ENRICHING TABLE EGGS WITH IODINE (I)

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Abstract

During the recent several decades, some experiments have been done in order to produce designer eggs enriched with higher concentration of Iodine, by adding potassium iodide (KI) in the feed mixtures or by adding larger amount of fish meal in the feed composition. In our conditions, the experiment was carried out on 80 weeks old laying hens (Hisex Brown) treated with standard amount of Iodine supplied from standard premixes (0.8 mg/kg feed) and with same type of hens treated with enlarged amount of Iodine in feed by adding solution of potassium iodide (KI) which enlarged the content of Iodine in the feed till 5 mg/kg. The laying hens were divided in two groups: 1. control group – 10 hens and 2. experimental group – 20 hens. The control group was fed with vegetable basic feed containing 0.8 mg Iodine per kg,, offering 120 g of feed/hen/day. The experimental group was fed with the same type of feed and the same amount, enriched with Iodine on the level of 5 mg/kg. The content of Iodine in the egg yolk of control group was 12 μg, but in the yolk of the eggs from the experimental group, after 30 days of treatment, the amount of Iodine was raised to 23μg, which enrichment was nearly doubled. The yolk from enriched eggs are better source of Iodine then regular eggs because they can supply 11 to 15% of daily requirements for adult people in case they consumed one egg per day. In the conditions of the usual custom of our people to consume 3 eggs per week the amount of Iodine from such designed eggs will be about 5 to 7% from requirement.

Key words: laying hens, eggs, enriched, iodine

INTRODUCTION

Tadzer I.S. and Bogdanov B. (1994), discussing iodine deficiency in Macedonia concluded that disease cause because of lack of iodine in food is not rare. The most of water resources in Macedonia are also very poor source of iodine (Toshev P. et al., 1992). The most usual way for supplying iodine in food for all population is using salt enriched with iodine (iodinated salt). But, depending of time of storage the iodine from iodinated salt can be lost. The average loosing goes up to 50%. The other sources for supplying sufficient amount of dietetic iodine could be marine fishes, but using of this type of fishes in the diet of our people is not enough. The daily requirement of iodine for grown population is about 150 to 200 μg, which amount in the common diets does not supply sufficient quantity and because of that appear negative balance of iodine. The possible source of iodine in the diet of our population can be hen egg. In Macedonia have been done investigations for content of I in table eggs from the different regions. The conclusion is that the amount of iodine is differing from 3 to 6 μg in an egg. In some countries as Great Britain the content of iodine in eggs is higher. This enrichment is coming from the inclusion marine fish as a feedstuff in the feed mix composition. Also, the amount of I in eggs can be increased by using other rich types of feed or by drinking water unless it is not poor with I, as it is case in many water recourses in our country.

The last several decades, many researchers work on producing designer eggs enriched with I adding the potassium iodide (KI) in feed of laying hens. Similar results could be reached by adding greater amount of fish meal in the feed mix. Garber et al. (1993) working on designing eggs with I found an enrichment of their concentration of 711 μg in an egg. This result is showing the possibility of enriching eggs with this mineral and also is giving the direction how to make them as a significant source of I for adult population. Eggs as a good protein

source could be in the same time the source of this essential mineral up to the level of 5% of daily I requirements.

Because, in our country in conventional production of eggs the content of iodine is relatively low, from 3 to 11µg in the egg (Bogdanov B. et al., 1996), we conducted an experiment with an idea to produce the eggs enriched with I.

The distribution of I egg's content is in the yolk and albumen. But it is well known that the higher concentration of dry matter and the higher amount of minerals are placed in the yolk. The amount of dry matter in the yolk takes about 51%, but in the albumen it takes from 8-10%. Because of this conclusion in our investigations we have determinated the quantitative content of I in the yolk. Also, the yolk is a part of egg in which is does not content any significant protein alergences or other antinutritients, which characteristics allows the egg yolk to be included in different diets for wide mass of population beginning from little children to the adults people. That was the basic reason for our investigations the determination of I to be focused on the content of yolk.

MATERIAL AND METHOD

With the aim to answer of the established problem it was realised an experiment with laying hens 80 weeks old (Hisex Brown), treated with standard amount of I supplied from the premixes in amount of 0.8 mg/kg feed mixture, and with enlarged amount of I added in the feed as a solution of potassium iodide in water in amount of 5 mg/kg feed. Laying hens were divided in two groups: 1. control group-10 hens and 2. experimental group - 20 hens. The hens were placed in standard cages and fed with basic feed (Table 1). The control group was offered basic feed (0.8 mg I/kg), 120g per hen/day, and experimental group with enriched feed (5 mg I/kg feed).

