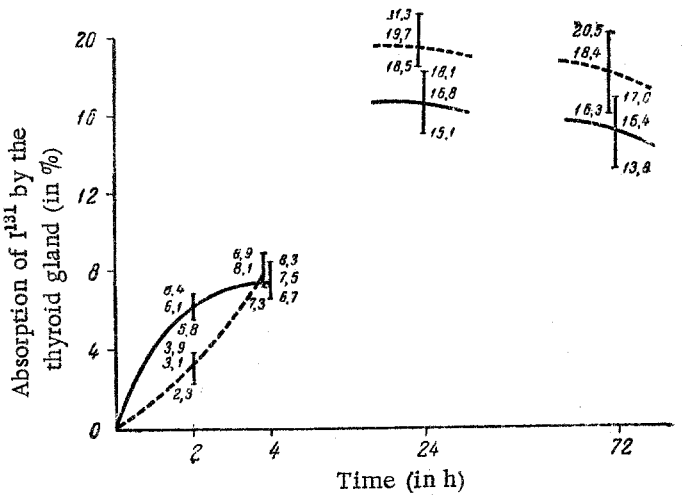
Four hours after administration of radioactive iodine the absorption of the isotope by the thyroid gland was $8.1 \pm 0.39\%$ in the experiment with physical exertion and $7.5 \pm 0.26\%$ in the experiment without. The differences between these figures were not significant, the value of $p = 0.05$.

The level of absorption of isotope after 24 and 72 h was higher with physical exertion than without. The differences between the indices were statistically significant.

Absorption of I^{131} by the Thyroid Gland in Athletes with or without Physical Exertion

Athletes	Absorption of I^{131} (% of dose administered)							
	after 2 h		after 4 h		after 24 h		after 72 h	
	without exertion	with exertion	without exertion	with exertion	without exertion	with exertion	without exertion	with exertion
G	6.5	2.3	7.9	8.3	14.4	17.6	13.1	15.4
K	5.7	2.0	6.1	7.3	13.4	15.6	12.0	14.8
G	7.2	3.9	8.1	9.0	22.1	25.7	20.0	22.8
E	5.0	3.3	6.5	7.2	17.9	21.5	15.7	20.1
K	6.6	2.2	7.2	8.6	18.1	20.6	17.1	19.6
R	6.0	2.9	8.5	7.8	15.3	20.4	14.2	18.0
P	7.3	3.6	8.1	9.5	17.8	21.3	16.3	18.8
N	6.2	2.2	7.3	6.8	10.5	14.4	10.3	11.1
E	5.6	1.7	6.2	7.3	18.3	20.0	17.2	19.3
K	7.1	2.3	7.9	8.1	16.1	17.8	13.2	15.3
V	5.2	1.9	6.6	6.3	18.1	20.6	17.5	18.1
V	5.4	6.2	8.7	10.5	22.0	22.4	20.1	25.8
K	6.2	3.8	9.3	7.6	15.0	16.9	13.9	16.2
G	5.9	2.7	6.5	8.0	15.2	17.9	13.1	15.3
Z	6.0	2.0	7.1	8.2	13.8	20.4	12.1	19.1
O	6.3	7.1	9.2	11.3	21.0	23.1	21.2	26.2
Arithmetic mean	6.1	3.1	7.5	18.1	16.8	19.7	15.4	18.4
Mean square deviation	± 0.15	± 0.38	± 0.26	± 0.39	± 0.80	± 0.73	± 0.77	± 1.0

These results show that considerable physical exertion in athletes was associated with an obvious decrease in the absorption of I^{131} by the thyroid gland during the first 2 h after administration of the isotope. Subsequently (after 4, 24, and 72 h) this level gradually rose and reached higher values than in the experiments without physical exertion.



Pattern of absorption of radioactive iodine by the thyroid gland in athletes during an experiment with (----------) and without (——————) physical exertion. I confidence limits at p = 0.05.

The initial decrease in the accumulation of I^{131} by the thyroid gland was evidently a typical nonspecific "stress" reaction in response to severe physical exertion. Later, after 24 and 72 h, the initial depression of function was replaced by a compensatory increase on thyroid activity. It is evident that this interpretation of the facts would be perfectly suitable to subjects undergoing severe physical exertion for the first time [5, 6, 7]. In our investigations, however, those taking part were experienced athletes, accustomed to running regularly in every training period. The "stress" reaction is known to become gradually weaker with every repeated application of a strong stimulus [5]. Consequently, the change in the level of absorption of I^{131} by the thyroid gland during the first period of physical exertion in the athletes cannot be regarded as a typical "stress" reaction. This phenomenon may reflect some form of strengthening adaptation of the organism to the repeated, transient application of severe physical exertion, and such an adaptation may have developed, moreover, on the basis of a typical "stress" reaction.

When making a general assessment of the degree of training of athletes and of their capacity to endure physical exertion, as a rule in our investigation the decrease in the 2-hourly absorption of I^{131} was more pronounced, and the subsequent increase in the accumulation of the isotope was higher in the trained athletes than in the less highly trained subjects. Moreover, in the two athletes in whom the level of the 2-hourly absorption of the isotope was higher after exertion than in conditions of relative rest, the capacity to withstand the test itself was lower. This also showed that the lowering of the accumulation of I^{131} by the thyroid gland in trained athletes in response to a first period of physical exertion is a normal reaction.

SUMMARY

Radioiodine absorption by the thyroid gland after prolonged physical exercise (3000 m race) was studied in 16 athletes, aged 20-24 years. 2 hours after administration of the isotope the level of its accumulation in the gland was halved. In 24 and 72 hours the content of radioiodine in the gland was higher than in experimental conditions without physical exercise. The phenomenon described evidently reflects the normal reaction of the thyroid gland of athletes to habitual physical excercise.

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