

# Poultry Product Manufacturing Using By-Products of Fat-and-Oil Industry

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## Abstract

The article presents the results of the use of "Gorlinka" concentrate in the feeding of broiler chickens of the cross "Ross 308". Differences in poultry feeding were as follows: the chickens of the control group were fed mixed fodder (with sunflower seed meal) used at the poultry farm, and the chickens of experimental control - mixed fodder in which a new feeding product was introduced instead of 75% of the sunflower seed meal. Housing and feeding conditions, as well as other requirements, corresponded to the standard of the cross "Ross 308". The duration of the experiment corresponded to the period of broiler farming at the poultry farm (37 days). It should be noted that the introduction of the studied concentrate had a positive effect on the poultry meat productivity, which is confirmed by the results of the weekly weighing. Thus, the total and average daily live weight gain of the poultry during the fattening period was higher in the experimental group than in the control one by 141.2 g and 3.98 g, respectively. The feed consumption by volume in the experimental group was lower than in the control group by 10.63%. The morphological and biochemical compositions of the blood of the poultry were also studied. The analysis showed that the studied haematological parameters of the poultry were within the physiological norm. However, it is important to note that in the blood of the experimental group poultry, as compared to the control group, was observed a slight increase in the red cell content by  $0.12 \cdot 10^{12}/L$ , the total protein by 2.1 g, calcium by 0.24 mmol/L and phosphorus by 0.25 mmol/L. The obtained data of haematological studies show, first of all, that poultry feeding is nutritious and improves the metabolic processes in the body. The slaughter yield of chickens of the experimental group was higher than in the control group by 1.98%. The protein content in the breast and thigh muscles of the control group was 22.12% and 21.05%, and of the experimental group - 22.61% and 21.4%, respectively. The amino acid content in the breast and thigh muscles was higher in the experimental group than in the control group by 1.89% and 1.42%. The additional profit due to the use of a new local feed additive in the mixed fodder for meat poultry was 1085.53 rubles.

**Keywords:** broiler chickens, live weight, mixed feed, sunflower meal, the "Gorlinka" concentrate.

## INTRODUCTION

Currently, the population's consumption of poultry meat and chicken eggs conforms to medical standards. However, the acutest problem is the quality of these products. To make a profit, the poultry enterprises are increasing the volume of products, sometimes disregarding its quality [1, 2].

The reason is the increasing production costs of new equipment, depreciation, salary, etc. It is important to note that 70-75 % of these costs are allocated to the feeding.

However, there is a solution to this problem. In our opinion, each region of our country needs to revise the generally accepted feeding programs for agricultural poultry, taking into account the local feed sources, which will allow not only expanding the feeding base but also improving the quality of poultry products, while reducing feeding costs [3, 4].

The most popular, and also one of the most expensive protein ingredients of vegetable origin in the poultry fodder is sunflower meal.

It is important to note that the Volgograd region is characterized by a sharply continental climate, and sunflower has high requirements for its cultivation (certain temperature, water content, weather conditions, soil composition). An alternative crop, suitable for cultivation in the region, is an oilseed - sareptsky mustard. The by-product of mustard seeds' processing for oil is mustard seed meal, which contains anti-nutrients. Scientists of the Volgograd State Agrarian University proposed a hydrobarothermic method for neutralizing mustard seed meal, as a result of which a new fodder product was received, called protein-containing feed concentrate "Gorlinka".

Considering the above-mentioned, the aim of the research was to increase the poultry meat productivity by using the concentrate "Gorlinka" as part of a mixed fodder for broiler chickens.

## MATERIALS AND METHODS

The research was conducted in 2015 - 2017 in the laboratory "Analysis of fodder and livestock products" of Volgograd SAU, Research Center "Cherkizovo" and ZAO

"Poultry Farm Krasnodonskaya", Ilovinsky district of the Volgograd region. The general research scheme is shown in Figure 1.

