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HACCP-BASED FOOD SAFETY ASSESSMENT OF NUTRITION MEAT: BIOSAFETY PRINCIPLES AND ECONOMIC DAMAGES CAUSED BY INFECTIOUS (PARASITIC) DISEASES

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ОЦЕНКА БЕЗОПАСНОСТИ МЯСА НУТРИИ НА ОСНОВЕ ПРИНЦИПОВ HACCP И АНАЛИЗ ЭКОНОМИЧЕСКОГО УЩЕРБА ОТ ИНФЕКЦИОННЫХ (ПАРАЗИТАРНЫХ) ЗАБОЛЕВАНИЙ

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Abstract. The meat of nutrias differs in its biological qualities, nutritiousness, and especially in its ecological cleanness from other animal meats. In the motherland of nutrias in South America and Europe, delicacies and other dietary foods are cooked. It is similar to turkey meat, which is very popular in our country. The color of nutria meat is like the color of European hare. The muscle fiber is characterized by being thin, delicate, and having gathered fat. Safety of feeding products management in the field of agriculture is determined by modern concepts of quality and safety processes effectively. This concept responds to all HACCP principles, which are held in the entire production process. The aim of the HACCP system is discovering dangerous factors and guaranteeing the safety of products. The HACCP system uses preventive measures and puts the responsibility for food safety on the producer. In the comparative controlling of final product safety, the HACCP principle is the governing method. Arthropod parasites of hair lice, namely Pitrufquenia coypus, are widely spreading in the skin and leather of nutrias. In nutrias, these lice are encountered at any time of the year (16.8%-76.6%), but mass-scale spreading occurs in spring and summer months. Also, invasion can be found in any adult nutria (28.1%-59.6%). This case is especially dangerous for nutrias that have babies (mother nutrias), which are not going for walks and are always living in cages. The lice always live in the aural and spine parts of nutrias. For cleaning nutrias of these lice, a 0.1 percent Varbex preparation was used. The repeating treatment was held in 2 weeks. The measures took place in cages with a sprayer, and for every head (the body part was soaked), 0.1-0.2 liters of Varbex solution was used. Meanwhile, we disinfected the floor, the walls of cages, and walking areas. For this aim, for every 1 m^2 place we used 200 ml solution of varbex. After the cure, the common clinical care and feeding of nutrias were normal.

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Аннотация. Мясо нутрии отличается от мяса других животных своими биологическими характеристиками, питательной ценностью и, в особенности, экологической чистотой. На родине нутрий (в Южной Америке) и в Европе из этого мяса готовят деликатесные и диетические блюда; по своим свойствам оно напоминает мясо индейки, популярное в нашей стране. Цвет мяса нутрии схож с цветом мяса зайца-русака. Мышечные волокна характеризуются тонкой, нежной структурой и наличием внутримышечного жира. Обеспечение безопасности пищевой продукции в сельском хозяйстве осуществляется на основе современных концепций управления качеством и безопасностью производственных процессов. Данный подход полностью соответствует принципам системы HACCP, применяемой на всех этапах производства. Цель системы HACCP — выявление опасных факторов и предотвращение попадания небезопасной продукции к потребителю. Система HACCP базируется на превентивных мерах и возлагает ответственность за безопасность пищевых продуктов на производителя. При контроле безопасности готовой продукции принципы HACCP являются определяющими. Широкое распространение среди нутрий имеют эктопаразиты — власоеды вида *Petrufgeana coypus*, обитающие в волосяном покрове и на коже животных. Заражение этими паразитами встречается у нутрий в любое время года (с частотой от 16,8% до 76,6%), однако массовое распространение наблюдается в весенне-летний период. Инвазия может затрагивать нутрий любого возраста (показатели варьируются от 28,1% до 59,6%). Особую опасность это представляет для самок, имеющих потомство, которые содержатся в клетках без выгула. Вши у нутрий обычно локализуются в области ушных раковин и вдоль позвоночника. Для обработки животных от вшей применяли 0,1%-ный раствор препарата «Варбекс». Повторную обработку проводили через две недели. Обработку осуществляли в клетках методом опрыскивания; на каждую особь (с тщательным смачиванием шерстного покрова) расходовали 0,1–0,2 л раствора «Варбекса». Одновременно проводили дезинфекцию пола, стенок клеток и выгульных площадок, расходуя 200 мл раствора «Варбекса» на 1 м² площади. После обработки содержание и кормление нутрий осуществлялись в обычном режиме.

Keywords: HACCP, food safety, nutria, disease.

Ключевые слова: ХАССП, безопасность пищевых продуктов, нутрия, заболевание.

