

The effectiveness of using Volgafish fish concentrate in the diets of broiler chickens

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Abstract. The presented studies were conducted in the period from 2021 to 2023 in the conditions of the center "Safety and Effectiveness of feed and additives" of the Volgograd State Agrarian University on the ROSS-308 bird. To perform the study, four groups were formed in three repetitions: control, I-experienced, II-experienced and III-experienced with 40 heads each. The bird was raised from the daily to 37-day age with outdoor maintenance. The chickens were kept on a deep litter (sawdust), the feeding technology, watering and microclimate parameters meet the requirements of the ROSS-308 cross. The chemical composition of fish concentrate exceeds fishmeal in terms of crude protein content by 2.15%, crude fat – by 0.25%, crude ash – by 0.28%, which suggested the replacement of fishmeal in broiler chicken feeding programs for this feed product. The use of Volgafish fish concentrate in the composition of compound feeds for broiler chickens, replacing 50.00%, 75.00% and 100.00% fishmeal, allowed to increase the average daily growth of poultry by 1.38-5.18%, and the live weight of individuals by 37 days of age by 1.32-5.01%.

1 Introduction

The modern poultry industry requires scientifically based and rational feeding of poultry, which is a necessary condition for the full realization of their potential with intensive use [1, 2]. Poultry accounts for more than 30% of all animal protein consumption in the world. By 2030, poultry farming is expected to account for 41% of all animal protein consumed by humans. This explains the increased attention of specialists and scientists to feed programs, which is the basis for the further development of poultry farming. Any branch of agriculture is based on the use of new technologies and developments that increase production efficiency. This also applies to poultry farming in full [3, 4].

Researchers and poultry farmers are constantly exploring options to reduce the cost of producing broiler chickens [5]. It has been repeatedly shown that reducing the diets of

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traditional feed products, through their alternative replacement, reduces the cost of feed for poultry. In this regard, attention should be paid to reducing the production costs of compound feed by using new cheap sources of the most expensive part -protein.

Fishmeal has long been considered a common source of available protein, but the feed industry every year notes a tendency to a shortage of fishmeal, and its high cost contributes to the falsification of its composition. [6,7,8].

The modern feed market, in addition to fishmeal, is represented by a number of feed products similar to it in nutritional value [9, 10,11]. Most often, fishmeal is adulterated with urea and ammonium nitrate, which can cause mass poultry deaths [12,13].

Thus, the feed industry needs an alternative source of easily digestible protein with a suitable amino acid profile to replace traditional protein sources [14,15].

The fish concentrate we are investigating has promising advantages in this regard. Volgafish fish concentrate is a by-product of the production of aquaculture products with higher nutritional value, has a crude protein content of 50.00%, crude fat – up to 17.50%, crude ash - up to 20.00%. In addition, the fish concentrate we study contains a large amount of important fatty acids and minerals (especially calcium and phosphorus), and therefore, it is successfully integrated as a feed element into the poultry diet. In this regard, studies have been conducted to study the effectiveness of using Volgafish fish concentrate in feeding poultry of meat productivity.

2 Materials and methods

The methodological basis of these studies was the scientific developments of the authors who studied the use of non-traditional feed products in the cultivation of poultry meat productivity. The presented studies were conducted in the period from 2021 to 2023 in the conditions of the center "Safety and effectiveness of feed and additives" of the Volgograd State Agrarian University on poultry of the ROSS-308 cross. To perform the study, four groups were formed in three repetitions: control, I-experimental. II-experienced and III-experienced with 40 heads each. The bird was raised from a day old to 37 days old with outdoor maintenance. The chickens were kept on a deep litter (sawdust), the feeding technology, watering and microclimate parameters meet the requirements of the ROSS-308 cross.

3 Results

The modern poultry industry requires scientifically based and rational feeding of poultry, which is a necessary condition for the full realization of their potential with intensive use. This explains the increased attention of specialists and scientists to feed programs, which is the basis for the further development of poultry farming. Any branch of agriculture is based on the use of new technologies and developments that increase production efficiency. This also applies to poultry farming in full. One of the most frequently used innovations in this field is the use of new poultry feeds that make the diet balanced.

Before conducting a series of scientific and economic studies in the laboratory, the comparative chemical composition of the studied feed products was studied and analyzed (Figure 1).

