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CHANGES INTO THE HAIR CELLS IN THE MINK OF CAGE BREEDING UNDER VARIED INTENSITIES OF INFESTATION BY EIMERIIDOSES

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ABSTRACT

This work studies indicators of commercial properties of mink skins. There have been present indicators assessing the quality of male and female caged mink skins obtained from animals with varying degrees of intensity of invasion by eimeriidoses. This study involves four experimental groups of male and female mink skins, under varied degrees of invasion intensity (II). The first group of skins - from clinically healthy animals. The second group of skins - from mink patients with eimeriidoses with a weak degree of II. The third group of skins - from minks sick with eimeriasis with a moderate degree of II. The fourth group of skins - from animals with eimeriasis with a high degree of II. The extensiveness of the invasion of minks by Eimeriids in the Russian Federation's North-West region's fur farms is analyzed. There had presented the results of studying the length and thickness of hair, height, density, and softness of the hair coat, area, and sorting parameters of male and female mink skins obtained from animals with varying degrees of intensity of invasion by eimeriidoses. Also have been described the lifetime defects that arise due to shortcomings in breeding work, improper feeding, and fur animals' maintenance. Mink general physiological state's influence and its immunological reactivity on the fur skin's quality have been studied and discussed.

Disciplinary: Animal Science, Bioscience and Biotechnology, Veterinary, Biology.

1. INTRODUCTION

Fur has long played an essential role in developing trade and serves as a foreign exchange source. Many countries of the world buy fur from Russia. Some colored varieties of mink obtained in our

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country had quoted on the world market higher than skins from competitive European countries.

To a large extent, furs' quality depends on the organizational and economic activities carried out in fur farms. However, industrial processing and dressing of fur cannot significantly improve the quality of skins. Intravital defects on skins often arise due to shortcomings in breeding work, improper feeding, and keeping animals (Abramov et al., 2013; Balakirev, 2016). The animal's general physiological state and its immunological reactivity can also affect fur raw materials (Berestov, 2015). Aymeriidoses are among the main reasons for the slowdown in young minks' growth, increased mortality, and deterioration in adult animals' fur (Abramov, 2014). Representatives of the general Eimeria and Isospora are in the intestinal mucosa's epithelial cells and cause catarrhal-hemorrhagic enteritis. Catarrhal-hemorrhagic enteritis manifested by hyperemia and edema the small intestine's mucous membrane, the epithelium's desquamation, and disruption of the villus structure (Eremeeva, 2013).

One of the many fur-bearing animals' species is mink, breeding in fur farms (Ilyina et al., 2014). At the moment, it is mink production that is the leader in the industry. Minks are excellently breeding in captivity. They quickly adapt to life in cages and artificial feed (Kuznetsov et al., 2020).

It knows that mink belongs to the group of animals producing relatively short-haired skins (Pereverzeva, 2015). Despite this, various scientists' studies have established significant differences in hair length indicators in both females and males (Shepelev and Pechenezhskaya, 2011). These fluctuations are due to each animal's characteristics, sex, age, and seasonal variability (Terashima et al., 2001; Tsarev, 2012). This indicator is also significantly influenced by factors: feeding, age, the season of the year, and conditions of keeping animals (Tsepkov, 2015; Tserevetinov, 2016). The hair of the mink has a tiered structure. According to the length, the hair categories are descending order in the following sequence: guides, guard, transitional, and downy (Tymoshenko, 2016).

The research aimed to study the indicators of some commercial properties of the hair coat of male and female caged mink skins obtained from animals with varying degrees of II eimeriidoses.

2. MATERIALS AND METHODS

Laboratory research for diagnosing parasitosis of fur animals was at the Department of Parasitology, named after V.L. Yakimova, from 2013-2019.

For conducting a scatological study, from each animal were taken fecal samples of 10-20 g packed in plastic bags, hermetically sealed, and labeled. The temperature regime for sample storage + 4°C. Feces was examined by the Darling method using a universal diagnostic flotation fluid (Belova et al., 2013).

The identification of the species of coccidia oocysts was by morphological method (Krylov, 1999).

Eimeriid oocysts were sporulated according to the method of Arnastauskene (1985) using a 2% potassium dichromate solution. After concentration and washing, the oocysts were placed in this solution in a thermostat at a temperature of 25-28°C, after which oocysts were viewed daily directly in Petri dishes by microscope.

