

ISSN 2225-6016

ВЕСТНИК

*Смоленской государственной
медицинской академии*

Том 17, №4

2018



УДК 615.1

IODINE DEFICIENCY: ISSUE, PREVENTION, SOLUTION

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Abstract

Objective. To study the possibility of using iodine-containing drugs and iodized salt as measures to prevent the development of iodine deficiency diseases.

Methods. A regulatory framework content analysis was carried out, a patient survey was conducted and data on the epidemiological situation in the Smolensk Region concerning the number of iodine deficiency diseases were studied.

Results. Prevention and treatment of iodine deficiency play an important role in maintaining the socio-economic potential of the country. The experience of many countries suggests that the use of iodine and iodine drugs is the most effective way to solve the problem of iodine deficiency.

Conclusion. The prevalence of iodine deficiency diseases among children and adolescents in the Russian Federation is increasing, which may lead to a decrease in the country's socio-economic potential. That stimulates the creation of a number of new policy initiatives of the Ministry of Health of the Russian Federation aimed at combating thyroid diseases caused by insufficient consumption of iodine.

Keywords: public health, iodine deficiency, children, iodized salt

ЙОДОДЕФИЦИТ: ПРОБЛЕМА, ПРОФИЛАКТИКА, РЕШЕНИЕ

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Резюме

Цель. Изучить возможность использования йодсодержащих лекарственных препаратов и йодированной соли в качестве мер профилактики развития йододефицитных заболеваний.

Методика. Проведён контент-анализ нормативно-правовой базы, проведено заочное анкетирование пациентов, были изучены данные об эпидемиологической ситуации в Смоленской области по числу йододефицитных заболеваний.

Результаты. Вопросы профилактики и лечения йододефицитных состояний играют важную роль в поддержании социально-экономического потенциала страны. Опыт многих стран мира свидетельствует о том, что наиболее эффективным путем решения проблемы дефицита йода является использование йодированной соли и лекарственных препаратов йода.

Заключение. Распространенность йододефицитных заболеваний среди детей и подростков в РФ растет, что может привести к снижению социально-экономического потенциала страны. Это стимулирует создание ряда новых политических инициатив Министерства Здравоохранения РФ, направленных на борьбу с заболеваниями щитовидной железы, которые обусловлены недостаточным потреблением йода.

Ключевые слова: общественное здравоохранение, йододефицит, дети, йодированная соль

Introduction

Iodine deficiency is a global public health problem that has a harmful effect on the health of about two billion people worldwide [12]. It is precisely iodine deficiency that is today regarded as one of the main causes of mental development impairment in newborns and infants. Impaired production and action of thyroid hormones can lead to the development of pathologies of varying degrees of severity, from goiter to irreversible brain damage, called endemic cretinism [2]. Endemic goiter is only a visible manifestation of the existing danger, fraught with a huge number of "hidden effects" that significantly reduce the quality of life of the population. All this necessitates the search for new methods to combat this pathology, which

would combine in itself therapeutic efficacy and economic feasibility. At this stage of development of the global health care system for the prevention of iodine deficiency diseases, the primary intervention strategy to combat iodine deficiency, which is iodization of table salt, developed by the World Health Organization in 1993, is being actively used [12].

It is known that a change in the rhythm of a person's life, an active urbanization, a change in ecology - all this leads to the formation of new causes that affect human health. First of all, it concerns the development of noncommunicable diseases (NCDs), which are currently one of the leading causes of death worldwide. Diseases of the thyroid gland are among the most common NCDs, along with cancer and cardiovascular pathologies [5]. It is known that iodine deficiency is a significant public health problem in 118 countries [12]. It is estimated that at least 1572 million people worldwide are at risk of IDD infection, i.e. those who live in areas where iodine deficiency is common (the total goiter level is above 5%), and at least 655 million of them, as researchers believe, suffer from goiter. Most of them are located in developing countries in Africa, Asia and Latin America, but much of Europe is also vulnerable [7]. The urgency of this problem is due to the global trend associated with an increase in the number of diseases caused by iodine deficiency disorders. The main danger is the fact that iodine deficiency can have a serious impact on both the health of an adult and the prenatal development of a child, which, in turn, can cause cretinism.

Iodine plays a central role in the physiology of the thyroid gland, being the main component of thyroid hormones (thyroxine and triiodothyronine). These hormones control the metabolic activity of all tissues by regulating genes whose protein products affect cellular respiration [6]. Thyroid hormones have multiple effects, which are manifestations of the process of regulating the general level of metabolism and energy consumption of the body's cells: fetal development; metabolic rate; body temperature; heart rate and strength; expansion of peripheral vessels; the number of circulating red blood cells; breath; peripheral nervous system; liver metabolic enzymes; bone exchange; effect on skin and soft tissue.