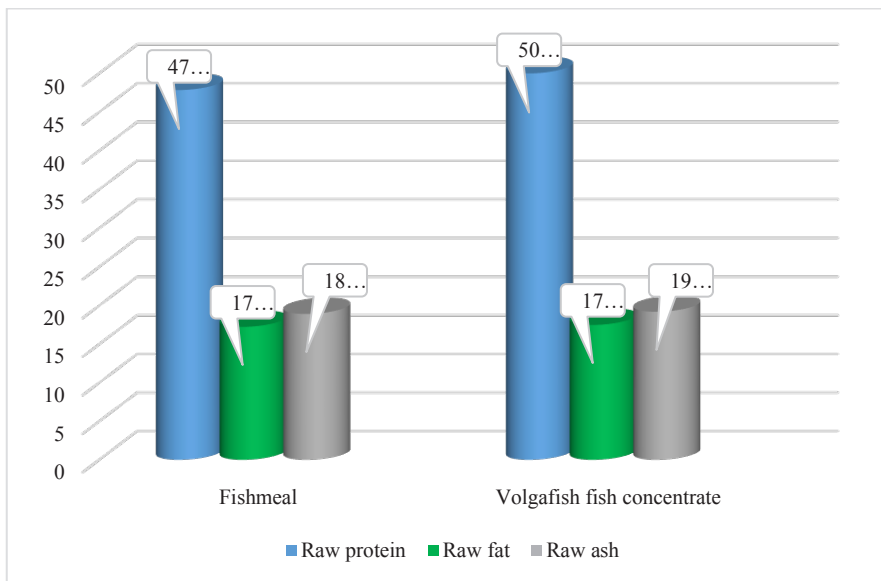


Fig. 1. Comparative chemical composition of fish meal and Volgafish fish concentrate, %

The rations for poultry of the experimental groups differed from the control group only by partial or complete replacement of fish meal with Volgafish concentrate. (Table 1).

Table 1. Scheme of scientific and economic experience

Group	Number of heads	Duration of experience, days	Feature of the feeding program		
			start	height	finish line
Control	120	37	OR with 4.00 % fishmeal	OR with 5.00 % fishmeal	OR with 2.00 % fishmeal
Experienced I	120	37	OR with 2.0% fish-meal and 2.0% Volgafish	OR with 2.5% fish-meal and 2.5% Volgafish	OR with 1.0% fish-meal and 1.0% Volgafish
Experienced II	120	37	OR with 1.0% fish-meal and 3.0% Volgafish	OR with 1.25% fish flour and 3.75% Volgafish	OR with 0.5% fish flour and 1.5% Volgafish
Experienced III	120	37	OR with 4.0 % Volgafish	OR with 5.0 % Volgafish	OR with 2.0 % Volgafish

The basic ration (RR) for broiler chickens from 1 to 3 weeks of cultivation consisted of 25.12% wheat grain; 25.00% corn grain; 20.00% full-fat soy; 7.18% soybean meal; 7.00% sunflower cake; 4.00% fish meal; 2.58% sunflower meal; 3.00% corn gluten; 1.50 % meat and bone meal; 0.20% lysine monochlorohydrate (98%); 0.25% L-lysine sulfate; 0.21% DL-methionine; 0.10% L-threonine; 1.93% sunflower oil; 0.25% table salt; 0.22% monocalcium phosphate; 0.16% anhydrous sodium sulfate; 0.30% limestone grits and 1.00 % of the premium.

The rations for poultry of the experimental groups from 1 to 3 weeks of cultivation (start) differed from the control only by partial or complete replacement of fish meal with Volgafish concentrate.

Poultry of the 1st experimental group received a diet containing 2.00% Volgafish fish concentrate and 2.00% fishmeal (replacement of 50.00%); broilers from the 2nd experimental group were fed a diet containing 3.00% Volgafish and 1.00% fishmeal (replacement of 75.00%); mixed feed for The 3rd experimental bird was injected with Volgafish fish concentrate in the amount of 4.00% of the feed weight (100% replacement).

The nutritional value of the compound feed in the starting period had the following values: metabolic energy - 310.00-311.50 Kcal/ 100 g; crude protein – 23.00-23.08%; lysine – 1.40-1.50%; methionine – 0.60-0.62%; calcium – 1.00% and phosphorus – 0.7%.

