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Influence of Microalgae Chlorella Vulgaris On Meat Productivity of Quail

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abstract
The scientific paper presents the experimental results of the application microalgae Chlorella vulgaris when growing young quails. The experiment was conducted on two groups of 10-day-old Phoenix quails, which were fed complete feed. The birds of the second group were additionally received dry biomass of the microalgae Chlorella vulgaris with feed daily at a dosage of 4 mg/kg of live weight. The studies have established that in the second group of quails that received the studied additive, the live weight and average daily gains were greater than in the control in males by 2.6% (P≤0.001) and 7.9%, in females by 4.5% (P≤0.01) and 12.7% (P≤0.001), respectively. In the quails of the second group, the slaughter weight increased by 7.8%, the weight of the ungutted carcass by 8.8%, the semi-gutted and gutted carcass by 8.7%, the yield of edible parts by 11.3% and muscles by 13.5% (P≤0.01), the relative and absolute weight of the liver and gizzard. Application dry biomass of microalgae Chlorella vulgaris did not negatively affect the meat quality of the experimental birds.
Keywords: *feeding, quails, weight, gain, meat, quality*

INTRODUCTION

In recent years, Russian agricultural producers have begun breeding quails. The biological feature of quails is their intensive growth and early maturity, which results in a large amount of production per unit area. One quail can produce 20 times more eggs per year than its live weight. Quail meat and eggs have a unique chemical composition and are considered dietary.

The best meat qualities are possessed by meat breeds of quails, such as Pharaoh, Texas White, Virginia, Manchurian, Californian, etc. When raising quails for meat, the indicators of meat productivity, feed conversion, and the period of raising are taken into account.

As is known, it is possible to ensure the realization of the genetic potential of productivity in poultry only by organizing a complete balanced diet and providing the body with biologically active substances. Therefore, in order to increase the intensity of growing and preserving quails, biologically active feed additives are widely used. Of particular interest in quail feeding is the use of additives that have a positive effect on the adaptation of the body to various stress factors and meat productivity, for example, betaine. Undoubtedly, the future of feed additives lies in new biotechnologies, but today any farm in Russia can practically increase profitability in livestock farming up to two times, using a unique natural plant suspension of chlorella in feed rations, obtaining it in the required quantity cheaply and simply in its own conditions. The high nutritional value of dry chlorella, a large number of essential amino acids, macro-, microelements, vitamins allow us to recommend its use in compound feed, protein-vitamin-mineral additives and premixes for farm animals and poultry as a source of not only nutrients, but also biologically active substances.

Chlorella is a genus of single-celled green algae that surpasses all plant feeds and agricultural crops in vitamin content. Chlorella is an active producer of proteins, carbohydrates, lipids, and vitamins.

The high economic efficiency of using chlorella in poultry farming lies in its high concentration and rich set of biologically active substances in an easily digestible form for the bird's body, the low cost of the suspension, and its availability and ease of cultivation directly on farms.

The aim of the research is to study the growth dynamics and meat productivity of young quails using dry biomass of the microalgae Chlorella vulgaris in diets. Scientific novelty - for the first time in experimental studies, the positive effect of dry biomass of the microalgae Chlorella vulgaris on the survival rate, growth

dynamics and meat productivity of young quails and meat indicators was studied and established.

MATERIALS AND METHODS

Experimental studies were conducted at the Department of Agricultural Production and Processing Technology. For the experiment, two groups of quails, control and experimental Phoenix breeds, aged 10 days (n = 50), were formed according to the balanced group principle. The maintenance and feeding of the birds complied with zootechnical standards. The young animals were raised in three-tiered battery cages BVM-F-4Ts equipped with nipple drinkers and feeders. According to the experimental design, depending on their age, the experimental birds of both groups received complete feed PK-2 produced by Bogdanovich Feed Mill OJSC (basic ration - BR). In addition to BR, quails of the second experimental group received dry biomass of the microalgae Chlorella vulgaris with their feed daily at a dosage of 4 mg / kg of live weight, which was previously established in experiments on laboratory animals. During the experiment, the survival rate of the livestock, feed consumption, behavioral reflexes, and the color and consistency of the droppings were recorded daily.