For light microscopy, the obtained temporary preparations by the bright field method, the material was examined on a Microton-200M trinocular microscope manufactured by OOO PETROLAZER and a Carl Zeiss Primo Star microscope with visualization at magnification (approx. 10x, vol. - 10, 20 and 40) with a nozzle Micrometer model OMP LOMO. Photo registration was

carried out using microscope cameras and a Mi MIX 2 (Xiaomi) smartphone. All helmintoovoscopic methods were by GOST R-54627-2011, methodological guidelines MUK 4.2.3145-13, and the State Standard "Methods for laboratory diagnosis of coccidiosis" (Timofeev et al., 1982).

The study objects were male and female minks' skins in 24 pieces of the standard dark brown (STC) color type. The skins were removed with a pipe, keeping the head, paws, tail, and preserved in a fresh-dry way. We studied the hair length, thickness, height, density, hair coat softness, area, and mink skins parameters by GOST R 55587-2013.

The samples took from the ridge, belly, and rump to determine the size and thickness of dark brown mink skins' hair. At each topographic site, the hair had divided into categories: guard, transitional, and down. The average direct measurement of each hair category was by counting the method with an accuracy of 1 mm. The thickness (guard and transitional hair in the middle part) by microscope with an x7 eyepiece magnification x40 objective with 5 microns' accuracy. In each sample, 25 hairs of each declared category had studied at all topographic areas of male and female mink skins.

Measuring hair length. Distinguish between natural and true length. Natural depends on the length of the unstraightened (curled or curved) hair. The true length had established by measuring the straightened hair. Length values for all hair categories are in mm.

Measuring hair thickness. Before proceeding with hair thickness measurement, the price of one division of the eyepiece micrometer is setting by objective micrometer, usually with the graduation of 0.01 mm, that is, 10 microns. All hair categories are measured separately. The thickness is in microns.

Measuring the height of the hairline. The hairline's height is the shortest distance from the skin to the covering hair's tip, measured with a ruler, in mm.

Determination of the thickness of the hairline. Calculation of all categories of hair located on 1 cm2 of the skin.

Measurement of the softness coefficient. Hair softness is defined as the degree of elasticity of the hair when compressed or bent. The hairline's softness is a complex indicator and depends on the thickness and microstructure of the hair, the ratio of the shaft's thickness to its length, and the guard and down hair's quantitative ratio.

The softness coefficient is the ratio of the guard hair's thickness, expressed in microns, to their length, in mm, multiplied by 10^{-3}.

$$K = \frac{D}{L \times 10^{-3}} \quad (1),$$

D –the average thickness of the guard hair (μm),

L – the average length of guard hair (mm).

Determination of the area skins. Each skin area had determined as length (between eyes to root of tail) by twice width, measured in its middle, with an error of no more than 0.5 cm.

Statistical Analysis. Continuous variables are the mean ± SD, and dichotomous variables are as numbers and percentage values. All data were analyzed using SPSS. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS AND DISCUSSION

From 2013-2019 of six fur farms in the Russian Federation (Leningrad and Kaliningrad regions), the study examined 6118 intact minks infected with eimeriids (*Mustela vison, M. lutreola* Linnaeus,

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1761, *Neovison vison* Schreber, 1777). According to the results of parasitological studies, the causative agents of eimeriidoses were in 2687 animals (EI - 43.92%) (Table 1).

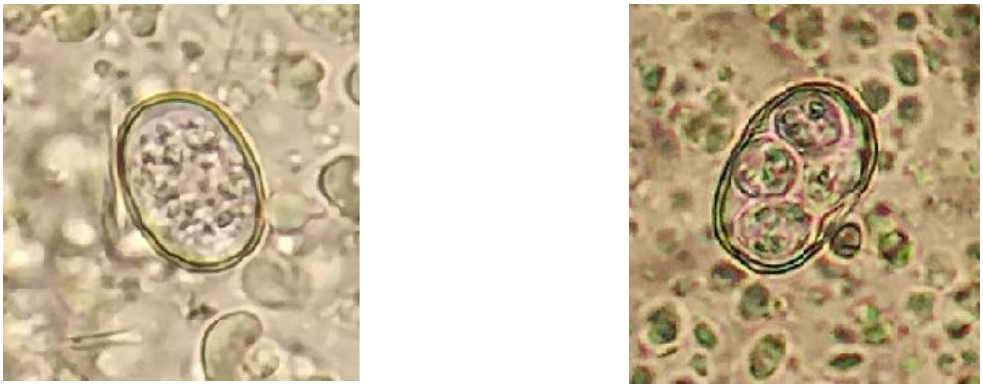
Table 1: Extensiveness of mink infestation by eimeriids in animal farms of the Russian Federation' North-West region

