Studying the problem of iodine enrichment of food products

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Abstract – **Trace elements are essential catalysts for various biochemical processes. One of the most important trace elements is iodine. Products optimal for iodization are those that contain the required number of amino acids tyrosine and phenylalanine, methionine for utilization of fatty acids, as well as unsaturated fatty acids. For that reason, meat and meat products are promising targets for iodization.**

Keywords – **iodine, iodine-casein, iodized salt**

I. INTRODUCTION

Iodine deficiency and related diseases have acquired an acute social importance, while the control of iodine deficiency in population has become one of top-priority health problems. Most of regions in Russia are depleted in iodine. Daily requirement in iodine for healthy people is at least 50 mcg, while for infants it is 90 mcg, for pregnant - 120-150 mcg and for lactating women - 200 mcg [1]. Meanwhile, the actual intake of iodine is only 40-80 mcg per day, i.e. 2-3 times lower than the recommended level. In recent years this fact resulted in significant increase in the number of people with iodine deficiency (hypothyroidism). For the prevention of hypothyroidism, iodine-rich foods both naturally enriched (sea salt, kelp, seafood) and enriched by adding iodine substances are widely used.

At first sight, the easiest way of iodine deficiency elimination is the use of iodized salt in the diet. In our country, the production of several salt types with optimal iodine content (iodized salt on the basis of "Extra" salt, preventional iodized salt with low sodium content, etc.) is implemented.

Salt iodization is mainly carried out by addition of fixed amount of potassium iodide or potassium iodate to cooking salt. For the prevention of iodine deficiency refined marine salt is also used. However, there are several problems related to the technology of obtaining a homogeneous iodized salt and to stability of iodized product during storage. In addition, iodine-rich food products have a specific taste and do not always meet the taste requirements of the consumers. In this regard, the purpose of our research was to determine the iodine content in salt samples for further study of its stability and residual content in meat products.

II. MATERIALS AND METHODS

The samples of iodized salt from different manufacturers with the same dates of production were purchased in retail chain. The content and stability of iodine in salt, as well as the residual content of iodine in meat products when replacing the cooking salt with iodized one were studied. Minced beef samples were prepared, in which common salt has been completely (2.2% by weight) replaced by iodized one:

Model 1 - fine marine iodized salt (I = 84.7 mg/kg)
Model 2 - iodized salt (I = 60.9 mg/kg)
Model 3 - iodized salt (I = 22.07 mg/kg)
Model 4 (control) - cooking salt (I = 0.0 mg/kg)

The iodine content was determined by voltammetric analyser "PLC-2A" according to federal standard GOST52689-2006.

III. RESULTS AND DISCUSSION

Iodized salt were monitored for two years; results are shown in Table 1. The results showed that more than half of salt samples did not match the value specified on the label. Only four samples had iodine concentration of 40 ± 15 mg/kg, which matched the values specified on the label. In 50% of the samples the content of iodine was in the range of 7-22 mg/kg.

Within three months of storage from the date of iodized salt purchase, iodine concentration decreased by 11 to 50%, despite compliance with the conditions of storage. Given these results, the use of iodized salt in cooking for prevention of iodine deficiency could be ineffective, especially if it is stored for a long time, often loosely-closed and in the light.

Table 1 Results of iodized salt monitoring

Sample	Iodine content, mg/kg	
	2011	2009
Fine marine iodized edible salt 1	36.9	25.4
Evaporated cooking iodized edible salt, extra	22.07	16.9
Fine marine iodized salt 2	84.7	35.9
Iodized salt 1	16.9	20.17
Evaporated iodized edible salt, extra 1	14.71	8.2
	5.02	0.78
		7.4
		6.1
		4.54
Evaporated cooking iodized edible salt, extra 2	17.8	24.3
Evaporated cooking iodized edible salt, extra 3	17.65	19.4
Iodized salt, extra	60.9	32.4

Natural sources of iodine are well-known, so for comparison, we investigated iodine content in kelp (laminaria) and products made from it (Table 2).

Table 2 Iodine content, mg/kg of product

Sample	Iodine content, mg/kg
Salad of kelp with carrot	32.4
Salad of kelp with onion	45.2
Frozen kelp (Salad of kelp with carrot and onion)	24.1
Salad of kelp with crab meat	55.6
Salad of kelp with cranberries	40.2
Dry kelp (laminaria)	80.35-200.0

As can be seen from Table 2, average daily iodine requirement of 150 micrograms supposes daily consumption of approximately 40-100 grams of kelp samples.

