Influence of nutritional value of complete feed on the chemical composition of rabbit meat

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Abstract. Rabbit breeding, one of the oldest branches of animal husbandry, provides man with a wide range of agricultural products, the main one being dietary meat. Many domestic and foreign scientists pay great attention to the chemical composition of rabbit meat and the factors affecting it. It is known that the protein content in rabbit meat increases with age, but no significant difference in the protein content in rabbit meat of different breeds has been established. The article shows the dependence of the chemical composition of rabbit meat on the ratio of nutrients in the diet with a dry type of feeding. In a scientific and economic experiment on young rabbits of the Soviet chinchilla breed, the influence of the ratio of nutrients in a complete granulated feed on the chemical composition of meat at slaughter at the age of 90 days was established. It was formed on the principle of analogs of the 2nd group of young animals at the age of 45 days, 60 heads in each: group 1 - control, 2 - experiment. The rabbits were fed with full-feed granulated feed (FGF), consisting of the same plant and mineral components: barley, oats, corn, grass flour, sunflower meal, feed chalk, monocalcium phosphate, table salt. The composition of the FGF 1 of the control group contained 1% of the vitamin and mineral premix P 90-2T; the composition of the FGF of the experimental group contained no vitamin and mineral premix. The diets of the control and experimental groups differed in the ratio of protein, fat and fiber. As a result of laboratory studies by the method of full zootechnical analysis, it was found that the chemical composition of rabbit meat from the hip part does not depend on the nutritional value of the diet, and the neck part does, and the protein content is inversely related.

1. Introduction

Rabbit breeding is one of the oldest goals of animal husbandry, giving a person a wide range of products: dietary meat, skin, fluff, valuable organic fertilizer for plants, slaughter waste for feeding carnivorous fur-bearing animals, ears for making glue and much more. The most and important valuable products of rabbit breeding is meat - a source of animal protein.

Scientists around the world agree that no other type of meat from farm animals and poultry can compare with the ideal use of nutrients and energy values: rabbit meat has the highest level of protein and the lowest level of fat, calories and cholesterol [1].

All over the world, rabbit farming is a well-developed and profitable livestock industry. The world production of rabbit meat, according to various sources, ranges from 2.0 to 2.5 million tons per year. Among the producing countries, the leader is China (660.0 thousand tons), followed by Italy (330.0), France (250.0), Spain (180.0). At present, Russia produces only 15 thousand tons of rabbit meat per
year, 78.5% of which has to be managed by the population; this is in the whole vast country of industrial organizations engaged in the production of rabbit meat, negligible [2].

The main importers of rabbit meat are Italy, Belgium, France, England and Switzerland [3]. Most rabbit meat per capita per year is consumed by Italians - 6 kg, French - 3 kg, Russians - less than 100 g. It is believed that the rabbit industry is the most promising direction for the development of beef cattle breeding. Domestic scientists have calculated that, in comparison with all other areas of animal husbandry, breeding rabbits is the most profitable in all respects. Currently, rabbit breeding is second only to poultry [6]. And one of the main reasons for this situation is the high selling price of rabbit meat, which directly depends on the cost of production. The most expensive item in the cost of rabbit meat is the cost of feeding, reaching 60-70%. Thus, lowering the cost of feeding with a satisfactory level of performance is paramount. The first steps in this direction have already been taken, we have shown the reserves of reducing the cost of feeding commercial young animals by 39.1% without reducing meat productivity. In the scientific and economic experiment on young rabbits of the Soviet Chinchilla breed at the age of 45-90 days, divided into 2 groups according to the principle of analogues, it was found that the meat productivity of the experiment did not significantly differ from the control. There was no significant difference in the live weight, in the relative and average daily increase, or in the mass of the carcass. At the same time, the rabbits of the experimental and control groups received PGC, identical in caloric content, but different in the ratio of nutrients. There was no vitamin-mineral premix in the PGC of the experimental group. Rabbits of the experimental group, on average, consumed 2.16 kg less feed per head per 45 days than control animals. With almost the same slaughter yield (55.5 and 55.1%), the feed conversion rate in the experimental group was lower by 1.32 (3.74 vs. 5.06). With an average price of 1 kg of mixed feed for rabbits of 20 rubles, feeding one head in the experimental group during the fattening period cost 105.5 rubles., in the control group - 148.7 rubles., 43.2 rubles more expensive, or 29.1%. But the feed in the experimental group was 10% cheaper, since it lacked 1% of the vitamin-mineral premix at the price of 200 rubles, per kg (2 rubles). Consequently, the total savings in feeding rabbits in the experimental group was 39.1% [7].