Types of eimeria and isospores	Number of examined	Infected	The extensiveness of invasion, %
Eimeria vison	6118	869	14.20
Eimeria furonis	6118	48	0.78
Total eimerium	6118	917	14.99
Isospora laidlawi	6118	1356	22.16
Isospora eversmanni	6118	3	0.05
Total isospores	6118	1359	22.21
Total monoinvasions:	6118	2276	37.20
Eimeria vison + Eimeria furonis	6118	34	0.56
Eimeria vison + Isospora laidlawi	6118	294	4.81
Eimeria vison + Isospora eversmanni	6118	2	0.03
Eimeria furonis + Isospora laidlawi	6118	34	0.56
Eimeria furonis + Isospora eversmanni	6118	1	0.02
Isospora laidlawi + Isospora eversmanni	6118	11	0.18
Mixed invasion by two parasites:	6118	376	6.15
Eimeria vison + Isospora laidlawi + Isospora eversmanni	6118	4	0.07
Eimeria vison + Eimeria furonis + Isospora laidlawi	6118	31	0.51
Mixed invasion by three parasites:	6118	35	0.57
TOTAL:	6118	2687	43.92

The predominant protozoa species were Eimeria vison, Eimeria furonis, Isospora laidlawi and Isospora eversmanni (Figure1-4).

a - unsporulated x1480 b - sporulated x1340

Figure 1: Oocyst *Isospora laidlawi* (original)



a - unsporulated x1440 b - sporulated x1440

Figure 2: Oocyst *Eimeria vison* (original).

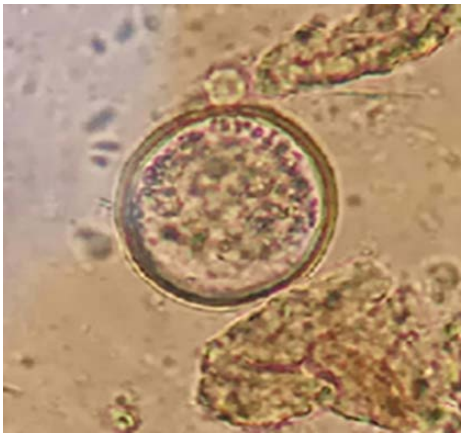
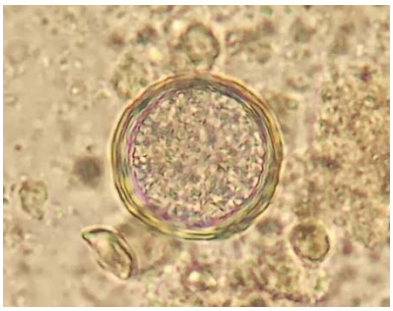


Figure 3: Unsporulated oocyst *Eimeria furonis* x3140 (original)



a - unsporulated x1890

b - sporulated x2680

Figure 4: Oocyst *Isospora eversmanni* (original)

Then the animals were divided into four experimental groups depending on the intensity of invasion (II). 1st group of skins - from clinically healthy animals (n = 6); 2nd group of skins - from minks sick with eimeriidosis with the weak intensity of invasion (n = 6); 3rd group of skins - from mink patients with eimeriidosis with medium intensity of invasion (n = 6); 4th group of skins - from patients with eimeriidoses with high intensity of invasion (n = 6). Simultaneously, the weak intensity of invasion was when 1 g of feces contained 1 to 280 oocysts, average from 280 to 560, and high from 560 to 1280 oocysts.

Analysis of the results of the length of down hair (Table 2) showed that there is no significant difference between the indicators of both natural and true length of down hair in skins from minks' females of second, third, and fourth groups. All of them are inferior to female mink skins of the first group on average by 2-3 mm. In males, the length of downy hair in all four experimental groups did not differ significantly.