The basic ration (OR) for broiler chickens from week 4 to week 5 of cultivation consisted of 25.00% wheat grain; 30.00% corn grain; 17.00% full-fat soy; 4.16% soybean meal; 10.59% sunflower cake; 5.00% fish meal; 2.50 % corn gluten; 0.22% lysine monochlorohydrate (98 %); 0.20 % L-lysine sulfate; 0.19% DL-methionine; 0.08 % L-threonine; 2.78% sunflower oil; 0.22% table salt; 0.38% monocalcium phosphate; 0.19% anhydrous sodium sulfate; 0.49% limestone grit and 1.00% premix.

The rations for poultry of the experimental groups from 4 to 5 weeks of cultivation (growth) differed from the control group only by partial or complete replacement of fish meal with Volgafish concentrate.

Poultry of the 1st experimental group received a diet containing 2.50% Volgafish fish concentrate and 2.50% fishmeal (replacement of 50.00%); broilers from the 2nd experimental group were fed a diet containing 3.75% Volgafish and 1.25% fishmeal (replacement of 75.00%); mixed feed for The 3rd experimental bird was injected with Volgafish fish concentrate in the amount of 5.00% of the feed weight (100% replacement).

The nutritional value of the compound feed in the starting period had the following values: metabolic energy - 315.15-317.20 Kcal/ 100 g; crude protein – 21.12-21.18%; lysine – 1.33-1.51%; methionine – 0.55-0.61%; calcium – 0.95-0.97% and phosphorus – 0.74%.

Thus, the new feed programs developed by us corresponded to the recommendations developed by the GNU VNITIP RAS on the nutritional value of compound feeds for broiler chickens.

4 Discussion of the results

The nutritional value of the developed feeding programs was based on the recommendations of VNITIP (All-Russian Scientific Research and Technological Institute of Poultry Farming, Sergiev Posad).

Poultry meat is an important source of complete and affordable dietary protein in the human diet. Its availability is determined by improved methods of poultry industry management, automatic equipment, integrated and balanced feeding, as well as other new technologies.

Broiler production has increased dramatically over the past decade, and it is expected to grow steadily in the future. To date, the accepted economic and environmental approach to the production of meat obtained from broiler chickens consists in faster production of larger poultry using less feed [13, 14, 15].

Before planting the second experiment, the entire batch of poultry was individually weighed and distributed into cages. The dynamics of the live weight of poultry was recorded weekly in the accounting journal, followed by the calculation of average production indicators by groups.

In this regard, the task of this study was to study (in a comparative aspect) the dynamics of the live weight of experimental individuals (Table 2).

Table 2. The results of the obtained growth intensity indicators broiler chickens, (g) M±m at n=120

The indicator for measuring the live weight of individuals at the age of days	Group			
	Control	I- Experienced	II- Experienced	III- Experienced
1 day	61,94±0,16	61,44±0,21	61,27±0,18	61,15±0,20
7 days	211,15±2,74	215,67±2,15	220,26±3,02*	217,24±2,98
14 days	529,50±9,16	531,99±8,25	535,17±8,64	541,05±9,11
21 days	954,21±11,02	998,15±13,67*	1011,00±11,25***	1038,00±12,68***
28 days	1595,00±16,36	1605,80±17,48	1622,00±16,21	1641,60±15,26*
35 days	2251,60±19,32	2270,80±21,99	2295,30±21,87	2354,90±20,12***
37 (before the slaughter)	2389,00±22,16	2420,50±23,08	2470,90±24,99*	2508,70±22,93***
Zootechnical indicators:				
Total increase	2327,06	2359,06	2409,63	2447,55
Average daily increase	64,64	65,53	66,93	67,99

* p<0,05; ** p<0,01; *** p<0,001

The live weight of the control group of the first scientific and economic experiment before slaughter was 2389.00 g, 1-experimental - 2420.50 g, which is higher relative to the control by 31.50 g or 1.32%; 2-experimental - 2470.90 g, surpassing the control group by 81.90 g or 3.43%; 3-experimental - 2508.70 g, which is compared with the control group, it was 119.70 g or 5.01% more.