Since rabbit meat is unanimously considered dietary, domestic and foreign scientists pay a lot of attention to its chemical composition and factors that can influence it [8]. It has been established that the chemical composition of rabbit meat depends on the breed and can vary depending on the age of the animal [9].

The aim of the research is to determine the degree of influence of the nutritional value of complete granulated feed (FGF) on the chemical composition of the meat of rabbits of the domestic breed of the Soviet chinchilla.

2. Material and research methods
Scientific research was carried out in the departments of fur farming and rabbit breeding and experimental rabbit breeding of the FSBI "Research Institute of Animal Breeding and Rabbit Breeding" named after V.A. Afanasyev on young rabbits of the Soviet breed chinchilla. From 120 heads of rabbits of 45 days of age, according to the principle of analogues in origin, age and live weight, 2 groups of 60 heads in each group were formed, 1 - control, 2 - experimental. The rabbits were kept one head at a time in a two-row shed cage. The rabbits were fed daily with complete ration granulated feed (FGF), according to the recommended standards [10]. The FGF of both groups was made at the Tosno feed mill from the same plant and mineral components: barley, oats, corn, grass flour, sunflower meal, feed chalk, monocalcium phosphate, table salt. The composition of the FGF 1 of the control group contained 1% of the vitamin and mineral premix P 90-2T; the composition of the FGF of the experimental group contained no vitamin and mineral premix. The nutritional value of the compound feed in each group and the chemical composition of meat were determined by the method of complete zootechnical analysis [11]. The gross energy of feed and meat was determined by multiplying the amount of each nutrient by its heat coefficient and then summed up.

At the age of 90 days, 5 heads of rabbits with an average live weight were slaughtered from each group, from the femoral and cervical parts of each carcass, after 24-hour cooling and ripening, meat
samples weighing 100 g were taken, from which average samples were prepared for laboratory study of the chemical composition.

Statistical processing of the results was carried out using Microsoft Excel tables included in the standard set of Windows Microsoft Office applications, using methods of statistical processing according to Student's test [12].

3. Research results
The composition of the FGF of the control and experimental groups, established by the method of complete zootechnical analysis, is presented in table 1.

Table 1. Nutritional value of FGF for young rabbits, %.

| Group       | Dry matter | Protein Nx 5.83 | Fat   | Cellulose | Ash   | Nitrogen-free extractive substances | Gross energy, kcal |
|-------------|------------|-----------------|-------|-----------|-------|-------------------------------------|--------------------|
| 1 – control | 87.14      | 16.44           | 1.47  | 17.94     | 7.80  | 43.48                               | 375.30             |
| 2 – experimental | 85.94 | 11.27           | 2.59  | 9.71      | 5.69  | 56.68                               | 371.94             |

Table 1 implies that the compound feed in both groups was identical in terms of gross calorie content, but slightly differed in the ratio of nutrients. The compound feed of the experimental group contained more nutrients with the highest digestibility coefficient (fat and soluble carbohydrates - BEV) and almost 2 times less fiber, which young rabbits digest poorly, by 3-10% [13].

Growth intensity, safety, meat productivity of rabbits in both groups were at the same level, without significant differences. The average carcass weight in the control group was 1470.0 ± 38.2 g; in the experimental group - 1410.0 ± 22.5 g; the lethal yield in the experimental and control groups was also at the same level, %: 55.1 - experience, 55.5 - control, safety - 93.3 and 90.0, respectively. But the feed conversion rate (FCR) in the experimental group was significantly lower than in the control - by 1.32. This testifies to the high economic efficiency of the diet of the experimental group, apparently due to the ratio of nutrients in it that is more adequate for young rabbits.

The chemical composition of the flesh of the cervical and hip sections of a rabbit carcass is presented in table 2.

Table 2. Chemical composition of rabbit meat, %, M ± m.

| Indicators   | Group       | Initial moisture | Hygroscopic moisture | Fat   | Protein (Nx 5.83) | Ash   | Nitrogen-free extractive substances | Gross energy, kcal |
|--------------|-------------|------------------|----------------------|-------|------------------|-------|-------------------------------------|--------------------|
|              | 1 - control |                  |                      |       |                  |       |                                     |                    |
| neck         | 61.34±     | 1.82±            | 18.39±               | 13.24±| 1.53±            | 3.67± | 265.76±                             |                    |
| femur        | 73.84±     | 2.16±            | 1.68±                | 12.63±| 1.15±            | 8.54± | 123.82±                             |                    |
|              | 2 - experimental |          |                      |       |                  |       |                                     |                    |
| neck         | 54.12±     | 1.99±            | 24.79±               | 17.42±| 1.69±            | 0.00  | 335.09±                             |                    |
| femur        | 73.52±*    | 2.19±            | 2.00±                | 11.87±| 1.17±            | 9.25± | 125.47±                             |                    |

