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[DOI: 10.24412/2520-6990-2021-16103-39-43](https://doi.org/10.24412/2520-6990-2021-16103-39-43)**THE EFFECT OF DRY EXTRACT OF ECHINACEA PALLIDA ON THE PRODUCTIVITY AND FEED CONSUMPTION OF QUAILS****Abstract.**

The aim of the experiment was to investigate the effect of dry echinacea extract on the productivity and feed consumption of Pharaoh meat quails.

The dry extract of the underground part of *Echinacea pallida* in the form of a homogeneous brown powder is the researched feed additive. The additive contains biologically active substances, i.e., polysaccharides (fructosans) and phenolic compounds (hydroxycinnamic acids), which have immune, antimicrobial and anti-inflammatory effects.

The research of the effectiveness of the *Echinacea pallida* extract feed additives application in the quails feeding were conducted at a research farm of Vinnytsia National Agrarian University. Scientific experiments were carried out on poultry according to generally accepted methods. Four groups of experimental birds were formed, each group had 50 heads selected by the method of analogous groups. The experiment lasted for 56 days.

Additional feeding by different doses of *Echinacea pallida* extracts as a part of complete feed had a positive effect on the live weight of the experimental quails. Thus, the additional feeding by the average dose of the researched additive in the amount of 12 mg per kg of live weight increases live weight, average daily and absolute growth of females by 13.3% ($P < 0.001$), 14.3% and 13.5% ($P < 0.001$) and males by 19.7% ($P < 0.001$), 23.1% and 20.3% in comparison with control analogues.

Quails consuming a phytobiotic supplement of *Echinacea pallida* dry extract has reduced feed consumption per 1 kg of growth by 14.9%, relative to control.

It has been found that the use of *Echinacea pallida* extract in the feeding of quails increases the safety of livestock by 4%.

Keywords: *Echinacea pallida* extract, fodder, quail, growth, live weight.

Statement of the problem. In the European Union, as in world practice, the antibiotics application in animal and poultry feed is prohibited because they degrade the products quality. Therefore, the issue of involving plant biostimulators in solving this problem is currently relevant [6, 8, 9].

Many Ukrainian scientists and practitioners focus on the application and implementation of new biologically active feed additives of natural origin, which improve metabolic processes, increase immunity and do not accumulate in livestock products [10, 11].

Analysis of recent research and publications. The new category of natural growth stimulants derived from herbs, spices and plant extracts needs special attention. After all, phytogenics (phytobiotics) are extremely heterogeneous in composition and biologically active substances level [5, 7].

According to Ya.V. Diakonova researches [1], it was established for the first time that the grass and roots of *Echinacea pallida* contain 16 amino acids. In particular, free asparagic, glutamic acid and proline dominate in free grass, and aspartic, glutamic acid, proline, arginine, phenylalanine and threonine are found in the roots. Cystine is found in the fruits of *Echinacea pallida*. However, there is no cystine in the grass and roots. Aspartic acid has an immunomodulatory effect, increases physical endurance, normalizes the balance of excitation and inhibition in the central nervous system (CNS), and glutamic acid is a neurotransmitter amino

acid, it regulates metabolic processes in the CNS, increases the body's resistance to hypoxia.

The aim of the experiment was to investigate the effect of dry echinacea extract on the productivity and feed consumption of Pharaoh meat quails.

Materials and methods of research. The experiment of the effectiveness of the *Echinacea pallida* extract feed additives application in the quails feeding were conducted at a research farm of Vinnytsia National Agrarian University

Scientific experiments were conducted on poultry according to generally accepted methods [2, 3]. According to the results of weighing carried before feeding in the morning, the absolute, average daily and relative gains of live weight during the experiment were calculated.

Feed consumption was recorded daily, weekly and for the entire growing period. At the end of the experiment, the feed consumption per 1 kg of live weight gain was calculated.

Four groups of Pharaoh meat quails were selected for the experiment. According to the principle of analogues, 50 heads were formed in each group [2]. The experiment lasted for 56 days. At 30 days of age, the poultry was divided into females and males (25 females and 25 males). The first control group consumed the basic diet, i.e., complete feed TM Multigain, and quails of the experimental groups were additionally fed by different doses of feed additives of *Echinacea pallida* dry extract (Table 1).

Feeding patterns

Group	Number of animals in the group, heads	Duration of the experiment, days	Feeding characteristics
1 - control	50	56	BD (complete feed)
2 - experimental	50	56	BD + Echinacea pallida (6 mg / kg live of weight)
3 - experimental	50	56	BD + Echinacea pallida (12 mg / kg live of weight)
4 - experimental	50	56	BD + Echinacea pallida (18 mg / kg live of weight)

*BD – basic diet

The investigated feed additive is dry extract of the underground part of Echinacea pallida in the homogeneous brown powder. The additive contains biologically active substances, i.e., polysaccharides (fructosans) and phenolic compounds (hydroxycinnamic acids), which have immune, antimicrobial and anti-inflammatory effects.

