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Results of iodine deficiency prophylaxis in children of Tver

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Abstract. 142 pupils of primary school of two boarding school were examined to compare the efficacy of two methods of iodine deficiency prophylaxis. Before and 6 weeks after the beginning of iodine prophylaxis in all children following indices were determined: thyroid volume, ioduria (median), TTG in blood and thyreoglobilin antibodies titer. First group of children got in addition to iodized salt bans containing 92±12 mcg of iodine combined with protein casein, and the second one got only iodized salt. It was noted that Iodcasein intake leads to ioduria normalization after 6 weeks, and use of iodized salt almost did not change the level of urinary iodine excretion. Thus, Iodcasein intake can be recognized as alternative and efficient method of mass prophylaxis of Iodine deficiency.

Iodine deficiency disorders (IDD) are spread worldwide. Measures foe prophylaxis and control for IDD are related as of high priority along with HIV, poliomyelitis and tuberculosis [4].

At the moment, iodized salt is used for population prophylaxis of iodine deficiency sole. No doubt, that the search for new approaches, which would allow to provid an organism with iodine is necessary. Research and production company Medbiopharm (Obninsk) had synthesized new iodine compound (Iodcasein) which successfully passed through biological trials in animals and could serve as alternative method for iodine prophylaxis [1, 2, 3]. The aim of the present study was comparative analysis of the efficacy of Iodcasein and iodized salt for iodine deficiency eliminating as well as their influence on thyroid functioning in children. For this purpose, bread enriched with iodized casein, and food with iodised salt added were used.

Materials and methods

Initial examination of 142 pupil of primary boarding school was performed in Tver. Of those, 61 (62%) boys and 38 (38%) girls (average age 10,0±0,15 years old) were studied in boarding school #2 (Moscow district), and 29 (66,7%) boys and 14 (33,3%) girls (average age 9,9±0,21 years old) attended boarding school #1 (correction school type 7) (Zavolzhski district).

According to epidemiologic criteria of IDD severity proposed by ICCIDD [5], the examination consisted of endocrinologist examination, ultrasound study of thyroid, determination of iodine concentration in single urine sample and thyreoglobuline level in blood. To access hypophysial and thyroid state in children, thyrotrophic hormone (TSH) level was measured in blood, to exclude damaging action of external factors, including iodine containing, - thyroglobulin antibody titer (ABTG) and microsomal fraction (TMSA).

For ultrasound examination portable scanner CA-600 (Mcdison, South Cores, detector 5-9 mHz/ 40 mm) was used. Thyroid volume was calculated according common formulas. 50^{th} and 97^{th} percentiles were taken as age indices of thyroid volume. If thyroid volume exceeded 97^{th} percentile, we account this as goiter.

The level of iodine renal excretion (with mediana calculation) was determined in single morning sample by cerium-arsenit method (O. Wawsehinek, 1985) in Laboratory in-vitro diagnostics of medical Radiological Research center of RAMS (Obninsk). Results were interpreted in accordance with ICCIDD recommendations [5].

Determination of TH in blood and basal level of TSH were performed by immuno-enzyme method with standard assays (Immunotech and Vector-Beat), ABTG titer and TMSA were detected by thyreoGlob and thyreoGnost by the method of passive hemagglutination in the same laboratory. According with the noted methods normal concentration of Tg was 0-50 ng/ml, TSH – 0,3-4 mIE/l, AT titer up to 1:320.

To compare the efficacy of various approaches of iodine prophylaxis all examined children were divided into 2 groups. First group consisted of 99 children of boarding school #2, which got for lunch in addition to regular diet (with iodized salt) buns containing 92±12 mcg of Iodine combined with protein, casein, every day during 1,5 months (April, May). Second group was formed by 43 pupils of the boarding school #1, who got (in April and May) for the breakfasts and the lunches food cooked with iodized salt (approximately 5 g per child).The iodine level in the salt meet the requirements of federal standard (32±15 mcg/kg). Groups were similar in sex and age. In 3 weeks after the study beginning (in the end of April), the second examination was performed. It included estimation of ioduria and clinical examination to find manifestation of acute toxic allergy reaction. Complete second examination was performed in the groups in 1,5 months after the study begin.

Statistical processing of the obtained result was performed by common methods with variation and correlation analysis. Difference reliability was estimated by Students' test.

Results and discussion

Results of endocrinology examination revealed that in all examined children thyroid was in euthyroid status, its increase was estimated in 15,8%. Mainly it was diffuse thyroid goiter (I stage) (13,7%). Nodular goiter was revealed in one boy (2,2%) of the second group.