In the feed and meat samples of the experimental animals. The dry matter content of quails was determined by drying the sample in a SM 50/250-250 ШС drying cabinet at a temperature of 105±5 °C, protein – according to the Kjeldahl method using a DK-20, UDK 132 device; fat – on a Soxhlet device, fiber – on an AKV-6 device; ash – by dry ashing; calcium – by the volumetric method; phosphorus – on a UV-1280 spectrophotometer.

The content of exchange energy in the compound feed was determined by the formula:

ME = 17.84*nP + 36.78*nF + 17.71*nK + 17.71*nBEV, where ME is the exchange energy in 1 kg of compound feed, MJ; nP, nF, nK, nBEV are digestible protein, fat, fiber, and nitrogen-free extractive substances in grams.

At the end of the fattening period, at the age of 40 days, a control slaughter of the birds was carried out, during which a pathological anatomical assessment of the organs and tissues, anatomical cutting of the carcasses and a morphometric analysis of the internal organs were carried out. The quality of quail meat was assessed according to the requirements of GOST R 51944-2002 "Poultry meat. Methods for determining organoleptic indicators, temperature and weight."

All digital material was processed using the variation statistics method with the definition of Student's t-test of reliability. The difference P ≤0.05 was considered reliable.

RESULTS AND DISCUSSION

We have found that the microalgae Chlorella vulgaris did not negatively affect the physiological state of the experimental quails. During the experiment, normal behavioral reflexes were observed in the entire population, and no food remains were observed. The color and consistency of the droppings corresponded to this type of bird. The feeding scheme for the quails is presented in Table 1.

The use of microalgae Chlorella vulgaris had a positive effect on the growth, development and survival of quails. The experimental data obtained in different age periods are presented in tables 2, 3, 4.

On the 17th day of the experiment, the live weight of the birds of the second group was 4.1% more than that of the control quails, on the 24th day the difference between the live weights was insignificant, the difference in the average daily gain in live weight between the groups was also insignificant. On the 38th day of the experiment, the weight of the males of the second experimental group was 2.7% (P≤0.001), and that of the females was 4.5% (P≤0.01) more than that of the control.

Table 1: Feeding scheme for quails

Bird age, days	Amount of feed prescribed per head per day, g	Content in the daily diet	
		crude protein, g	exchange energy, kcal
10	9.0	2.50	26.10
11	10.0	2.50	29,00
12	11.0	2.75	31.90
13	12.0	3.00	34.80
14-18	13.0	3.25	37.70
19-21	14.0	3.50	40,60

22-23	14.0	3.50	40,60
24-26	15.0	3.15	43.50
27-28	16.0	3.20	46.40
29-38	16.0	3.20	44,00

Table 2: Growth dynamics and average daily gain in live weight of experimental quails in the period from 10 to 24 days, g (n = 50)

Indicator	Group I control, OR	II experimental group OR
Live weight at the age of 10 days	47.35±0.87	47.73±1.16
at the age of 17 days	80.85±1.74	84.13±1.98
at the age of 24 days	117.30±1.98	118.53±2.24
Average daily growth	5.00±0.10	5.06±0.83

Table 3: Dynamics and average daily gain in live weight of experimental quails in the period from 31 to 38 days, g

Indicator	Group I control		II experimental group	
	males (n = 30)	females (n = 36)	males (n = 38)	females (n = 42)
Live weight at 31 days	130.20±3.07	162.53±1.46	130.80±1.81	164.20±2.02
at the age of 38 days	186.00±4.34	232.47±2.14	191.00±4.22***	243.00±2.67**
Average daily growth	7.97±0.21	9.99±0.12	8.60±0.43	11.26±0.22***

**P ≤0.01, ***P ≤ 0.001

A similar pattern was observed for the average daily live weight gain in quails. During the analyzed period, the average daily gain in males of the second group was 7.9%, in females - 12.7% (P≤0.001) more than in the control group. Our data are consistent with the results of R.A. Chudak's studies, which were obtained by feeding betaine to Japanese quails.

In general, by the end of the experimental period, the average live weight of quails in the control group was 209.23±3.86 g, and in the second group of birds that received the studied additive, 217.00±4.24 g. The increase in live weight of quails during the accounting period in the control group was 161.88±3.71 g, in the second experimental group – 169.27±4.21 g, the average daily increase in live weight was 5.78±0.13 g and 6.05±0.15 g, respectively (Table 4).