Table 2: Mink downy hair length, mm, n = 25

Topographic areas	Sex	1 group, n=6		2 group, n=6		3 group, n=6		4 group, n=6	
		NHL*	THL*	NHL*	THL*	NHL*	THL*	NHL*	THL*
Belly	♂	11.2±0.2	12.8±0.2	11.0±0.3	13.2±0.2	10.8±0.2	12.4±0.2	10.0±0.2	11.4±0.4
	♀	13.0±0.3	14.0±0.3	11.9±0.8	12.2±0.6	11.7±0.6	12.05±0.5	10.0±0.4	11.0±0.4
Ridge	♂	17.3±0.3	18.4±0.3	16.8±0.2	18.6±0.2	16.8±0.4	18.2±0.4	16.4±0.2	18.3±0.2
	♀	13.1±0.2	14.3±0.2	12.8±0.3	13.0±0.5	12.1±0.8	12.1±0.8	10.7±0.6	11.7±0.4
Rump	♂	13.1±0.2	14.6±0.3	12.9±0.2	14.5±0.2	12.2±0.4	14.0±0.2	12.0±0.3	13.8±0.3
	♀	12.0±0.7	13.0±0.7	11.7±0.5	12.1±0.5	11.1±0.2	11.9±0.2	9.3±0.7	10.8±0.6

NHL* - natural hair length
THL* - true hair length

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Results of analysis of the length of transitional hairs (Table 3) indicate no significant difference between the indicators of both natural and true length in skins from animals of both sexes of first and second groups. The indices of the natural and true length of transitional hairs in the corresponding topographic areas of the skins of females of minks of the third and fourth groups are significantly less than those of the first and second groups by an average of 2 mm, in males by 2-3 mm.

Table 3: Mink transitional hair length, mm, n = 25

Topographic areas	Sex	1 group, n=6		2 group, n=6		3 group, n=6		4 group, n=6	
		NHL*	THL*	NHL*	THL*	NHL*	THL*	NHL*	THL*
Belly	♂	15.5±0.3	17.4±0.2	15.3±0.2	16.4±0.2	14.4±0.3	15.2±0.2	13.7±0.3	15.1±0.2
	♀	14.2±0.5	15.4±0.5	14.0±0.2	14.4±0.8	12.9±0.2	13.5±0.2	12.3±0.5	13.5±0.5
Ridge	♂	20.9±0.3	21.9±0.3	20.0±0.3	21.5±0.3	20.0±0.3	21.2±0.4	19.4±0.4	21.2±0.2
	♀	14.6±0.3	15.4±0.3	14.4±0.3	15.3±0.3	13.5±0.2	13.6±0.2	12.8±0.5	13.8±0.5
Rump	♂	17.9±0.3	19.9±0.3	17.4±0.4	18.6±0.4	16.4±0.4	18.0±0.3	15.2±0.2	15.8±0.2
	♀	14.1±0.4	15.2±0.4	13.7±0.4	15.4±0.4	11.1±0.3	12.1±0.3	11.3±0.3	12.0±0.3

The analysis of the obtained results (Table 4) showed no significant difference between the indicators of the length of the guard hairs in the corresponding topographic areas of females' skins and males of minks of the first and second groups. The indicators of the length of the guard hairs in female mink skins of the third and fourth groups are significantly less than those of the first and second groups by an average of 2-3 mm, and in males by 3-4 mm.

Table 4: Mink guard hairs length, mm, n = 25

Topographic areas	Sex	1 group, n=6	2 group, n=6	3 group, n=6	4 group, n=6
Belly	♂	24.9±0.4	24.2±0.3	20.6±0.3	20.5±0.3
	♀	19.5±0.6	18.9±0.6	17.2±0.5	16.1±0.5
Ridge	♂	27.1±0.2	26.2±0.3	24.8±0.3	24.5±0.2
	♀	20.0±0.4	19.8±0.4	17.1±0.4	16.2±0.4
Rump	♂	24.9±0.4	24.2±0.3	20.6± 0.3	20.5±0.3
	♀	19.2±0.4	18.8±0.4	16.7±0.5	14.8±0.3

At the next stage of the work, the height of the hairline of mink skins of different sexes of four groups was studied, depending on the intensity of invasion of eimeriidoses (Table 5). As a result, this study found no significant difference between hair height indicators in skins from minks' females and males from the first and second groups. The indicators of hair height in minks' females from third and fourth groups are significantly less than those of the first and second groups by an average of 2-3 mm, and in males in the same groups by 4-6 mm.