The mass of the gutted carcass in the control group was determined at the level of 1700.50 g, in the 1st experimental group - 1727.00 g, in the 2nd experimental group – 1778.00 g, in the 3rd experimental group - 1826.00 g. The results obtained during the determination of the slaughter yield of the obtained meat revealed a certain superiority of the experimental groups over the control group, which is confirmed by our calculations. Thus, the lethal yield in the 1st experimental group was 71.35% (0.18% difference with the control group); in the 2nd experimental group - 71.96% (0.79% difference with the control group); in the 3rd experimental group – 72.09% (0.92% difference with control analogues).

The total meat yield, taking into account the safety of livestock, was 198.99 kg in the control group, which is 2.41% lower when compared with the 1st experimental group, where the total meat yield was 203.79 kg; in the 2nd experimental group, this indicator was at 211.58 kg, in the 3rd experimental group - 213.40 kg, which is 6.33% and 7.24%, respectively, is higher than in the control group.

In this regard, the task of this study was to study (in a comparative aspect) the dynamics of the live weight of experimental individuals (Table 3).

Table 3. The results of the obtained indicators of the growth intensity of broiler chickens, (g) M±m at n=250

The indicator for measuring the live weight of individuals at the age of days	Group	
	Control	1- Experienced
1 day	61,65±0,39	61,32±0,44
7 days	200,50±10,65	211,00±9,60
14 days	519,24±17,33	538,50±18,30
21 days	931,50±20,18	969,70±21,02
28 days	1495,00±22,93	1593,00±23,19**
35 days	2231,00±30,36	2350,00±31,20**
37 (before the slaughter)	2325,00±33,95	2409,00±34,60
Zootechnical indicators:		
Total increase	2 263,35	2 347,68
Average daily increase	62,87	65,21
The number of goals at the beginning of the experience	250	250
The number of goals at the end of the experience	245	247
Livestock safety, %	98,00	98,80

The live weight of the bird at the age of 37 days was 2325.00 g in the control group; in the experimental this indicator reached 2409.00 g, which was higher relative to the control group by 84.00 g or 3.61%; the total increase in live weight in the control group was 2263.35 g, in the experimental - 2409.00 g, which is higher than in the control group the group by 84.33 g or 3.72%.

The average daily increase in live weight of individuals of the experimental groups was higher relative to the control group by 0.89-3.35 g, which is reflected in Figure 2.

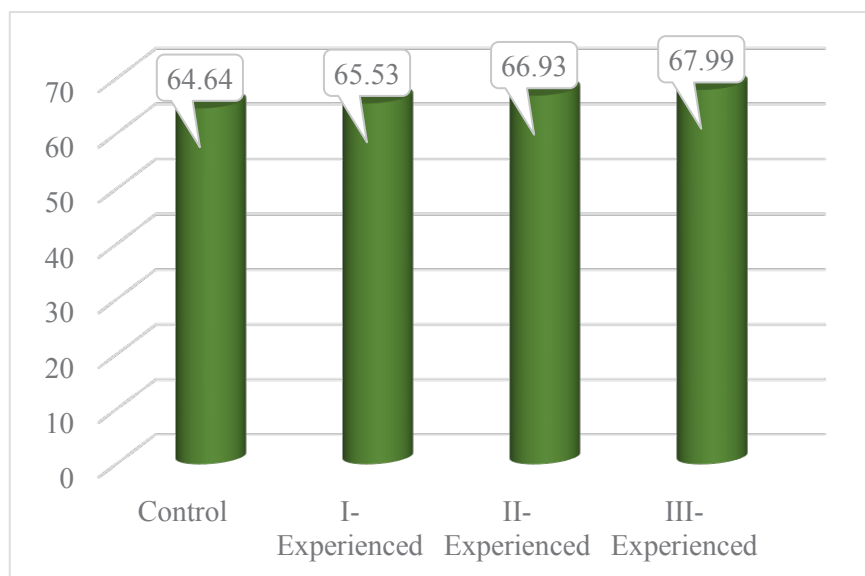


Fig. 2. Average daily growth of broiler chickens from daily to 37 days of age, g

The safety of livestock was higher in poultry, in the diet of which fish meal was completely replaced with Volgafish concentrate, amounted to 98.80% versus 98.00% in the control group.