In the Table 1 the main results of the ultrasound examination of children are listed. Average thyroid volume in the first and the second group was similar, 3,6±0,13 ml и 3,7±0,17 ml correspondently. The was no significant discrepancies between boys and girls. Also there were reliable differences in hyperplasia occurrence in the first and the second groups. It was 4,2% and 4,3% correspondently. Nodular formation were diagnosed in a one (1,1%) boy of the first group and in one boy (2,2%) of the second group.

Clinical examination of the children of the first group in 3 and 6 weeks after confirmed the absence of acute toxic or allergic reactions to Iodcasein. Thyroid palpation of the in 6 weeks after did not revealed reliable differences with initial data.

At the secondary USE in most children both first (91,2%) and second (93,8%) groups, no changes in thyroid echostructure was detected. The analysis of the thyroid volume (Table 1) in examined children demonstrates that the volume stayed constant in children of boarding school # 2 (3,7±0,14 ml) and has the tendency to increase in the school of 7^{th} type (4,1±18 ml). At this, in last, the increase of thyroid volume was revealed more often in comparison with children of boarding school #2 (31,0% and 12,3% cases correspondently). The frequency of thyromegalia did not change reliably both in the first (4,2% to 6,7%) and in the second (4,3% to 6,3%) groups.

Thus on the base of performed iodine prophylaxis (1,5 month) in absolute majority of children no changes in morphological structure of thyroid was revealed. When Iodcasein used, no enlargement of average thyroid volume was detected in the first 1,5 months. When iodized salt is used this tendency was present. Thyroid enlargement was not caused by auto immunity process. This was proved not by ultrasound examination sole, but by the absence of increased thyroglobulun antibody titer and microsomal antibody titer in all examined children of the first and the second groups (MAT 1:160 in majority of children) before and against iodine prophylaxis.

Table 1

Main ultrasound thyroid indices in children before and after the prophylaxis

Groups (n, n_1)	Average thyroid volume (ml)		Thyromegalia frequency, (%)		Change of thyroid before iodine prophylaxis (%)		
			97 percentile				
	initial	after	initial	after	enlargement	diminution	No changes
1 group (99,89)	3,6±0,13	3,71±0,14	4,2	6,7	12,3	9,9	77,8
Boys (61,52)	3,7±0,18	3,71±0,19	5,2	5,8	12,8	12,8	74,4
Girls (38,37)	3,5±0,19	3,61±0,22	2,7	8,1	11,8	6,9	82,3
2 group (43,32)	3,7±0,17	4,11±0,18	4,3	6,3	31,0	10,4	58,6
Boys (29,20)	3,4±0,14	4,11±0,19 p<0,001	3,4	5,0	33,3	11,1	55,6
Girls (14, 12)	4,0±0,37	4,21±0,37	5,9	8,3	27,3	9,1	63,6

Notes: n – the number of examined initially, n1 – 6 weeks after, p – differences reliability.

Table 2

Ioduria in children of Tver before and after iodine prophylaxis

Ioduria	Kinetics of ioduria in examined children					
	Group 1			Group 2		
	initial (n=99)	3 weeks after (n=75)	6 weeks after (n=89)	initial (n=43)	3 weeks after (n=40)	6 weeks after (n=32)
Median of ioduria, mcg/l	89	139	271	36	66-67	45-49
Ioduria, %						
<100 mcg/l	60,2±6,4	36,0±9,4 p<0,05	11,5±10,96 p<0,001	88,6±5,1 p<0,001	70,0±8,8 p<0,05	78,1±8,4
0 - 19,9 mcg/l	1,0	4,0	1,1	11,4	10,0	12,5
20,0 - 49,9 mcg/l	16,3±9,5	6,7	2,3	59,1±9,8 p<0,01	27,5±14,1	40,6±14,2
50,0 - 99,9 mcg/l	42,9±7,6	25,3±10,2	8,1±6,1 p<0,01	18,1±10,6	32,5±13,5	25,0±16,4
>100 mcg/l	39,8±8,9	64,0±6,9 p<0,05	88,5±3,6 p<0,001	11,4±8,3	30,0±13,8	21,9±16,9

Notes: p1 – difference reliability between 1st and 2nd groups, p1 – difference reliability inside the 1st group 3 weeks after, p2 –inside 2nd 3 weeks after, p3 – inside 1st 6 weeks after.

In Table 2, iodine insufficiency in children of Tver and ioduria dynamics after 3 and 6 weeks of active iodine prophylaxis are presented.