Table 5: Mink hair height, mm, n = 25

Topographic areas	Sex	1 group, n=6	2 group, n=6	3 group, n=6	4 group, n=6
Belly	♂	22.5±0.4	21.8±0.2	18.4±0.4	18.3±0.3
	♀	16.5±0.6	15.7±0.6	13.2±0.5	13.1±0.5
Ridge	♂	26.5±0.2	25.9±0.4	21.3 ±0.3	20.4±0.2
	♀	17.0±0.4	15.8±0.4	13.9±0.4	13.2±0.4
Rump	♂	24.1±0.2	23.3±0.3	18.8±0.2	18.7±0.2
	♀	16.2±0.4	15.3±0.4	13.7±0.5	11.8±0.3

One of the significant properties is the thickness of a hair of various categories, which, together with their length, determines the softness, elasticity, and silkiness of the hair coat of mink skins.

The results of studying the guard's thickness indicators, transitional, and downy hairs in different topographic areas of male and female mink skins are in Table 6.

Table 6: Mink hair thickness, μm, n = 25

Group n=6	Topographic areas	Sex	Hair type					
			Downy		Transitional		Guard	
			$X \pm m_x$	C_y, %	$X \pm m_x$	C_y, %	$X \pm m_x$	C_y, %
1	Belly	♂	12.8±0.1	8.1	25.8±0.2	2.3	99.9±0.4	3.1
		♀	12.7±0.2	11.6	25.5±0.1	3.5	98.1±0.7	4.6
	Ridge	♂	12.7±0.2	6.1	25.9±0.2	2.8	98.4±0.5	3.7
		♀	12.6±0.1	10.2	25.4±0.1	3.4	96.3±0.8	6.6
	Rump	♂	12.7±0.1	7.9	25.8±0.2	2.4	98.7±0.6	4.6
		♀	12.6±0.2	10.1	25.4±0.2	3.6	95.8±0.9	3.9
2	Belly	♂	12.6±0.1	8.1	24.8±0.1	3.2	98.3±0.4	1.9
		♀	12.5±0.1	11.2	25.1±0.1	5.2	96.7±0.8	6.8
	Ridge	♂	12.5±0.2	11.2	25.7±0.2	5.0	97.3±0.7	3.5
		♀	12.4±0.1	10.3	24.9±0.1	3.8	96.2±0.7	3.9
	Rump	♂	12.5±0.2	10.4	25.6±0.3	4.6	96.3±0.6	3.0
		♀	12.4±0.1	11.2	24.7±0.2	3.6	95.1±0.8	4.6
3	Belly	♂	12.3±0.1	8.1	24.3±0.2	3.2	95.3±0.3	1.9
		♀	12.4±0.2	12.2	24.4±0.2	3.2	95.8±0.7	4.6
	Ridge	♂	12.4±0.2	11.2	24.5±0.1	5.0	94.3±0.5	3.5
		♀	12.3±0.2	8.1	24.2±0.1	3.6	95.1±0.9	4.4
	Rump	♂	12.5±0.2	10.4	24.5±0.2	4.6	94.3±0.7	3.0
		♀	12.3±0.2	8.9	24.0±0.1	4.6	94.8±0.8	5.3
4	Belly	♂	12.2±0.2	12.3	24.3±0.1	8.0	95.4±1.0	6.4
		♀	12.2±0.1	12.4	23.8±0.1	4.5	94.4±0.8	5.2
	Ridge	♂	12.4±0.1	8.1	24.4±0.2	6.7	95.2±0.9	6.0
		♀	11.8±0.2	1.5	23.7±0.1	4.8	93.1±0.9	6.2
	Rump	♂	12.4±0.2	12.5	24.4±0.2	6.9	94.6±1.0	6.8
		♀	12.1±0.2	11.3	23.2±0.2	3.9	92.8±0.7	4.9

Table 5, the results suggest that there is no significant difference between the thickness of down hair in the corresponding topographic areas of male and female mink skins of all experimental groups. The indices of the transitional hairs thickness in skins from minks' males and females of first and second groups exceed those of the third and fourth groups by an average of 1-2 microns. Indicators of guard hair thickness in the corresponding topographic areas of male and female mink skins of the third and fourth groups are inferior to similar indicators on average by 3.5-4.5 microns.