The territory of our republic is one of the most fascinating corners of the world due to its geographical relief. Just as the plants widespread here are distinguished by their diversity and endemicity, the animal world is also correspondingly diverse. In such a diverse physical and geographical territory of Azerbaijan, various animal species live, including nutria, a wild animal with fur. Nutria is a water animal with a snout. It was brought to Azerbaijan for the purpose of obtaining fur. Currently, nutria are bred in cages, free and semi-free conditions. Nutria mainly settle on the banks of rivers and lakes. However, first, they cut the water in a certain place to prevent it from flowing and create ponds. They do this so that when the water increases, their nests will not be flooded. To build a pond, they gnaw a tree with their sharp teeth, pour mud on the sides of the pond, and fill the empty spaces with stones. They build their houses around the back of the cut part of the tree from the branches and leaves. They make their nests only under water. Nutria live in North America, in some parts of Europe and Asia. The body length of nutria reaches 1 meter. Their weight varies between 30-32 kg. Nutria feed on plants. In spring and summer, they eat green leaves and cereals, and in winter, they eat spikes that they collect in the summer for reserves. They store their supplies underwater in their burrows [11].

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In Azerbaijan, which is an independent state, special state care is shown to the development of small entrepreneurship and private farms. In our republic, small and medium-sized entrepreneurship has begun to develop very widely in the last 10–15 years. Nutria, as a form of entrepreneurship, is taking shape and developing as one of the main economic sectors. Recently, due to the prevailing food shortage in the world, as well as the low economic costs and increasing interest in this convenient type of livestock farming, nutria have begun to be developed in various regions [2].

Currently, the most widely used system for food safety management in the world is the HACCP (Hazard Analysis and Critical Control Point) system, which is a mechanism for identifying, assessing, and controlling hazardous factors, which is of great importance for food safety management. HACCP is considered the most effective system used for food safety management in modern times [9].

The use of the HACCP system allows for the development of preventive methods instead of end-product testing and provides the opportunity to prevent, eliminate, or minimize threats to food product safety using scientifically based methods [10].

Biosafety — as a scientific discipline, it encompasses the development of theory and practical methods for protecting humans, animals, and the environment from biological agents that are dangerous. The term biosafety means "the protection of life" [15].

Nutria meat is similar in color to the meat of the island rabbit. The muscle fibers are thin and delicate and are often characterized by the accumulation of fat. Unlike older nutria, the meat of young nutria has less fat and more connective tissue. In nutria, fat accumulates under the skin, in the pelvic cavity, in the lumbar region, around the kidneys, and only in highly fatty nutria in other parts of the body. The accumulation of fat between the muscle fibers of the meat is very rare in nutria, so the muscle cross-section in them is uniform in color and the meat is not marbled. As soon as the skin of a nutria is removed, the meat turns red. However, after 3–4 hours, as a result of the oxidation of myoglobin by oxygen in the air, it darkens and acquires a blue or blue-violet color [5].

Nutria are subject to various diseases, including parasites. One of the most widespread and harmful parasitic diseases among nutria is syphunculiasis (lice infestation). This disease causes some damage to nutria. Nutria infected with it also act as a source of invasion [1, 3].

This is a disease of nutria, and its causative agents are skin-sucking insects from the class Insecta. In Azerbaijan, hair-eating insects belonging to the genus Mallophaga, Petrufguenia coypus, are widespread; they differ in their specificity and are widespread everywhere as the main parasite of nutria [6–8].

The most widespread of the arthropod parasites living in the skin and fur of nutria is the Petrognatha coypus hairworm. The parasite causes discomfort, itching, and even inflammation in nutria; babies are relatively stunted in growth, become weak, become less resistant to other diseases, and finally, death occurs among the weakened ones. Freeing nutria from lice is important for obtaining high-quality fur [3, 4].

Material and methodology

The research work was carried out in the Garayazi State Nature Reserve of the Gazakh region and in the laboratory of the Department of Infectious Diseases of the Azerbaijan State Agrarian University. The Garayazi State Nature Reserve was established on an area of about 6000 hectares in the Kuratraf forests of the Agstafa forestry in the Gazakh region by the decision of the Azerbaijani government dated March 2, 1978. However, later, 1119 hectares of land from the forested and unforested territory of the reserve were transferred to the Sadigli viticulture state farm of the Gazakh region, leaving 4855 hectares. In June 2003, by the decision of the Cabinet of Ministers of the Republic of Azerbaijan, the area of the reserve was expanded to 9658 hectares. According to literature data and our experience, this disease is recorded in young nutria, and in this case it can cause stunting,

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weakness, the appearance of various diseases, and even mass mortality among nutria. We recorded this invasion mainly in the Garayazi State Nature Reserve, as well as in farms and neighborhoods nearby. Nutria kept in cages that do not have contact with water spread the parasite among themselves. In animals kept in such conditions, infection is frequent and the intensity is high. The number of lice in nutria has been determined from 8 to 850 (on average 125). Parasitism of lice in nutria occurs in all seasons of the year (16.8–76.6%), and mass reproduction occurs in spring and summer. Invasion is recorded in different groups of young nutria (28.1–59.6%). This situation is most dangerous for mother nutrias who are kept in permanent cages and are not allowed to walk, and who have suckling babies with them. Lice most often settle in the folds of skin at the base of the ears and on the back of nutria.