The loss of livestock was not caused by poultry diseases, but was associated with technological factors.

The meat qualities of poultry are assessed by the following indicators: live weight before slaughter, the mass of the gutted carcass, the number of edible and inedible parts and the chemical composition of muscle tissue.

In this regard, we conducted a control slaughter of poultry, during which we evaluated the above-mentioned indicators (Table 4).

Table 4. Slaughter rates of broiler chickens

Indicator	Group	
	Control	Experienced
Weight before slaughter, g	2325,00±33,95	2409,00±34,60
The mass of the gutted carcass, g	1650,00	1719,00
A killer exit, %	70,97	71,36

The live weight of the broilers of the control group before slaughter was 2325.00 g, in the experimental group by 84.00 g (3.61%).

The percentage of lethal yield in the control group was 70.97, in the experimental group 71.36, which is 0.39% higher.

However, for a more complete assessment of the slaughter qualities of poultry when using various diets, we carried out anatomical butchering of carcasses.

Compound feeds are an aspect of high economic importance in commercial poultry farming, not only because they are primarily responsible for the growth response of birds, but mainly because they represent the largest cost in the production cycle.

The economic sustainability of poultry farming largely depends on the nature and quality of the feed used.

In order to make a final assessment of the studied feeds in a comparative aspect, we studied the economic efficiency of their use (Table 5).

Table 5. Economic efficiency of using fish concentrate in feeding broiler chickens

Indicator	Group	
	Control	Experienced
Livestock at the beginning of the experiment, heads	250	250
Livestock at the end of the experiment, heads	245	247
Livestock safety, %	98,00	98,80
Pre-slaughter weight, g		
The weight of the gutted carcass, g	1650,00	1719,00
Total meat received (gross yield), kg	404,25	424,59
Compound feed consumed during the period of experience per 1 head, g	3 680,00	3 680,00
Compound feed consumed during the period of experience for the initial livestock, kg	920,00	920,00
Production costs (total), rubles	50 972,00	51 934,50
Feed costs per 1 head, rubles	163,44	162,45
The cost of compound feed for all livestock, rubles	40 860,00	40 612,50
Cost savings on feed, rubles	-	252,50
The selling price of 1 kg of meat products, rubles	140,00	140,00
Income from the sale of broiler chickens, rubles	56 595,00	59 442,60
Additional products were received in the amount of rubles	-	2 847,60

Profit, rubles	4 163,00	7 508,10
Additional profit due to the use of Volgafish fish concentrate, rubles	-	3 345,1
The level of profitability, %	7,93	14,45

The results of the economic assessment of poultry meat production using various diets showed that with the complete replacement of fish meal with Volgafish fish concentrate, the additional profit per 250 heads of broiler chickens is 3345.1 rubles, which led to an increase in profitability by 6.52% (14.45% vs. 7.93%).

With the same consumption of compound feeds, the live weight of the experimental bird of the new feeding option was 108.00 grams higher compared to the base one. The safety of livestock in the new version was 99.52%, which is higher than in the basic version by 0.91%. The level of profitability from the use of compound feed containing fish concentrate in the experimental group of poultry was 28.02%, which was higher than that of analogues from the control group by 7.7%.

5 Conclusions

Broiler production is an integral part of the global poultry industry, and broiler meat is an important source of protein for human consumption.

The problem of protein in poultry meat is one of the most pressing problems in the modern agricultural industry. More and more people around the world are striving for a healthy lifestyle and a healthy diet, which leads to an increase in consumption of poultry meat.

However, at the same time, it becomes necessary to ensure high quality and rich composition of food products, especially protein, since this is the main building material for the body.

In order to solve the problem of protein in meat poultry farming, it is necessary to conduct additional research and develop new methods of feeding and rearing birds.

In this regard, we have determined the possibility of using high-protein fish concentrate "Volgafish" of domestic production in the feeding of broiler chickens. As a result of comprehensive studies, the influence of the developed compound feeds with different levels of fish concentrate administration has been established not only on the productive qualities of poultry in the meat production line, but also on the quality of meat obtained from them. The economic feasibility of replacing fishmeal with Volgafish fish concentrate in the diets of broiler chickens has been proven.

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