The thickness of the hair coat of a fur animal's fur is one of the defining properties in assessing the quality of fur raw materials. Table 7 gives the study results of the density of male and female mink skins' hair.

Table 7: Density of hair coat of mink skins, thousand pieces/1cm^2

Group n=6	Sex	The density of hair coat, $X \pm m_x$			
		Topographic areas			
		Ridge	Rump	Belly	∑average
1	♂	21148.1±411.4	21249.2±413.0	20100.9±389.4	20832.7±411.6
	♀	21114.7±411.1	21159.0±411.3	20088.2±368.4	20787.3±394.9
2	♂	21133.2±236.6	21094.7±367.1	20097.9±322.4	20775.2±376.6
	♀	21118.4±301.5	21077.0±321.0	20084.4±329.0	20759.9±371.4
3	♂	18840.6±315.2	18907.7±318.3	18224.0±319.4	18657.4±373.1*
	♀	18704.3±311.1	18801.4±308.8	18121.1±302.9	18542.2±352.3*
4	♂	17142.8±267.5	17184.5±269.5	17074.1±250.6	17133.8±341.5*
	♀	17102.1±251.8	17116.5±259.5	17038.2±248.2	17085.6±325.2*

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The data in Table 6 presented that in all male and female mink skins, the thickest hair is on the ridge and rump, and rarer on the belly. The indices of the thickness of the hair cover of male and female mink skins of the first and second experimental groups do not have significant differences. Indicators of the thickness of the hair of male and female mink skins of the third and fourth groups are significantly inferior to those of the first and second groups by an average of 10-15%. Consequently, skins obtained from male and female mink with a medium and high degree of intensity of invasion indicate that hair density indicators are noticeably lower than in healthy animals and animals with weak invasion intensity. That is a cause of negatively affects the quality of the skins and their assessment.

One of the criteria affecting skins' main commercial properties is the hairline's thickness and length, determining the hairline's softness. In contrast, the hair thickness ratio to its length serves as a quantitative expression of the hair's softness and is called the softness coefficient. The results of calculating the degree of softness of male and female mink skins are in Table 8.

Table 8: Softness coefficient of mink skins, Km $x \times 10^{-3}$

Group n=6	Topographic areas					
	Ridge		Rump		Belly	
Sex	♂	♀	♂	♀	♂	♀
1	3.8	4.9	4.0	4.9	3.9	4.9
2	3.7	4.8	4.1	5.0	4.1	5.0
3	3.9	5.6	3.9	5.5	4.1	5.6
4	3.9	5.8	4.2	5.7	4.0	6.2

The softness coefficient by formula 1 of male mink skins in the corresponding topographic areas is practically the same for all experimental groups. Therefore, it is not a characterizing factor of the degree of intensity of invasion. The softness coefficient of female mink skins in the first and second groups' corresponding topographic areas is less than that of the third and fourth experimental groups, which indicates a softer hair coat in a clinically healthy animal and with a weak intensity of invasion.

At the final stage of the study, the dimensional characteristics and indicators of sorting of mink skins were studying by GOST R 55587-2013. The results of studying the dimensional characteristics of male and female mink skins are in Table 9.

Table 9: Dimensional characteristics of mink skins

Group n=6	Sex	Skins parameters			
		Length, cm		Area, cm^2	
		$X \pm \tau_x$	C_v, %	$X \pm \tau_x$	C_v, %
1	♂	84.7±0.9	6.0	1368.7 ±14.8	6.1
	♀	66.8±0.9	6.0	1020.8±13.2	6.0
2	♂	82.8±0.9	5.9	1355.5±14.6	5.9
	♀	68.7+0.8	5.9	990.7±13.5	6.1
3	♂	79.1±0.9	6.0	1339.2±14.6	6.0
	♀	58.6±0.7	6.0	812.6±13.7	5.9
4	♂	77.4±1.0	6.2	1316.9±15.6	6.3
	♀	55.9±0.9	6.1	715.8±13.6	6.2

There is no significant difference between the indicators of male mink skins of the first, second, and third groups. The indicator of the area of male mink skins of the fourth group is significantly less than the rest on average by 2-3%. There is no significant difference between the area indicators of female mink skins of the first and second groups. Indicators of the area of female mink skins of the

third and fourth groups are significantly less than those of the first and second experimental groups on average by 1.5-3%. Table 10 shows the results of sorting male and female mink skins.