Results of the experiment

When keeping nutria in open aviaries without water, it was found that the number of insects recorded ranged from a minimum of 8 nutria to a maximum of 850 nutria, with an average of 125 samples. As can be seen from Table 1, nutria can be found in any season of the year in the range of 16.8%-76.6%, with the most widespread periods being spring and summer. The amount of initial infection in the life of nutria is large (Table 1, 2); for example, in the period from 8 to 3 months of age, 28% of nutria are infected; from 6 months of age, this increases to 55.1%; from 9 months, it is 54.5%; and from 59.6% to 49.2% in 1-year-olds. Among nutria, mainly mother nutria, cubs, and nutria that are constantly kept in cages and are given for fattening are infected. Basically, insects accumulate on the skin, around the ears, and on the neck. In nutria, mites first settle on the animals' heads, necks, and chests. At this time, some itching symptoms are noticeable on the eyebrows, at the base of the ears, and at the temples. Then, small nodules and scabs form, localized in nutria on the back, chest, abdomen, base of the tail, lips, nose, tips of the ears, and lower legs.

Table 1

INFECTION OF NUTRIA WITH SIPHUNCULIASIS BY SEASON

Seasons of the year	*Number of nutria examined (start)*	*Extensiveness of invasion*	
		First of all	*Infection, %*
Summer	180	113	62,8
Summer	158	121	76,6
Autumn	165	53	32,2
Winter	125	21	16,8
Overall result	628	308	49,2

Table 2

INFECTION OF NUTRIA OF DIFFERENT AGE GROUPS
WITH THE PARASITE PETASIGENIUM COULYSI

Age groups of nutria	*Extensiveness of invasion*	
	In every head	*Infection, %*
From 1 month to 3 months	44	28,1
From 4 months to 6 months	88	55,1
From 7 months to 9 months	85	54,4
From 8 months to 12 months	93	59,6
Total	308	49,2

During the study, the disease was diagnosed based on clinical signs such as itching, baldness, inflammation, infiltration, crusting, and wrinkling of the skin, as well as epizootological data such as

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the infection of several animals and the occurrence of the disease in the autumn-winter season. Although it is easier to diagnose in cases where the symptoms of the disease are clearly visible, we found that it is difficult to diagnose the latent form of the disease in the summer months. Therefore, we made the actual diagnosis based on the detection of the tick and its eggs. We took the material for examination from the border of diseased and healthy tissue. It is necessary to try to include living tissue with the scab, because it is not worth looking for ticks in the scab, scales, or hair follicles. From weakly infected nutria, we took scabs from the neck, nape, lower jaw, scrotum, ear flap, and the inner surface of the limbs. We used various methods to find the tick. During the study we conducted, we placed the material in a Petri dish, covered it with a lid, and heated it slightly. We easily saw the mites that had come out of the lesion and collected on the hot lid by looking at it with a microscope.

In the experiment, we poured a few drops of white oil on the scab placed on the glass, and then pierced it with a needle and broke it. At this time, the appearance of moving or immobile mites and their eggs under low magnification of the microscope confirms the diagnosis.

When making the diagnosis in the laboratory, we immersed the sample placed in a watch glass in warm water and kept it in a thermostat for 15-20 minutes. Microscopy allows us to find only live mites. Since the dead ones remained in the scab, it was possible to select them. If necessary, we can also use 10% alkali instead of warm water.

The Varbex preparation is a highly toxic insecticide and can be used against all types of insects. Due to the fact that nutria quickly get rid of parasitic insects, an experiment was conducted using this preparation in the Garayazi State Nature Reserve of the Gazakh region, and its results are shown in Table 3 below.

Table 3

TOXICITY OF THE DRUG VARBEX
AGAINST THE PREDATOR PERFUGENIA COYPUS IN NUTRIA

Concentration of the drug, %	*Amount of parasites (count)*		
	In practice	*Dead*	*Intensity of dead parasites, %*
0,001	60	2	3,2
0,005	60	9	15,0
0,01	60	17	28,2
0,05	60	30	50,0
0,075	60	56	93,3
0,1	60	60	100
Water (Control)	60	Survived	0%

Conclusion

As can be seen from the results of the experiment, 0.1% Varbex preparation is the best preparation for nutria to get rid of parasitic insects that eat the skin. The preparation can be used again after 14-15 days. Treatment:

1. To get rid of lice in nutria, a 0.1% solution of Varbex preparation is used. Repeated treatment is carried out after 2 weeks. After the second treatment, no infection is observed for a month. The procedure is carried out in cages or specially prepared places with a sprayer until the skin and fur surface of the body are completely wetted (using 0.1-0.2 liters of solution per head). The general clinical condition and feed intake of nutria treated with Varbex remain normal.

2. At the same time, the floor, walls of cages, and walking area can be disinfected with a 0.1% solution of Varbex. For this, 200 ml of solution is used per 1 m^2 of area.

3. When working with preparations against *Pemphigus capitis* lice, the instructions for storage, transportation, and use of pesticides in agriculture must be followed. It should also be taken into

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account that it is not recommended to work with insecticides for more than 5-6 hours, and during this time it is forbidden to smoke, eat, or drink. At the end of the work, hands and face must be washed.

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