Table 1. The structure and nutritive value of basic feed

Ingredient	%
Maize	54.72
Soybean meal	22.50
Sunflower meal (28%)	5.00
Maize gluten	2.00
Sunflower oil, crude	2.88
DL methionine	0.07
Choline chloride (60%)	0.11
Potassium carbonate	0.31
Sodium bi carbonate	0.40
Bentonal	0.30
Mono calcium phosphate	1.25
Calcium carbonate	9.79
Salt	0.17
Premix	0.50
Total	100.00
ME, Kcal/kg	2750
Crude protein, %	17.8
Lysine, %	0.91
Methionine, %	0.36
Methionine + cistine, %	0.69
Threonine, %	0.63
Triptophane, %	0.19
Arginine, %	1.12
Calcium, %	4.00
Phosphorus, total, %	0.62
Phosphorus, available, %	0.37
Potassium, %	0.82
Sodium, %	0.21
Chlorine, %	0.17
I (iodine), mg/kg ~	0.80 (control feed)
I (iodine), mg/kg ~	5.00 (experimental feed)

From the data in Table 1 can be seen that the composition of feed was designed only by feedstuffs from plant origin which means that it is not enough I to be supplied the recommended amount needed for basic physiological requirements of birds. Because of this an additional amount of I was included by using special premix and the enrichment of experimental feed with I was done by adding a solution of potassium iodide.

During the experiment it was monitored the following performances of laying hens: - live weight (at the beginning and at the end of experiment), laying intensity, average egg mass, feed consumption, daily iodine consumption in μg per hen.

The concentration of I in the yolk was monitored by collecting the eggs for lab analysis: - 10^{th} day from the beginning of the experiment; 20^{th} and 30^{th} day. Every sample of yolk was made by mixing of 6 yolks from the groups. The eggs were hardboiled, and after that the yolks were separated, measured individually and the samples were homogenised.

Determination of iodine in yolk was measured accordingly the method of Dunn I. et al. (1993), modificate from Bogdanov B. et al. (1996). The samples were wet digested with strong mineral acids solution, prepared with sulphuric, perchloric and nitric acid. After that, iodine was measured accordingly the catalitical function of reduction of Ce^{++} in Ce^{3+} together with arsenic oxidation (As^{3+} in As^{5+}).

RESULTS AND DUSCUSION

The obtained results from this investigations are presented in table 2.

Table 2. Enriching the table eggs with iodine in yolk

Indicator	Group	
	1- Control	2- experimental
	mg iodine in kg feed	
	0.80	5.00
Number of experimental hens	10	20
Hen's age	80	80
Number of weeks in experiment	8	8
Live weight of hens		
- at the beginning, kg	2.18	2.33
- at the end, kg	2.26	2.26
Egg production		
- intensity, %	92.00	90.00
- average egg mass, g	70.97	70.83
Daily feed consumption, g	120	120
Daily consumption of I, μg/hen	96	600
Content of I in 100g yolk		
- 10 days of treatment, μg	65	65
- 20 days of treatment, μg	-	103
- 30 days of treatment, μg	-	125
- average content of I, μg	65	98
- average content of I in one yolk, μg	12	23
Average mass of one yolk, g	19.49	18.46

From the data presented in the table 2 can be seen that laying hens from control group consumed 96 μg I/day and the experimental group 600 μg I/day. The content of I in 100g yolk in experimental group was increasing slowly from 65 μg at the first of collection day ($10^{th\ day}$), to 103 μg at the second, and to 125 μg at the last of collection day (30^{th} day). The amount of I in yolk was enriched slowly, and the highest level was reached one month after the beginning of treatment. In the following period, in case of feeding the hens with fresh feed mixture highest level could be maintained. The content of I in the yolk of eggs from control group was 12 μg which result is in balance with the results of literature (Bogdanov et al., 1996), where maximum concentration of I in one whole egg was 11 μg. In the eggs from experimental group the content of I in yolk

on the 30th day of treatment was 23 μg, which means that the enriching with I was doubled. The yolk from enriched eggs are better source of I then regular eggs because they can supply 11 to 15% of daily requirements for adult people in case they consumed one egg per day. In the conditions of the usual custom of our people to consume 3 eggs per week the amount of I from such designed eggs will be about 5 to 7% of requirement. Similar participation of egg iodine was reported by Lee S.M. et al., 1994 for the people of Great Britain.

CONCLUSSIONS

From the investigations performed with the aim to be produced table eggs with enriched amount of I in yolk can be concluded the following:

1. Standard enriching of vegetable feed mixtures for laying hens with I (0.8mg iodine/kg) enables production of eggs with 65 μg of I/100g yolk, and 12 μg of I per yolk respectively.

2. The laying hens fed the same type of feed mixture enriched with I (5 mg/kg) permanently increased the transfer of I in egg yolk from 65 to 125 μg per 100g in period of 30 days, but the concentration in one yolk was 23 μg.

3. Enriched yolks with I enable the supplying of daily requirements of adult people with iodine, on the level of about 5%, if they eat 3 eggs per week.

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