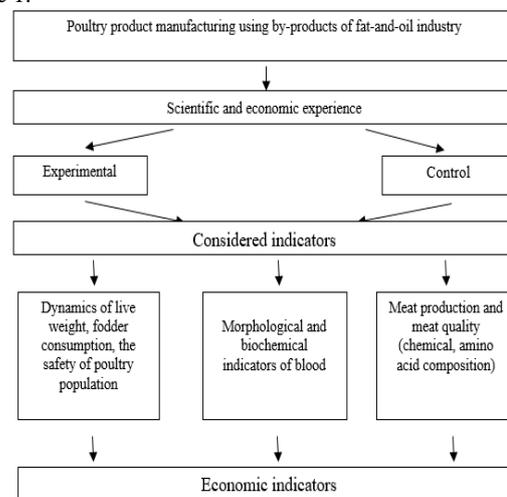


Figure 1. General research scheme

Chemical, amino acid, mineral and vitamin compositions of the traditionally used sunflower meal, as well as our new protein feed "Gorlinka", were studied in the laboratory "Analysis of fodder and animal products". In addition, the veterinary and sanitary safety indicators of the fodders were examined.

Then the experiment was carried out on broiler chickens of the cross "Ross 308" at the ZAO "Poultry Farm Krasnodonskaya", which is one of the largest poultry meat manufacturers in the South Federal District of the Russian Federation. The enterprise uses the floor housing scheme on deep litter and three-phase feeding system of broilers "Ross 308". The farming period is 37 days. In the control and experimental group, there were 50 day-olds/each.

The conditions of housing, the microclimate parameters, feeder and watering space in the experimental and control groups met the requirements for the cross.

The poultry in the control group was fed mixed fodder used at the poultry farm. The composition of the feed was as follows: wheat, corn, sunflower meal, soybean meal, corn gluten, sunflower oil, L-lysine sulfate, DL-methionine, L-threonine, extra salt, phosphate defluorinated P, limestone, premix. Chicken broilers of the experimental group were fed 75% of the "Gorlinka" concentrate instead of sunflower meal. According to the cross requirement, the feeding of broiler chickens is divided into periods of start, growth, and finish. Each farming period is characterized by the different needs of birds for energy, nutrients and biologically active substances. The poultry feed for the experimental and control groups corresponded to the nutritional value recommended for the cross.

### RESULTS AND DISCUSSION

The zootechnical analysis of the feed ingredients in the laboratory "Analysis of feeder and livestock products" of the Volgograd State Agrarian University together with the Research Center "Cherkizovo" allowed concluding the following: the dry matter content in sunflower meal is 89.4%, which is lower in comparison with the concentrate by 2.5%; the content of raw fat, crude protein and crude ash in sunflower meal was 8.1%, 35.2%, and 6.5%, respectively, which is lower than in mustard concentrate by 1.4%, 3.5% and 0.4%, respectively. In general, the metabolizable energy content in the feed concentrate "Gorlinka" was higher in comparison with the sunflower meal by 10 kcal.

The amino acid analysis of the feeds also showed the superiority of the "Gorlinka" concentrate (24.88%) over the traditionally used seed meal (22.03%).

Vitamin and mineral composition of the studied feeds showed that "Gorlinka" exceeded the sunflower seed meal by the following parameters: vitamin E - by 0.5 mg/kg, vitamin D - by 40 IU/g, calcium - by 1.2 g; phosphorus - by 2.1 g; potassium - 1.4 g; magnesium - 0.3 g; iron - 15.6 mg; zinc - 24.1 mg; copper - 2.7 mg; manganese - 4.8 mg; cobalt - 0.09 mg.

The content of heavy metals, such as cadmium, lead, and mercury, was below the detection limit in the tested feed. The mass fraction of chromium and arsenic in sunflower meal and the concentrate "Gorlinka" was within the permissible limits and amounted to 0.05 and 0.01 mg/kg, respectively.

Thus, fodder concentrate in terms of chemical composition, amino acids, vitamins, minerals, and safety indices equals the traditionally used sunflower seed meal.

One of the most important indicators for assessing the growth of farm livestock is the control of their live weight. Weighing of meat chickens was carried out weekly throughout the farming period [5] (Table 1).

The analysis of Table 1 allows us to conclude that one week after the scientific and economic experiment, a positive effect from feeding the cross "Ross 308" on a new feed product in the mixed fodder was observed.