Table 10: Results of sorting mink skins

Group n=6	Sex	Size	Sub size	Number of skins	Class	Defectiveness class	Quality, %	Number of heads	∑ heads per group
1	♂	Especially large A	0000	4	1	1	130.0	5.2	7.7
		Especially large A	000	2	1	1	125.0	2.5	
	♀	Especially large B	1	3	1	1	105.0	3.2	6.2
		Large	2	3	1	1	100.0	3.0	
2	♂	Especially large A	00	3	1	1	120.0	3.6	7.0
		Especially large A	0	3	1	1	115.0	3.4	
	♀	Large	3	5	1	1	95.0	4.8	5.7
		Large	4	1	1	1	90.0	0.9	
3	♂	Especially large B	1+	4	2	2	79.2	3.2	4.5
		Especially large B	1	2	2	3	66.0	1.3	
	♀	Large	5	2	2	2	61.2	1.2	3.5
		Large	6	4	2	2	57.6	2.3	
4	♂	Large	2	2	2	3	63.0	1.3	3.7
		Large	3	4	2	3	60.0	2.4	
	♀	Large	6	3	2	3	54.0	1.6	3.1
		Medium	7	3	2	3	50.4	1.5	

Analysis of the results obtained allows to state that the skins of males and females of minks of the first and second experimental groups were represented mainly by sizes: extra-large A and extra-large B, large (female skins), all they corresponded to the characteristics of the 1st grade (full-haired, with thick and even hair) and the 1st group of defectiveness (no defects), therefore, the quality of male mink skins of the first and second experimental groups ranged from 115 to 130%, the quality of female mink skins from 90 to 105%, which confirms their value. The following sizes mainly represented the skins of males and females of minks of the third and fourth experimental groups: large and medium (except for the skins of males of group 3 - OKB), all of them corresponding to the characteristics of the second variety (less full-haired, with a sparse and insufficiently equalized hair coat); The second and third groups of defectiveness, which significantly reduced their value, the quality of male mink skins of the third and fourth experimental groups was from 60 to 79%, the quality of female mink skins from 50 to 61%. The decrease in the group of defectiveness of male and female mink skins of the third and fourth experimental groups was by the presence of defects characteristic of this type of skin: cut-off (bitness) of the hair cover, wiped spots, dampness, twisting of the awn tops, all of them belong to lifetime. Such defects arise due to shortcomings in breeding work, improper feeding, and maintenance of fur-bearing animals. Besides, the animal's general physiological state and its immunological reactivity influence the skins' quality.

4. CONCLUSION

This study examined 6118 minks infected with eimeriids (*Mustela vison, Mustela lutreola* (Linnaeus, 1761), *Neovison vison* (Schreber, 1777)) and intact minks in six fur farms in the Russian

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Federation' North-West region (Leningrad and Kaliningrad regions). Aymeriidoses were detecting in 2687 animals (EI - 43.92%). The predominant protozoan species were Eimeria vison, Eimeria furonis, Isospora laidlawi, and Isospora eversmanni.

The second group of skins from female mink females with eimeriidoses with a low intensity of invasion has the same hair length indicators (except for down hair) and hair height. Male skins did not differ significantly from the first group of skins obtained from clinically healthy animals. The skins of the third group from mink females and males with medium invasion intensity and the fourth group of skins from animals of both sexes with high invasion intensity are inferior in terms of the length of transitional, guard hairs and the height of the hairline to the mink skins of the first and second groups.

The skins of male and female minks of the first group obtained from clinically healthy animals have the same indicators of the leading commercial properties of the hair coat and quality assessments with the skins of males and females of the mink of the second group obtained from animals with eimeriidosis with a low intensity of invasion, therefore, fur raw materials will have high consumer properties; In the third group's male and female mink skins, obtained from animals with eimeriidosis with an average intensity of invasion, and the fourth group, obtained from animals with a high intensity of invasion, the leading commercial's indicators properties of the hair cover significantly decreased. It had determined the deterioration of the sorting indicators, the loss of quality, and the value of fur raw materials.

5. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding author.

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