

## OPPORTUNITIES FOR DIETARY CORRECTION OF THYROID FUNCTION OF RATS

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**Abstract.** *This article examined the influence of pomegranate bark extract on the thyroid hormone levels and thyrotropic activity of the pituitary gland in rats that were fed a low-iodine diet and exposed to external radiation on the 25th day of their life.*

*It was demonstrated that pomegranate bark extract led to an increase in the concentration of thyroid hormones in rats with normal growth, normalization of thyroid hormone levels in iodine-deficient rats, in rats exposed to radiation during the adolescent growth period, and in rats subjected to both of these factors. Additionally, a correlation with the duration of extract application was observed. Furthermore, regardless of the duration of pomegranate bark extract usage, there was a pronounced stimulation of thyrotropic pituitary activity in all groups of rats under investigation. These findings suggest that pomegranate bark extract holds promise as a potential preventive measure for thyroid function disorders, pending further experimental research into its mechanism of action, dose determination, and duration of application.*

**Keywords:** *pomegranate bark extract, thyroid hormones, iodine deficiency, thyrotropic activity.*

### INTRODUCTION

Hypothyroidism is a clinical syndrome caused by a prolonged, persistent deficiency of thyroid hormones in the body or a decrease in their biological effect at the tissue level. Deficiency of thyroid hormones leads to changes in all organs and systems, determining the multisystem nature of its clinical manifestations.

The main cellular change is a reduction in oxygen consumption, a decrease in the intensity of oxidative phosphorylation and ATP synthesis. The cell experiences an energy deficit, leading to reduced enzyme synthesis and suppression of cellular metabolism processes. For preventive purposes, iodization of food products is used worldwide, while for treatment, hormone replacement therapy for thyroid hormones, thyroid tissue transplantation, and other methods are employed.

The narrow therapeutic range of L-T4 requires careful dose adjustment. The dose may vary depending on the etiology of hypothyroidism, the patient's body mass, the presence of comorbidities, and the use of other medications [1,2,3]. However, these methods have several known drawbacks, including overdosage, tissue rejection, and difficulties in donors, among others. An interesting and promising method for correcting this condition, in our opinion, could be an experimental study of the effects of pomegranate bark extract, which contains, as shown [4], the enzyme glutathione peroxidase, with selenium as an essential element for peripheral thyroid hormone metabolism during this disease in rats.

### MATERIALS AND RESEARCH METHODS

Experiments were conducted on: 1) growing rats, in which the two previous generations were maintained on a standard diet, and 2) experimental group rats, whose iodine intake was reduced by 70% throughout the existence of this population. Iodine consumption in the control group was 34.0 µg/day, which is within commonly accepted standards, while in the experimental group, it was 4.0 µg/day. The iodine concentration in the feed was measured using the Stolz method [5].

The extract was prepared as follows: 100 grams of pomegranate peel were soaked in 1 liter of cold distilled water acidified with oxalic acid to a pH of 3.4 for 24 hours. Then, 5 ml of the extract was added to 45 ml of drinking water.

C - control group - growing rats in which two previous generations led to a standard diet;  
C E - growing rats in which two previous generations led to a standard diet + extract;

E-experimental group - throughout the entire existence of this population, they were kept at a reduced (by 70%) level of iodine consumption;

E - throughout the entire existence of this population, they were kept at a reduced (by 70%) level of iodine consumption + extract;

The thyroid status of all animals was assessed based on the following indicators:

-Levels of thyroxine and triiodothyronine in serum (RIA using kits from the Minsk Institute of Bioorganic Chemistry

-Thyrotropic activity of the pituitary gland using histological sections stained with alcian blue - PAS - Orange G, allowing the counting of thyrotropic cells in the adenohypophysis. Differences in groups that did not receive the extract were calculated relative to the control group, and in groups with the extract, relative to groups without the extract.

