APPLICATION OF “JODIS” AS A STABILE SOURCE OF IODINE IN THE NUTRITION OF LAYING HENS

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Abstract

The study aimed at finding out how to replace the unstable iodine additives by the stable ones in feeding of laying hens. The control hens received potassium iodide (1 mg of iodine/kg of feed), the feed of trial groups was supplemented with dry stable concentrate iodine “Jodis” (1 mg and 4 mg of iodine/kg of feed). In the control group the amount of iodine in eggs was 5.8 µg/100 g, in the trial groups - 7.2 and 17.2 µg/100 g (by 24% and 196 % more), respectively. The amount of iodine was 0.8 µg/100 g in the liver of control layers; 0.9 and 1.0 µg/100 g in the liver of trial groups (by 12.5% and 25.0 % more), respectively.

Key words: laying hens, eggs, liver, feed additives, iodine.

The World Health Organization has announced that the iodine is one of the most important food components affecting consumers’ health. At least 29% of the world population (1.572 million people) experience health problems related to iodine deficiency. From them, 655 million people including 11% of European people develop hypertrophy of the thyroid gland. Forty-three million of the inhabitants of our planet suffer from psychical disorders caused by iodine deficiency in their mothers during pregnancy (9).

The symptoms of iodine deficiency may develop in humans and animals (2). Iodine contained in eggs is easily assimilated by the human organism (10, 17). Flyn et al. (6) proposed a model for vitamin and mineral enriched food, based on the maximum safe dose allowed in the European diet, to avoid excessive use of feed additives in animal nutrition. The authors conclude that European nutrition may be securely supplemented with most vitamins and mineral substances.

The problem of iodine deficiency has been known for several centuries; however, it has not been completely solved until now. Since 1920, there have been attempts to iodise water, dairy products, bread, and salt. Nowadays, human health programmes in many countries try to overcome iodine deficiency by encouraging the use of iodised salt as well as the production of iodine-enriched food (5, 6). It has been recommended to supplement feed with iodine compounds, especially those of vegetable stock, in which the amount of iodine is small and unstable. The main problem is instability of sodium iodide and potassium iodide. These salines are used most frequently but they are not stable. Solutions have been complicated by the fact that iodine is volatile, i.e. it is unstable and evaporates even if included in other chemical substances (19).

The effect of liquid stable iodine and liquid phytoegenic additives on the chicken organism, based on thyroid morphology and hormone levels in blood serum, was investigated. Changes in thyroid microstructure indicated a reduced gland activity, compared with the control group. By the end of the growing period (42 d of age) the thyroid hormones in the blood serum had increased from 14.3% to 27.1%, compared with the controls (18).

The effect of replacing the unstable iodine additives by the stable ones in the feeding of laying hens on iodine concentrations in eggs and liver was investigated.

Material and Methods

The investigations were carried out on 120 Hisex Brown layers, 28 weeks old, under field conditions. The hens were assigned to three equal groups. The control group received standard commercial layer mash with potassium iodide (1 mg of iodide/kg of feed), while two trial groups received feed supplemented with 1 or 4 mg of iodine/kg of feed contained in the dry...
stable concentrated iodine preparation “Jodis” (Producer - Jodavita Ltd, Lithuania). After a feeding period of 20 weeks, the amount of iodine in the eggs and liver was determined following the method described by Moxon and Dixon (15). Data were analysed by ANOVA with the statistic software JMP (Version 5.1, SAS Institute). Differences between means were tested for significance by the Student’s t-test.

Results

The feeding trial with laying hens demonstrated that the egg weight of the layers of the trial groups was slightly lower than that of the control group, and the amount of iodine in their eggs increased significantly (Table 1).

The “Jodis” administered in a dose of 1 mg of iodine/kg of feed increased the amount of iodine in the egg samples by 1.4 µg/100 g (by 24%) over the control group (P<0.01). The concentration of 4 mg of iodine/kg of feed increased the amount of iodine by 11.4 µg/100 g (by 196%) over the control group (P<0.001). Despite lower egg weight, the consumer of the eggs of trial groups received more iodine – by 19.29% and 177.16%, respectively.

The content of iodine in the liver is presented in Table 2.

The data in Table 2 show that the amount of iodine in the liver of layers of the trial groups was higher in comparison with the control group.

Discussion

In different parts of the world new methods are being developed, and researches are conducted to improve qualitative indices and nutrient value of eggs (7, 10). The data in scientific literature show that iodine in eggs ranges from 1.0 to 12.5 µg/100 g in iodine deficient regions, compared to 4–102 µg/100 g in normal regions (1). From the results of our investigations (Table 1), it is evident that poultry eggs produced in Lithuania will be deficient in iodine. Supplementing feed with the usual potassium iodide is not sufficiently effective because this element in potassium iodide saline is volatile and unstable in feed. The preparation “Jodis” can be used in the nutrition of laying hens as a good alternative.

Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>Feeding characteristics</th>
<th>Egg weight (g)</th>
<th>Amount of iodine (µg/100 g)</th>
<th>Amount of iodine (µg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K + potassium iodide</td>
<td>67.89 ±2.64</td>
<td>5.8 ±0.09</td>
<td>3.94 ±0.07</td>
</tr>
<tr>
<td>2</td>
<td>K + “Jodis” (1 mg of iodide/kg of feed)</td>
<td>65.22 ±3.76</td>
<td>7.2 ±0.08*</td>
<td>4.70 ± 0.23*</td>
</tr>
<tr>
<td>3</td>
<td>K + “Jodis” (4 mg of iodide/kg of feed)</td>
<td>63.49 ±3.07</td>
<td>17.2 ±0.10**</td>
<td>10.92 ± 1.02**</td>
</tr>
</tbody>
</table>

K – standard composite feed
* P<0.01 ** P<0.001

Table 2

<table>
<thead>
<tr>
<th>Group</th>
<th>Feeding characteristics</th>
<th>Liver weight (g)</th>
<th>Amount of iodine (µg/100 g)</th>
<th>Amount of iodine (µg)</th>
<th>Amount of iodine (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K + potassium iodide</td>
<td>40.78</td>
<td>0.8 ±0.05</td>
<td>0.32624</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>(1 mg of iodide/kg of feed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>K + “Jodis” (1 mg of iodide/kg of feed)</td>
<td>39.43</td>
<td>0.9 ±0.05*</td>
<td>0.35487</td>
<td>108.78</td>
</tr>
<tr>
<td>3</td>
<td>K + “Jodis” (4 mg of iodide/kg of feed)</td>
<td>35.16</td>
<td>1.0 ±0.05*</td>
<td>0.3516</td>
<td>107.77</td>
</tr>
</tbody>
</table>

* P<0.001
Daily iodine intake was increased by feeding animals either with inorganic iodine salines or seaweeds *Laminaria digitata*, which contain a lot of iodine. Samples of fresh muscle of pigs receiving the feed with seaweed contained by 45 % more of iodine compared with the control group, receiving potassium iodate at the same concentration (8). Similar results were obtained in our trial, during which the amount of iodine in the liver was investigated.

During the investigations performed in Denmark, seaweeds in the feed for laying hens were used, and their drinking water was sterilised with iodine. The researchers found that the iodine content of eggs varied between 13 µg and 170 µg, reflecting the amount of iodine in the feed (12).

Jeroch et al. (10) noted that the supplementation of layers’ feed with 2 mg of iodine/kg of feed increased the amount of iodine in eggs to 43 µg, compared to 11 µg in the eggs of the hens fed control feed (0.5 mg iodine/kg of feed).

In Polish feeding trials with Lohmann Brown laying hens, 1% premixes with 150 and 300 mg of iodine /kg were compared. It was calculated that daily consumption of one iodine-enriched egg would supply 33% to 35% of the recommended daily iodine intake (3). In our trial, that made up 3.13% and 7.28%, iodine supplementation did not exceed the EU recommended norms.

In 2005, the European Commission asked the European Food Safety Authority (FEEDAP) to evaluate the physiological requirements for iodine of different animal species and possible effect of this supplement on human and animal health or the environment. The FEEDAP Panel concluded that it is safe to supplement feed with iodine, but also stated that the current maximum addition levels for laying hens may be too high and could lead to exceeding the Upper Limit in humans. Reducing iodine to a maximum of 4 mg/kg of complete feed for laying hens was suggested. The FEEDAP Panel also expressed the need for more and updated data on iodine requirement and tolerance in animals and on the impact of iodine supplemented feed on dietary iodine intake of humans. When the amount of iodine in the feed and in the yolk exceeds critical levels, negative reactions occur. Excess iodine in the feed of growing meat-type chickens may delay sexual maturity, in layers it may lead to a gradual decrease in the rate of production and at about 2,500 mg of iodine/kg of feed completely inhibit the ovulation (13). According to Lichovnikova et al. (14) the prolonged feeding of excessive amounts of iodine has detrimental effects on egg production, body weight, yolk index, and eggshell quality. In their study it was also noticed that iodine transfer from feed into eggs is also much higher (10%–20%) than from feed into meat as shown by dose-response.

In 1987, human nutrition science proposed the concept of “functional food” as a possibility to design commonly used food products so that they would not only have a nutritional value, but also show supplementary physiological effects on the human organism, reduce the risk of illnesses, and positively affect the immune system. Poultry meat and eggs can also contribute to the increasing range of functional food (4). In our trial, the eggs of the laying hens receiving the feed with “Jodis” (4 mg of iodine/kg of feed) contained by 196% more iodine than the eggs of the control group, which received iodine in the form of potassium iodide (1 mg of iodine/kg of feed). It was proposed to promote iodine enriched poultry meat and eggs as functional food.

According to our data, consumption of one egg (an average weight is 60 g) enriched with the additive “Jodis” ensures a supply of 10.3 µg of iodine (when birds get 5 mg of iodine/L of water), which makes 7% of the recommended daily intake.

Previous studies at our university had also indicated that “Jodis”, used as a feed additive, positively affected the productivity of broilers, improved biochemical blood serum indices, and reduced thyroid activity. The amount of iodine in the meat of broilers receiving drinking water supplemented with iodine was from 3 to 5 times higher than that in the control groups (7, 11, 19). Consumption of 200 g of chicken meat, enriched with “Jodis”, would add another 20 µg of iodine, making up 30.3 µg in total, that is 20% of the daily iodine requirement for an adult. Therefore, it can be argued that the preparation “Jodis” may be a harmless source of iodine to people. The remaining part of iodine requirement can be supplied through iodinised salt, seafood or, other products.

Turkish researchers supplemented layers’ feed with 3, 6, 12, and 24 mg/kg of iodine in the form of calcium iodate. High supplementation levels (12 and 24 mg/kg) had undesirable effects on feed conversion ratio, egg weight, and albumen quality. Iodine supplementation to the feed significantly increased the iodine content in eggs, but only levels up to 6 mg/kg supplementation had a negative influence on egg production and egg quality (20).

In our trials, iodine content positively correlated with the amount of feed, and in eggs it was significantly higher than in the liver. Similar data has been obtained by other researchers (16).

In conclusion, preparation “Jodis” can be recommended in poultry feeding instead of the unstable potassium iodide.

References

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