Thus, in the control group a seven-day poultry's live weight was 149.6 g, and in the experimental - 152.8 g, the reliability between the indicators was  $P > 0.95$ . In the experimental group, the live weight of the poultry at the end of the experiment was higher than in the control group by 146.9 g (6.65%).

The total and average daily growth of broiler chickens over the period of the experiment was calculated. It allows assessing the growth of the poultry. So these indicators were higher in the experimental group rather than in the control group, by 147,2 g and 3.98 g, respectively.

Another important controlled indicator that allows us to measure the effect of new feed products on the productive qualities of broiler chickens is the consumption of mixed fodder per unit of growth in live weight.

To measure the meat production of broiler chickens, anatomical cutting of carcasses was made (Table 2). The slaughter yield in the experimental group was higher by 1.98% ( $P > 0.999$ ) compared to the control group.

In addition, an important indicator characterizing the poultry meat productivity, after the slaughter yield, is the breast muscles yield as a ratio to the live weight. This indicator in the experimental group was 26.64%, and in the control group - only 22.74%.

Quality and safety of products is the key criterion at the present stage of intensive poultry farming development in the conditions of market saturation. The meat of broiler chickens is relatively affordable, it is a high-quality source of easily digestible proteins, vitamins, amino acids, minerals. Human consumption of meat of appropriate quality serves the body growth and functioning and prevents numerous diseases. Therefore, it is important to pay special attention to the impact of new feeding technologies both on nutritional value and on the content of heavy metals in meat [6, 7].

The chemical composition of the poultry breast and thigh muscles is shown in Table 3.

Adding the "Gorlinka" concentrate into the mixed fodder had a positive effect on the chemical composition of the muscle tissue of broiler chickens. The content of the protein, the most valuable component in human nutrition, in the breast and thigh muscles was higher in the experimental group than in the control group by 0.49% and 0, 35%, respectively.

To date, much attention is paid to the dietary nutrition of a human. Thus, the content of crude fat in the poultry breast and thigh muscles was less in the experimental group than in the control group [8, 9].

In the breast muscles of the control group poultry, the lysine content was 6.651%, in the experimental group - 6.773%, which is 0.122% higher. The content of methionine in breast muscles of broiler chickens in the control group was 2.63%, in the experimental group - 2.719%, which exceeded the control group figures by 0.089%. The total content of amino acids in the breast muscles of the poultry of the control group was 48.98%, and the experimental group - 50.87%, the difference in favor of the experimental group was 1.89%. In the thigh muscle tissue, the lysine content in the control group was 6.247%, in the experimental group - 6.446%, which was higher than in the control group by 0.199%. The amount of methionine in the thigh muscles of the control group was 2.457 g, in the experimental group - 2.522%, which is more than in the control group by 0.065%. The total content of amino acids in the thigh tissue of broiler chickens in the control was 45.71%, in the experimental group - 47.13%, which was more than in the control group by 1.42%.

Vitamin E in the breast and thigh muscles of the experimental group was 0.26 and 0.31  $\mu\text{g}$  more than of the control group (Table 4).

The negative influence of heavy metals on human health can lead to a change in the structure of internal organs, a slowdown in body growth, sexual development and reproduction, a behavioral change. Therefore, it is urgent to control the content of heavy metals in food today [10].

The content of heavy metals in the muscles of the studied broiler chickens is presented in Table 5.

**Table 1 – Live weight of studied meat poultry**

Weighing day	Group	
	Control	Experimental
Day-old	40.4	40.1
7-day	149.6±0.98	152.8±0.86*
14- day	404.7±1.31	420.9±1.34***
21- day	842.9±2.75	884.1±2.44***
28- day	1441.8±4.9	1511.6±4.81***
35- day	2021.0±13.9	2127.4±14.06***
37- day	2207.6±18.44	2354.5±19.5***

a) Hereinafter \* P>0,95, \*\* P>0,99, \*\*\*P>0,999

**Table 2 – Anatomical cutting of carcasses of studied broilers (M m)**

Group	Indicator					The rate of edible carcass parts to inedible
	Live weight, g	Carcass weight, g	Slaughter yield, %	Muscle mass, g		
				Totally	Breast	
Control	2255.6 ±4.5	1633.73 ±1.613	72.43 ±0.05	983.96 ±1.60	513.00 ±0.67	2.49 ±0.002
Experimental	2438.19 ±3.77***	1814.26 ±2.79***	74.41 ±0.04***	1153.29 ±2.86***	649.45 ±1.97***	2.77 ±0.007***