## **RESULT AND DISCUSSION**

From the obtained data (Table 1), it can be seen that in rats from the iodine-deficient group, the concentration of thyroxine in the blood is reduced, and the content of triiodothyronine remains unchanged; the ratio of the concentrations of these hormones is altered in favor of T3.

Application of pomegranate bark extract for one month led to an increase in the concentration of both hormones, but only in the control group, animals that received the extract showed an increase in the proportion of T3.

The result of the study on the influence of a 3-month intake of pomegranate bark extract on the concentrations of T4 and T3 in the serum of rats from different experimental groups are presented in Table 2.

The obtained data indicate that chronic iodine deficiency leads to a decrease in the concentration of thyroid hormones in the blood serum of four-month-old rats.

The three-month application of the extract in iodine-deficient animals did not change the levels of T3 and T4, although there was a tendency towards an increase in the proportion of triiodothyronine. At the same time the three-month application of pomegranate bark extract led to a reduction in this proportion.

The results of the study on thyrotropic activity of the pituitary are presented in Table 3. From the data presented, it can be concluded that iodine deficiency leads to an increase in the thyrotropic activity of the pituitary.

The application of the extract also caused a significant, albeit less pronounced, increase in the thyrotropic activity of the pituitary, both after one and three months of intake.

*Table 1.*

*The effect of monthly intake of pomegranate bark extract on the concentrations of thyroid hormones in the blood serum of rats of different experimental groups*

Experimental groups	T 4 (n mol/l)	T 3 (n mol/l)
C	108,7 ± 3,44	1,12 ± 0,10
C E	120,2 ± 4,12	1,45 ± 0,08*
E	73,5 ± 3,14*	1,07 ± 0,05
E E	108,4 ± 2,14*	1,20 ± 0,04*

\*- The differences are significant

*Table 2.*

*The effect of 3 months of taking pomegranate bark extract on the concentrations of thyroid hormones in the blood serum of rats of different experimental groups (n - 4)*

Experimental groups	T 4 (n mol/l)	T 3 (n mol/l)
C	91,5 ± 2,31	1,37 ± 0,02
C E	60,8 ± 1,89*	0,57 ± 0,05
E	70,2 ± 1,36*	0,70 ± 0,09
E E	65,2 ± 1,49	0,78 ± 0,12

\*- The differences are significant

### CONCLUSION AND FINDINGS

It is known from the literature that when the amount of iodine necessary for normal thyroid metabolism is insufficient, and thyroid function is compromised, certain adaptive processes are activated, regulated by the corresponding stimulation of the pituitary thyrotropic hormone [6,7,8]. The consequence of such an effect is the development of goiter, the main clinical marker of chronic iodine deficiency.

The functioning of this component of thyroid homeostasis maintenance is directed towards reducing stress in the pituitary-thyroid system [9,10].

Our results clearly revealed a stimulating effect of pomegranate bark extract on the concentrations of thyroid hormones in the circulating blood. These changes cannot be solely attributed to a possible enhancement of peripheral deiodination of T4, as that would result in a predominant increase in T3 concentration. Based on this, one would expect the normalization of thyrotropic function in rats from the specified groups.

*Table 3.*

*Effect of pomegranate bark extract on the thyroid-stimulating activity of the pituitary gland in rats of different experimental groups*

Experimental groups	% Thyrotrophs			
	Two month old rats		Four month old rats	
	n	M ± m	n	M ± m
C	3	12,8 ± 0,29	7	13,8 ± 0,21
C E	3	19,7 ± 0,15*	3	17,6 ± 0,06*
E	3	33,5 ± 0,04*	8	26,8 ± 0,34*
E E	3	25,2 ± 0,06*	3	34,1 ± 0,17*

\*- The differences are significant

However, the results indicate not only a weakening of thyrotropic stimulation under the influence of the extract in iodine-deficient animals but, on the contrary, an enhancement of it in almost all groups using the extract. These findings require a cautious interpretation of the entire set of results and point to the need for dose selection and duration of extract administration, as well as a deeper investigation to elucidate the mechanisms behind these effects.

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