

Concentration of ^{137}Cs and heavy metals in meat of ducks, grown in different zones of radioactive contamination

Yu. Savchenko,

I. Savchuk,

S. Kovaliova,

The purpose. To study features of growing ducks on aboriginal feedstuffs at different systems of their growing and to develop methods of production of ecologically safe duck meat in terrains with different density of radioactive contamination of soils. **Methods.** 2 groups of young animals of ducks are generated: I group (control) — non-exercise growing in poultry yards with easy approach to water in pans; II group (test) — exercise growing on the natural bounded pools. Determination of specific activity of ^{137}Cs in feedstuffs, water and killing products of an auk was carried out with the use of AMA-05E and BDEG-20R, the concentration of heavy metals was measured using atomic absorption method on spectrophotometer S-115M. **Results.** In conditions of extensive growing experimental ducks in II and III zones of radioactive contamination on aboriginal feedstuffs and unbalanced rations on calcium, phosphorus and microelements they got meat of ducks with concentration of ^{137}Cs did not exceed allowances (DU-2006=200 Becquerel/kg) and fluctuated within the limits of 9,3 — 75,9 Becquerel/kg. Concentration of lead and cadmium in muscles and liver of experimental ducks did not exceed maximum concentration limit. **Conclusions.** Ecological safety of production of duck meat as one of main products of feed of population in regions with radioactive contamination was proved theoretically and in practice.

Key words: ducks, non-exercise and exercise methods of growing, specific activity of ^{137}Cs , concentration, lead, cadmium, muscles, liver.

Chernobyl Disaster caused radioactive pollution of vast territory and hugely increased the possibility of transfer of radionuclides from the environment to the human body in long term period as well as during short time after the accident. That's why permanent control in this direction is still actual and some sides of the problem still demand further study.

Among inhabitants of Polissya region, part of food in forming total doze of internal irradiation reaches 75-95%. That means that mobility of radionuclides in the chain "soil-plant-animal-food" must be reduced to the minimum as the most dangerous cause of internal irradiation. At the same time, it is not unimportant to control levels of pollution of mentioned territories with heavy metals (such as Pb, Cd, Hg) as highly toxic elements, and counting on the similarity of ways of their migration from the environment to the human body it seemed reasonable to combine studies of both — radiation and heavy metals — on the account of their accumulation in products of duck farming.

It should be noticed, that the problem of industrial ducks farming (including farming on polluted territories) is studied quiet closely. However most of inhabitants of polluted territories use different ways of farming and the question of ecological safety of food produced in such conditions is not enough studied yet.

Experimental part of the study took place during 2001-2012 years. Field experiments №3 and №4 were conducted on the territory of the 2-nd zone of pollution ^{137}Cs (more than 555 kBq/m²) in Khrestynivka village, Narodychy district. Experiment №3 took place in 2001 (in 15 years after the Disaster) whereas experiment №4 was conducted in 2012 (in 26 years after pollution). Experiment №1 was conducted in Grozyne village, Korocten' district (where levels of ^{137}Cs pollution were 185-222 kBq/m²) in 2003 and experiment №2 was conducted in Obyhody village, Korocten' district (where levels of ^{137}Cs pollution were 259-555 kBq/m²) in 2004.

Experiments started with birds of 1-day age. Experiments 1 and 2 took 105 birds each, which average weight was 41.4 and 38.1 g accordingly. Experiments 3 and 4 took 60 1-day age birds each, which average weight was 39.9 and 40.6 g accordingly.

During the 1-st month all the animals were kept at the same conditions after what they were separated in 2 groups described above. In the experiments 1 and 2 there were 50 birds in each group with average weight of 530 and 518 g accordingly and in the experiments 3 and 4 there were 25 birds in each group with average weight of 525 and 520 g accordingly.

As it was mentioned above the birds of 1-st (control) group were kept in cages during the daytime and were inside of buildings during nights whereas birds of 2-nd group during the day moved freely around ponds of area 0.4-0.6 ha, where they couldn't collect enough food, but returned to cages for feeding and spent nights inside of buildings as well as the 1-st group's members. The quantity of males and females in groups was the same.

Laboratory researches included study of heavy metals and ^{137}Cs contamination in food and water for ducks as well as in their flesh and liver afterwards.

In the experiments 1 and 2, the obtained results show existing difference between 2 groups. In the 2-nd group, the concentration of ^{137}Cs in the ducks' flesh was 32,8-66,7% less than in control group. It was found out that the main part of ^{137}Cs was accumulated in ducks bodies during first 60 days of life where they grew especially fast and then the speed of accumulation slowed down. Comparing to the 60-days age, at the age of 90-days the intensity of ^{137}Cs accumulation was 55% smaller. Comparing to the 90-days age, at the age of 120-days the intensity of ^{137}Cs accumulation was 29.6% smaller. And finally comparing to the 120-days age, at the age of 150-days the intensity of ^{137}Cs accumulation was 26.7% smaller. So during the whole period of 150 days concentration of ^{137}Cs in ducks' flesh decreased.

However in the experiments 3 and 4 results were somehow different. Being kept under condition of higher environmental ^{137}Cs pollution, animals continued accumulate radiation longer — until 90-days age and only after those 3 months the decreasing of ^{137}Cs concentration in their flesh could be registered.

In the experiment 3 (2001), levels of pollution ducks' flesh with ^{137}Cs were high during whole their life. However in the 2-nd group of animals levels were 22,1 %; 40,3; 44,5, and 40% less than in control group at the age of 60-, 90-, 120- and 150-days accordingly.

In all the experiments levels of ^{137}Cs in ducks flesh during 30-days — 150-days age was under maximal allowed levels (less than 200 Bq/kg).

As for heavy metals, it has been found out that Pb concentration in the flesh of ducks of the 2-nd group was smaller than in control (11.1% at the age of 60-days and 14.3% at the age of 150-days). Concentration of Cd was smaller in the 2-nd group comparing to control as well (13.6% at the age of 60-days and 25.0% at the age of 150-days).

Counting on natural mission of liver in the body, which can be characterized as a collector of variety toxic substances, it has been decided to study that part of animals' bodies on the subject of heavy metals concentration as well. It was proved that the liver gained concentration of Pb and Cd during whole the life of animals.

In general, it has been proved, that concentration of ^{137}Cs , Pb and Cd in flesh and liver of ducks farmed on the territory polluted in consequence of Chernobyl Disaster, allows (according to existing legal limits) to use products gotten during farming for food.

Conclusions

Ecological safety of production of duck meat as one of main products of feed of population in regions with radioactive contamination was proved theoretically and in practice.

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