**Table 3 – Chemical composition of poultry breast and thigh muscles, % (M m)**

Group	Indicator					Total amino acid content
	Dry matter	Protein	Crude fat	Crude ash		
Breast muscles						
Control	26.35 ±0.002	22.12 ±0.004	3.19 ±0.002	1.04 ±0.07		48.98
Experimental	26.48 ±0.01 ***	22.61 ±0.02 ***	2.81 ±0.02 ***	1.06 ±0.07		50.87
Thigh muscles						
Control	25.39 ±0.02	21.05 ±0.02	3.38 ±0.01	0.96 ±0.03		45.71
Experimental	25.67 ±0.02 **	21.4 ±0.01 ***	3.26 ±0.003**	1.01 ±0.04		47.13

**Table 4 – Vitamin E content in the breast and thigh muscles of the studied broiler chickens, µg/g**

Group	Content	
	Breast muscles	Thigh muscles
Control	11.97±1.28	15.76±1.93
Experimental	12.23±0.91	16.07±1.18

**Table 5 – The content of heavy metals in the muscles of studied broiler chickens, µg/kg**

Indicator	Group			
	Control Muscles		Experimental Muscles	
	Breast	Thigh	Breast	Thigh
	Weight fraction			
Lead	0.17±0.05	0.13±0.04	0.16±0.03	0.11±0.001
Cadmium	0.006±0.0003	0.004±0.0001	0.005±0.0002	0.004±0.0003
Mercury	below detection limit			
Arsenic	below detection limit			
Nickel	0.12±0.03	0.13±0.06	0.12±0.04	0.11±0.07
Chrome	0.08±0.002	0.07±0.004	0.07±0.001	0.07±0.001
Cobalt	below detection limit			

The content of heavy metals in the breast and thigh muscles was within the limits of standards.

The analysis of the morphological blood composition of the chickens of the compared groups showed that the

concentration of red and white cells was within the physiological norm. The content of erythrocytes in the blood of broiler chickens of the experimental group was more by 3.81% than for the control group. There was an insignificant decrease in the concentration of

leukocytes in the blood of the poultry of the experimental group by 2.14%, in comparison with the control group. The total protein content in the blood of the control group poultry was 52.7 g/L, while in the experimental group it was 2.1 g/L. The concentration of calcium and phosphorus in the blood of the experimental group was 3.07 mmol/L and 2.39 mmol/L, and in the control group - 2.83 mmol/L and 2.14 mmol/L, respectively. The analysis of the data obtained by haematological studies allows one to determine the normal metabolic processes in the body of broiler chickens, which indicates the usefulness of feeding.

The analysis of economic efficiency is the final stage of the research, as it allows us to give a full assessment of the feasibility of using new feeds and additives in the feeding of agricultural poultry. It should be noted that the livability of the livestock in the experimental and control groups was 100%. The total feed consumption (for 50 chickens) in value terms in the experimental group was 3710.76 rubles, which is lower than in the control group for 240.6 rubles. An additional amount of money from products received in the experimental group was 844.93 rubles, rather than in the control group. Additional profit for 50 chickens was 1085.53 rubles, that again proves the efficiency of using the feed concentrate "Gorlinka" in feeding broiler chickens.

#### CONCLUSIONS

The developed method of neutralizing the mustard seed meal makes it possible to expand the feeding of the Lower Volga region. The concentrate is superior to sunflower meal in the nutritional value, and its use as an ingredient in mixed fodder for broiler chickens contributes to an increase in live weight by 6.65%, carcass yield by 1.98%, a decrease in the consumption of mixed fodder by 10.63%, and improves the quality of meat. The use of mustard concentrate instead of sunflower meal in the chicken feeding positively affects haematological indices.

Thus, in order to increase the efficiency of the poultry industry, it is recommended to use mustard concentrate (in an amount replacing 75% of sunflower meal) in the diet of broiler chickens.

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