Ioduria median is the objective index of iodine supply in a human body. As presented in the table, initial median was below norm in both groups. In boarding school #2 it value (89 mcg/l) indicated mild iodine deficiency in children, and in school #1 it corresponded to moderate iodine insufficiency (36 mcg/l). Diminished iodine excretion was characteristic for the majority of 2nd group children (88,6%), at that in the first one it was noted only in 60,2% cases (p1<0,001).

So, in spite of regular use of iodized salt in Tver boarding schools for prevention of IDD, generally there is mild-moderate iodine deficiency in children. Clear correlation between ioduria median and thyroid volume was not revealed.

From the data presented in Table 2, it is obvious that against Iodcasein intake (first group) normalization of ioduria was noted (139 mcg/l) in 3 weeks. In addition, the frequency of iodine insufficiency was lowered form 60,2% to 36,0% (p1<0,05). In the second group against the consumption of food with iodized salt in 3 weeks ioduria median increase from 36,5 mcg/l to 66,5 mcg/l was noted and iodine deficiency frequency diminution from 88,6% to 70,0% (p<0,05). 6 weeks after the study beginning, ioduria median kept growth in the 1st group and mounted 271 mcg/l, at that in the second group it lowered (47 mcg/l). Consequently, in pupil of boarding school # 2, first group the percentage of iodine deficiency lowered to 11,5% (p1<0,001) and in the second group it kept being high – 78%.

Thus, preventive use of Iodcasein causes fast elimination of iodine deficiency, and when iodized salt is used, ioduria median during 1,5 month does not change significantly.

In the Table 3, main indices of functional condition of hypophysial-thyroid system of examined children are presented The highest TG median and average TG were noted in children of boarding school #1 (50 ng/ml; 57,9±5,07 ng/ml) , as in examined children of the first group these indices were lower (45 ng/ml; 45,1±1,37 ng/ml; p,<0,02).

These data correspond to revealed iodine deficiency in examined children and prove that the heavy iodine deficiency, the higher TG level in blood.

From data presented in the Table 3, average blood TSH in examined children of the first group was reliable higher than that of children of the second group (p<0,05). The correlation between iodine insufficiency and blood TSH was not revealed.

Against the iodine prophylaxis, the changes of the main indices of hypophysial-thyroid system (Table 3) were detected. As shown in the table, in both groups in majority of children reliable decrease TSH and TG were noted ТГ (p<0,001, p<0,02, p<0,001).

Table 3

Main indices of hypophysial-thyroid system in examined children before and after iodine prophylaxis

Groups (n_1, n_2)	**Average blood TSH**		**Average blood TG (ng/ml)**		**Median blood TG (ng/ml)**	
	Initial	**6 weeks after**	**Initial**	**6 weeks after**	**Initial**	**6 weeks after**
Group 1 (99,88)	3,5±0,11	2,8±0,18 p<0,001	45,1±1,37	37,0±1,66 p<0,001	45	35
Boys(61,55)	3,5±0,12	2,7±0,22 p<0,01	45,6±2,0	37,2±2,05 p<0,01	45	35
Girls (38,37)	3,4±0,21	2,8±0,33	44,2±1,57	36,6±2,84 p<0,02	45	30

Group 2 (43,25)	3,0±0,21 p<0,05	2,1±0,30 p<0,02 p<0,05	57,9±5,07 p<0,02	33,7±1,59 p<0,001	50	30
Boys(29,17)	3,0±0,26	1,9±0,29 p<0,001 p<0,05	54,2±4,75	33,2±2,10 p<0,001	50	30
Girls (14,8)	3,1±0,33	2,4±0,69	66,5±12,8	35,0±2,11 p<0,05	55	35

Notes: n- the number of examined initially, n1- repeat 6 weeks after, p – differences reliability between groups, p – differences reliability in a group, before and after.

So, the use of iodcasen as well as iodized salt in purposes of prevention improves functional condition of hypophysial-thyroid system of examined children in both groups. Further studies are required to develop active iodine profilaxis influence on structural and functional conditions of a thyroid. It will take longer observation time (6-12 months), and approbation in various population groups (children and adults), pathologic thyroid and normal. Daily dose of Iodcasein also need to be further studied to find optimal level taking into account iodine supply from other sources.

It should be noted, that Iodcasein did not cause toxic and allergy reactions in an organism. It intake for 1,5 months leads to significant decrease of iodine insufficiency as well as to improvement of functional condition of hypophysial-thyroid system in major part of children and did not lead to thyroid enlargement during this period. Iodized salt used for cooking promotes normalization of functional condition of hypophysial-thyroid system in most part of children. But it is less effective in comparison with Iodcasein in fast relieve of iodine deficiency. Iodine in combination with casein can be recommended as alternative way of population prophylaxis of iodine deficiency.

Literature

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