Due to the high level of diagnostic medicine at the moment, it is possible to identify a number of diseases associated with the effect of iodine deficiency on the growth and development of the organism. In iodine-deficient areas, reproductive function is impaired in women, the number of miscarriages and stillbirths increases [2]. Iodine plays a huge role in maintaining the normal level of brain activity and intellectual development of man. In a study of Boyages and Collins in China, it was shown that 72% of young people aged 30-35 years born during a period of severe iodine deficiency had an IQ – index below 70 points, which indicates a violation of intellectual abilities from moderate to severe. At the same time, among children of 7-14 years old, whose mothers received iodized salt, the frequency of similar disorders was 44% [3].

Methods

In the course of this study, the following methods were used: a survey, a content analysis of regulatory documents, a study of the price policy of pharmaceutical companies, an absentee questionnaire.

Studies were conducted on the basis of Regional State Health Care Institutions "Children's City Hospital" No. 1, 2, 3, 4, 5, 6, 7 of Smolensk. In the course of the study, the data of statistical reports "On the number of endocrine diseases in children under 14 years old inclusively and in young people from 15 to 17 years old living in the area of polyclinics number 1, 2, 3, 4, 5, 6, 7" from 2015 to 2018 were analyzed.

The total number of patients with endocrine dysfunction was (up to 2018): total – 4927 people, of which the number of patients under the age of 14 years – 3781 people; the number of patients between the ages of 15 and 17 is 1146 people (girls – 659 people; boys – 487 people).

We conducted an absentee questionnaire of parents of children and adolescents who visited an endocrinologist. Patient age ranged from 1 year to 17 years. Absentee survey was conducted among 50 students of various fields of training at the age of 17 to 23 years in four cities of Russia: Smolensk, Moscow, St. Petersburg, Novosibirsk. The choice of geographic subjects studied was due to the fact that these regions were recognized as iodine deficient in the course of research conducted by the Endocrinological Scientific Center (ENC) of the Russian Academy of Medical Sciences.

During the study, the following objects were studied: (1) Iodized salt: "Artemsol". Manufacturer – GP "Artemsol". Iodized table salt, sodium chloride - not less than 99.9%, enriched with potassium iodate, with a content of iodine mass fraction of 40 ± 15 mg per kg, is used to provide human iodine nutrition in order to overcome iodine deficiency. The average price of one kg of iodized salt on August 25, 2018 was 18.27 rubles. "Baikalochka". Producer – JSC Tyretsky Solerudnik. Iodized table salt, sodium chloride – not less than 99.9%, enriched with potassium iodate in the amount of 40 ± 15 mg per kg, used to prevent

iodine deficiency disorders, stimulates the mental development of children. The average price of one kg of iodized salt on August 25, 2018 was 13.00 rubles. "Extra". Manufacturer – TDS LLC. Salt, iodized, edible, cooking, extras, contains: anti-caking additive E-536, sodium chloride - not less than 99.9%, enriched with potassium iodate – 40 mg/kg. The average price of one kg of iodized salt on August 25, 2018 was 122.80 rubles. "Winter Beauty". Manufacturer – Akzo Nobel Sol. Iodized table salt, sodium chloride – not less than 99.9%, potassium iodate – 20 ± 5 mg/kg, fluorine – 250 ± 30 mg/kg, anti-caking agent E-535. The average price of one kg of iodized salt on August 25, 2018 was 152.40 rubles.