Table 4: Impact**Betaine aldehyde additives on feed costs, survival and weight gain of quails (n = 50)**

Indicator	Group I control	II experimental group
Preservation, %	82.50	100
Live weight, g at the beginning of the experiment (at the age of 10 days)	47.35±0.87	47.73±1.16
at the end of the experiment (at the age of 38 days)	209.23±3.86	217.00±4.24
Total live weight gain during the experimental period, g	161.88±3.71	169.27±4.21
% to control group	100	104.6
Average daily live weight gain during the experimental period, g	5.78±0.13	6.05±0.15
% to control group	100	104.7
Feed consumption per 1 kg of live weight gain, kg	2.56	2.45
% to control group	100	95.7

The use of microalgae Chlorella vulgaris contributed to a reduction in the consumption of compound feed. Per 1 kg of live weight gain, 2.56 kg of compound feed were spent in the control group, and 2.45 kg in the second experimental group, which is 4.3% less.

The results of the study of meat productivity of quails are presented in Table 5. The data in Table 5 show that the slaughter weight of quails receiving the additive was 198.67±27.18 g, which is 7.8% more than

the control, the weight of the ungutted carcass was 8.8% more, the weight of the semi-gutted and gutted carcasses – by 8.7%. The birds receiving the biologically active additive also increased the weight of edible parts by 11.3% and the muscle yield by 13.5% (P≤0.01). These results are most likely associated with the methionine-sparing activity of betaine, which is the main factor in additional protein synthesis. The morphometric analysis of the internal organs of the experimental quails is presented in Table 6.

We have noted that, compared to the control, the experimental bird had an increase in the relative and absolute mass of the liver and muscular stomach, but at the same time, the relative mass of the heart decreased. According to the data

R. A. Chudak, in quails given betaine, the liver and stomach weight was also greater than in the control, but an increase in heart weight was noted, which differs from our results [11].

Table 5: Meat productivity of quails in the control and experimental groups (n = 10)

Indicator	**Group I control**	**II experimental group**
Pre-slaughter weight, g	207.32±3.31	215.87±3.76
Slaughter weight, g	184.33±14.75	198.67±27.18
Carcass weight, guneviscerated	177.00±14.15	92.67±26.43
half gutted	167.67±13.57	182.33±25.83
gutted	134.67±13.30	146.33±22.78
Weight of edible parts, g	94.33±9.91	105.00±15.00
Mass of the pectoral and femoral muscles, g	69.00±1.54	78.33±0.68**
Output relative to pre-slaughter weight, %	85.38	89.25
half-gutted carcass	80,87	84.46
gutted carcass	64.96	67.79
edible parts	45.50	48.64
pectoral and femoral muscles	33.28	36.29

** P≤ 0.01

Table 6: Morphometric indices of internal organs of experimental quails (n = 10)

Indicator	Group I control	II experimental group
Pre-slaughter weight, g	207.32±3.31	215.87±3.76
Slaughter weight, g	184.33±14.75	198.67±27.18
Liver weight, g	5.33±0.67	6.00±0.58
To the carcass weight, %	2.89	3.02
Heart mass, g	1.67±0.33	1.67±0.33
To the carcass weight, %	0.91	0.84
Weight of muscular stomach, g	4.67±0.67	5.33±0.67
To the carcass weight, %	2.53	2.68
Weight of inedible parts, g	26.33±0.33	29.33±1.67
To the carcass weight, %	14.28	14.76

The table presents data on the assessment of the meat quality of the experimental birds, from which it is evident that the use of the betaine-aldehyde preparation did not have a negative effect on the quality of quail meat. Similar results were obtained by SM ElBahr et al., who also noted the positive effect of betaine on the quality of quail meat.

CONCLUSION

Dry biomass of the microalgae Chlorella vulgaris is a promising biologically active additive for quail breeding. The use of the additive in quail diets increased survival, had a positive effect on the growth dynamics and meat productivity of the experimental birds. By the end of the experiment, the birds of the second group that received betaine increased the live weight of males by 2.6%, females by 4.5%, average daily live weight gains of males by 7.9%, females by 12.7% (P≤0.001). The quails of the second group increased their slaughter weight by 7.8%, the weight of the ungutted carcass by 8.8%, the semi-gutted and eviscerated carcasses by 8.7%, the weight of the edible parts by 11.3% and the muscle yield by 13.5%

(P≤0.01), the relative and absolute weight of the liver and gizzard. The use of dry biomass of the microalgae Chlorella vulgaris did not have a negative effect on the organoleptic properties of the meat of the experimental birds.

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