*-p <0.05.
Despite the fact that the chemical composition of the meat of a rabbit of the Soviet chinchilla breed, presented in Table 2, is somewhat different from the data of other authors [9], the regularity of the influence of the nutritional value of the diet on it can be assessed, since the experimental and control groups were in the same conditions. There were no significant differences between the groups in the chemical composition of rabbit meat from the thigh. In the meat samples from the neck of the carcass of the experimental group, there is a significantly higher content of protein and gross calorie content, but at the same time, there is a significantly lower content of initial moisture, that is, in the carcasses of the experimental group there is a higher content of dry matter. The results of the experiment show how, by changing the ratio of nutrients in the diet of young rabbits with a dry type of feeding, it is possible to influence the chemical composition of the meat of the cervical spine.

4. Conclusion
As a result of scientific and economic experience on young rabbits of the Soviet chinchilla breed with control slaughter at the age of 90 days, it was found that with a dry type of feeding, the ratio of nutrients in the diet does not affect the growth rate, safety of livestock and meat productivity: control / experiment - carcass weight, g: 1470.0 ± 38.2 / 1410.0 ± 22.5; safety, %: 90.0 / 93.3; dressing percentage, %: 55.5 / 55.1. But there is a clear dependence of the chemical composition of meat in the cervical region on the ratio of nutrients in the diet: the carcasses of the experimental group had a significantly higher content of protein and gross calorie content, but at the same time, a significantly lower content of initial moisture, that is, the carcasses of the experimental group had a higher dry matter content. It is noteworthy that in the experimental diet the protein level is lower than in the control, and in the meat of the cervical spine, an inverse relationship can be traced. Obviously, the chemical composition of the cervical rabbit meat can be regulated by the ratio of nutrients in a complete granulated feed. The obtained results also convince us that the vitamin-mineral premix P 90-2T recommended for rabbits does not contribute to increasing the meat productivity of young rabbits on fattening and the quality of rabbit meat. It is economically feasible and profitable to strictly normalize the feeding of rabbits, taking into account their physiological need for nutrients, and to develop diets that are optimal in terms of the ratio of nutrients. The totality of scientific research in recent years indicates the need to review the norms of feeding young rabbits.

References
[1] Komlatsky G V and Turkova V S 2020 Socio-economic efficiency of industrial rabbit breeding Rabbit breeding and fur farming 6 39-50
[2] Komlatsky V I, Tsyanok L E and Turkova V S 2019 Development of rabbit breeding in the Kuban Rabbit breeding and fur farming 5 8-15
[3] Nigmatullin R M and Balakirev N A 2020 Breeding and selection and breeding work in rabbit breeding (M: Publishing House "Scientific Library") 514
[4] Balakirev N A and Kalugin Y A 2015 Rabbit breeding is a promising branch of animal husbandry Veterinary Medicine, Animal Science and Biotechnology 7 20-3
[5] Velkina L V 2019 World trends in the development of rabbit breeding Economy of agriculture in Russia 3 93-8 DOI: 10.32651/193-93
[6] Klimova N V and Mozhegova V D 2015 The effectiveness of investment in the development of rabbit business Scientific journal KabGAU 125 500-9
[7] Kvatnikova E G, Kosovskiy G Yu and Kvatnikov M P 2020 Meat productivity of rabbits with dry type of feeding without vitamin and mineral premix Rabbit breeding and fur farming 4 34-9
[8] Papadomichelakis G, Karagiannidou A, Anastasopoulos V and Fegeros K 2010 Effect of high digestible dietary fiber content on the fatty acid composition of two muscles in fattening rabbit Livestock Science 129 159-65
[9] Zhvakina A R, Tinaev N I, Trukhin I Yu and Golovanova E V 2017 Chemical composition and nutritional value of the pulp of carcasses and cuts of hybrid and purebred young rabbits
Agrarian scientific journal 9 10-4

[10] Balakireva I and Kladovshchikova V F 2007 Norms of feeding and norms of consumption of feed for fur-bearing animals and rabbits 185

[11] Petukhova E V, Bessarabova R F, Khaleneva L D and Antonova O A 1981 Animal feed analysis (M: "Kolos") 256

[12] Sobolev A D 2003 Fundamentals of Variational Statistics (Tutorial. M., 2003) 100

[13] Kvartnikova E G, Kosovskiy G Yu, Kvartnikov M P and Kumarin S V 2019 Digestibility of nutrients of full-feed granulated feed (FGF) by young rabbits in dynamics Rabbit breeding and fur farming 1 15-8