(2) Medicinal preparations intended for the treatment and prevention of iodine deficiency disorders: Iodomarin – tablets 100 μ g, 100 pcs. Manufacturer – Berlin-Chemie / Menarini. ATH – H03CA (iodine preparations). The pharmacological group: a drug of inorganic iodine [Hormones of the thyroid and parathyroid glands, their analogues and antagonists (including antithyroid agents)]. The composition of one tablet: potassium iodide – 131 mcg; excipients: lactose monohydrate; magnesium carbonate basic light; gelatin; carboxymethyl starch sodium salt; silicon dioxide highly dispersed; magnesium stearate. Pharmacological action: compensates for iodine deficiency. It prevents the development of iodine deficiency conditions, normalizes thyroid function, impaired by iodine deficiency. The average price of one package of the drug on August 25, 2018 was 129.00 rubles. Potassium iodide – tablets 100 mcg, 100 pcs. Manufacturer – Obolensky OP. ATH – H03CA (iodine preparations). A pharmacological group: a drug of inorganic iodine [Hormones of the thyroid and parathyroid glands, their analogues and antagonists (including antithyroid agents)], macro- and microelements. The composition of one tablet: potassium iodide – 131 mcg; excipients: lactose (milk sugar), magnesium hydroxycarbonate (magnesium carbonate basic), microcrystalline cellulose, sodium croscarmellose, magnesium stearate, talc, colloidal silicon dioxide (aerosil). Pharmacological action: compensates for iodine deficiency. It prevents the development of iodine deficiency states, normalizes thyroid function, impaired by iodine deficiency. The average price of one package of the drug on August 25, 2018 is 103.00 rubles. Microiodide – 100 μ g tablets, 100 pcs. Manufacturer – Tatkhimpharmpreparaty. ATH – H03CA (iodine preparations). The pharmacological group is a drug of inorganic iodine [Hormones of the thyroid and parathyroid glands, their analogues and antagonists (including antithyroid agents)]. The composition of one tablet: potassium iodide – 131 mcg; excipients: milk sugar; raffinated sugar; calcium stearate; aerosil Pharmacological action – compensates for iodine deficiency. It prevents the development of iodine deficiency states, normalizes thyroid function, impaired by iodine deficiency. The average price of one package of the drug on August 25, 2018 was 115.00 rubles. Yodbalans – 100 μ g tablets, 100 pcs. Manufacturer – Tatkhimpharmpreparaty. ATH – H03CA (iodine preparations). The pharmacological group: a drug of inorganic iodine [Hormones of the thyroid and parathyroid glands, their analogues and antagonists (including antithyroid agents)]. The composition of one tablet: potassium iodide – 130.8 mcg; excipients: magnesium stearate; MCC; colloidal silicon dioxide; corn starch; cellulose powder; lactose monohydrate. Pharmacological action: compensates for iodine deficiency. It prevents the development of iodine deficiency states, normalizes thyroid function, impaired by iodine deficiency. The average price of one package of the drug on August 25, 2018 was 104.00 rubles.

Results

The problem of development of iodine deficiency states is acute for the Smolensk region. According to statistics for 2015, the number of patients living, receiving treatment in the Smolensk region and having diseases caused by impaired endocrine system (FES) functions is 5113 people, by 2018 this figure decreased by 3.64% and amounted to 4927 people. Among them, endemic goiter I-th degree occurs in 2499 patients, obesity I-II degree – in 1189, cystic goiter – in 164 patients, for the period from 2015 to 2018. There have been changes, which are reflected in table 1.

Table 1. Comparative analysis of the data of the report "On the number of endocrine diseases in children up to 14 years old inclusively and in young people from 15 to 17 years old living in the area of polyclinics № 1, 2, 3, 4, 5, 6, 7" from 2015 to 2018

Index	Years		Changes
	2015	2018	
The total number of patients with impaired FES	5113	4927	-3,64%
Endemic goiter first degree	2499	3289	+31,62%
Obesity Grade I-II	1189	977	-17,83%
Cystic goiter	164	144	-12,21%

The data table 1 show that, despite the general trend towards a decrease in the number of patients with impaired endocrine system functions, the number of patients with endemic goiter I degree increased by

31.62% compared with data for 2015. This, in turn, indicates that the level of development of iodine deficiency diseases among children and adolescents in the Smolensk region increases significantly. The data once again confirms the need to introduce effective measures aimed at treating and preventing this group of pathologies among the population of the region.

We conducted a survey of parents of patients of children and adolescents visiting the endocrinologist. In the course of the survey, opinions on the prevention of iodine deficiency disorders with iodized salt were determined, as well as which medicines the endocrinologist recommends for the prevention / treatment of thyroid diseases.

When analyzing the questionnaires, it was found that the most common diseases in this group are: diffuse nontoxic goiter of 1 degree – 37%, subclinical hypothyroidism – 8%. More than 55% of respondents use iodized salt for food, while only 88% of them believe that the use of iodized salt is a good method for preventing iodine deficiency. Among the drugs for the treatment of diseases of the thyroid gland the most widely used are: Iodomarin – 42% and L-thyroxin – 32%, the main active substance of which is potassium iodide or levothyroxine sodium. Also, in addition to monotherapy, endocrinologists recommend complex treatment with 2-3 drugs, including: Iodomarin, L-thyroxin, Eutirox. In 88% of cases, the respondents answered yes to the question about the regularity of visiting the endocrinologist.

We also conducted absentee questioning of students. During the survey, respondents answered questions about what they think of the prevention of iodine deficiency with iodized salt and how often they are examined by an endocrinologist. The survey revealed that the prevalence of iodine deficiency disorders in this age group in these regions is low. Among all respondents, only 4.9% have diseases associated with dysfunction of the thyroid gland. It is significant that, despite the absence of these diseases, more than 57% of respondents use iodized salt, and 65.6% consider its use as an effective method of preventing iodine deficiency disorders. The main concern is the fact that more than 65% of all respondents are examined by an endocrinologist less than once a year, in Novosibirsk this figure reaches 84%, and only 18% of respondents visit this doctor once a year.