Thus, the manufactured products cannot compete with natural ones, since kelp is not just rich with iodine, but also contains biologically active substances helping to digest this iodine. Organic iodine compounds of algal flora are more effective than an equivalent amount of potassium iodide in normalization of thyroid function. This could be explained not only by iodine content of marine plants, but also by content of trace elements and macronutrients (molybdenum, copper, cobalt, etc.) and vitamins that are important for the metabolic processes.

At the next stage, a comparative study of heat treatment resistance of products naturally and artificially enriched with iodine was performed.

The V.M. Gorbatov All-Russian Meat Research Institute works on iodine enrichment of baby food. In this context the problem arose concerning the iodine preservation in product. In view of this problem, we studied the effect of heat treatment on residual content of iodine in food products enriched with various additives containing this trace element.

Comparative studies have established that heat treatment of meat products enriched with iodine leads to the destruction of iodine bonds with the product matrix, but the degree of this destruction is different with lowest destruction when using marine salt. Highest thermolability of iodine was found in iodine-casein, which is clearly shown in Fig. 1.

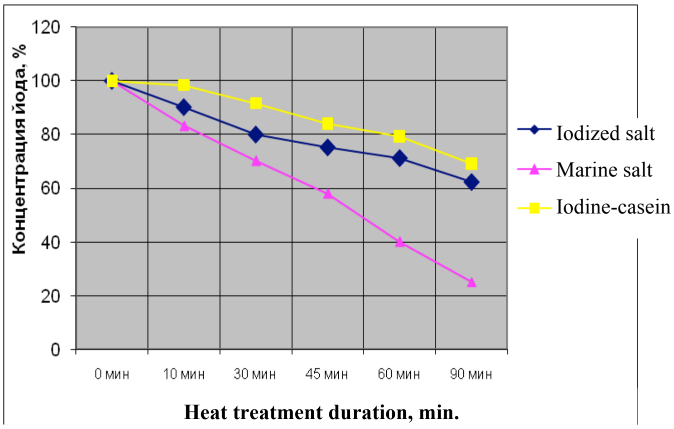

Fig. 1 Effect of heat treatment on residual content of iodine in meat products

At the next stage, a study of quantitative content of iodine in minced meat with replacement of coking salt with iodized one was performed (Table 3).

The studies found that the lowering of iodine concentration in minced meat has decreased insignificantly. As for microbiological parameters, the addition of iodine did not affect the delay of microbial spoilage.

Table 3 Iodine content in minced meat

Sample No.	Brought-in iodine, mcg/kg	Residual iodine, mcg/kg	Residual salt, %
Background, day 1, raw minced meat			
1	42	38	1.54
2	30	25.4	1.54
3	10.8	8.2	1.6
4	0	<5.0	1.6
Background, day 1, cooked minced meat			
1	42	26.7	1.71
2	30	17.4	1.66
3	10.8	<5.0	1.77
4	0	<5.0	1.71
Day 2, raw minced meat			
1	42	39.6	2
2	30	23.1	1.94
3	10.8	8.1	1.88
4	0	<5.0	1.6
Day 2, cooked minced meat			
1	42	26	1.6
2	30	15.5	1.88
3	10.8	<5.0	1.88
4	0	<5.0	1.54
Day 5, cooked minced meat			
1	42	24.2	1.6
2	30	14.7	1.9
3	10.8	<5.0	1.82
4	0	<5.0	1.5

IV. CONCLUSION

In the current study it was found that:

1. There is tremendous variation of iodine content in iodized salt. Up to 50% of the samples do not match the values specified on the label.
2. When manufacturing meat products with the replacement of cooking salt with iodized one, the residual content of iodine in meat products is quite low, and this is ineffective in the prevention of iodine deficiency.
3. The iodine content in its natural food sources (sea salt, kelp) allows recommending them for prevention of iodine deficiency.
4. It is necessary to improve the technology of salt iodization for manufacturing products with stable iodine content.
5. Further studies concerning iodine enrichment of meat products and the impact of technological processing on iodine preservation in final products are needed, especially for baby nutrition.

REFERENCES

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