Based on our data from a sociological survey, we can conclude that the use of iodized salt is a popular method of preventing iodine deficiency disorders. In order to identify the reasons for such a high popularity of this method, we conducted a study that compares the pricing policy of companies engaged in the manufacture of iodized salt, and pharmaceutical companies that produce drugs designed to prevent iodine deficiency disorders.

From the data presented in figures 1 and 2, it can be seen that the average cost of 1 kg of iodized salt ranges from 13 to 152 rubles. The iodine content in 1 g of such salt is usually 40 µg, i.e. to ensure the daily intake of iodine (excluding iodine derived from food) a person needs to consume at least 5 g of this salt daily.

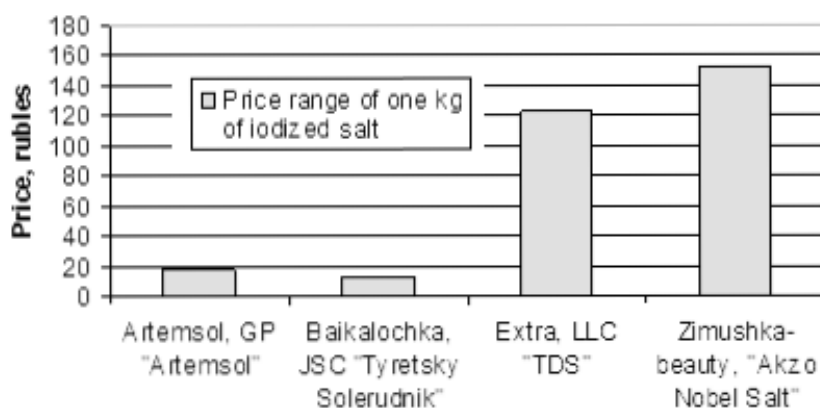


Fig. 1. Analysis of the price range of one kg of iodized salt

Figure 2 shows that the average price of drugs intended for the prevention of iodine deficiency conditions is 112 rubles. To cover the daily need for iodine, 1-2 tablets are sufficient (depending on the drug). Based on the results, it can be concluded that one of the main factors influencing the choice of buyers is price. The convenience of using iodized salt is also one of the reasons for the popularity of this method. Every day when cooking a person uses salt. In the event that salt is replaced by iodized salt, it will be possible to conduct non-drug prevention of iodine deficiency.

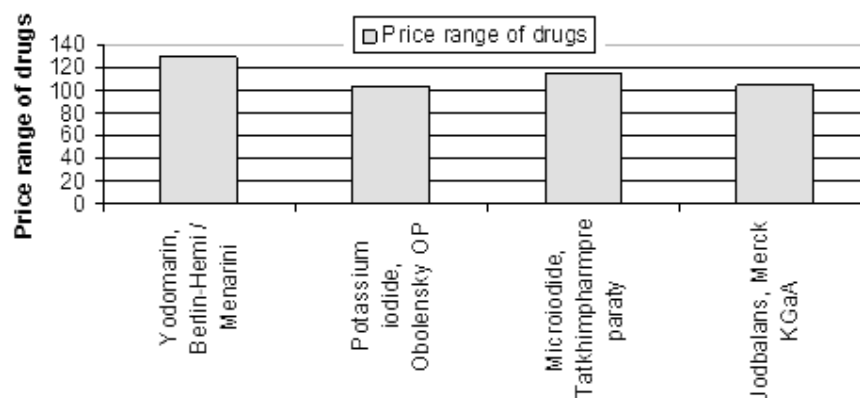


Fig. 2. Analysis of the price range of drugs intended for the prevention of iodine deficiency disorders

Conclusion

The Russian Federation belongs to countries with a natural iodine deficiency, including the Smolensk region. Issues of prevention and treatment of iodine deficiency disorders play an important role in maintaining the socio-economic potential of the country. This is the reason for the active promotion of the program of iodine prophylaxis among the population of our country. The experience of many countries suggests that the most effective way to solve the problem of iodine deficiency is the use of iodized salt in the diet (adoption of laws on universal salt iodization, mass iodine prophylaxis) and iodine drugs in high-risk groups IDD (individual iodine prophylaxis) [5].

Our studies have shown that the relevance of this problem for the Smolensk region is undoubted, because the prevalence of endemic goiter I-th degree among children and adolescents is increasing, which can lead to a decrease in the socio-economic potential of the country. That, in turn, stimulates the creation of a number of new political initiatives of the Ministry of Health of the Russian Federation aimed at combating diseases of the thyroid gland, which are caused by insufficient consumption of iodine. At the moment, a draft federal law on iodization of table salt in the Russian Federation, which is planned to be prepared by December 2019, is at the development stage [13].

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