The researched dry extract from the roots of Echinacea pallida was made on the basis of LLC Research Plant in Kharkiv [5].

Biometric data processing was performed using MS Excel software using statistical functions.

Statistical evaluation of differences was performed using Student test at three levels of probability: $P < 0.05$; $P < 0.01$; $P < 0.001$ (marked in the text respectively *, **, ***) [4].

Research results. It was found that on the 7th and 14th day poultry of the third experimental group consumed the average dose of dry extract of Echinacea pallida in the amount of 12 mg kg there is a probable increase in live weight, respectively, by 2.4 g, or by 10.4% ($P < 0.05$) and by 8.2 g, or by 12.9% ($P < 0.001$) (Table 2).

Table 2

Live weight of quails, g ($M \pm m$, $n = 50$)

Age of quails, days		Group			
		1-control	2-experimental	3- experimental	4- experimental
1		8.0 ± 0.08	8.1 ± 0.07	8.1 ± 0.07	8.1 ± 0.07
7		23.0 ± 0.60	24.0 ± 0.60	25.4 ± 0.68*	23.8 ± 0.43
14		63.2 ± 1.37	66.6 ± 1.76	71.4 ± 1.45***	65.6 ± 0.92
21		105.0 ± 1.36	118.0 ± 1.73***	123.8 ± 2.04***	115.0 ± 1.76***
28		154.8 ± 2.91	170.5 ± 3.29***	176.8 ± 1.04***	163.2 ± 2.15*
35	Females (n=25)	206.9 ± 2.53	216.4 ± 2.63**	231.4 ± 2.50***	221.0 ± 1.56***
	males (n=25)	173.2 ± 1.16	183.0 ± 2.51***	198.2 ± 0.72***	174.7 ± 2.07
42	Females (n=25)	262.0 ± 3.14	268.2 ± 1.16	291.2 ± 2.53***	276.1 ± 3.24**
	males (n=25)	200.9 ± 1.75	205.3 ± 1.73	238.2 ± 2.74***	204.4 ± 2.08
49	females (n=25)	300.5 ± 4.41	317.1 ± 4.09**	348.2 ± 1.96***	309.1 ± 2.97
	males (n=25)	221.8 ± 2.27	228.7 ± 2.16*	265.1 ± 1.58***	235.4 ± 2.59***
56	females (n=25)	322.8 ± 2.64	333.1 ± 3.15*	365.8 ± 1.40***	335.6 ± 2.38***
	males (n=25)	231.0 ± 2.23	242.9 ± 2.58**	276.5 ± 1.94***	254.5 ± 3.36***
Survival, %	females (n=25)	95	97	99	98
	males (n=25)	95	97	99	98

On the 21st day, the poultry of the second, third and fourth experimental groups significantly increased live weight by 12.4%, 17.9% and 9.5% ($P < 0.001$) than the control group. Similar changes in live weight are observed in young animals on the 28th days, in particular, the quails of the experimental groups predominate in the first control group by 10.1%, 14.2% ($P < 0.001$) and 5.4% ($P < 0.05$), respectively.

30-day poultry was divided by sex into females and males. Thus, 35-days females of the second, third and fourth experimental groups had an increase in live weight by 9.5 g or 4.6% ($P < 0.01$), by 24.5 g or by 11.8% ($P < 0.001$) and by 14.1 g, or by 6.8% ($P < 0.001$). The males of the second and third groups outperformed their control counterparts by 9.8 g or by 5.6%, and by 25 g or by 14.4% ($P < 0.001$).

Fed by the average and maximum dose of the researched feed additive 42-day poultry had the highest

live weight in females in the third and fourth experimental groups by 11.1% ($P < 0.001$) and 5.4%, respectively ($P < 0.01$). The males of the third group prevailed by 18.5% ($P < 0.001$) in live weight.

On 49th day live weight of females in the second group was greater by 16.6 g or 5.5% ($P < 0.01$) and by 47.7 g, or 15.9% ($P < 0.001$) in the third group than its control counterparts. In addition, males of the second, third and fourth experimental groups significantly increased live weight by 6.9 g or 3.1% ($P < 0.05$), 43.3 g or 19.5%, and 13.6 g or 6.1% ($P < 0.001$) than their control counterparts.

It was found that at the end of the experimental period (56 days) the poultry fed by different doses of dry extract of Echinacea pallida prevailed over the live weight. Thus, the largest weight was recorded in females and males of the second, third and fourth experimental groups; it was respectively higher by 3.2% (P

<0.05), 13.3%, 3.9% <0.001) and 5.2% (P <0.01), 19.7%, 10.2% (P <0.001).

It was also found that the survival of the population was higher by 2%, 4% and 3% in the second, third and fourth experimental groups.

There is an increase in absolute growth in the third experimental group by 2.2 g, or by 14.6% (P <0.05) and by 5.8 g, or 14.4% (P <0.01) compared with the control group (Table 3) at the age of 1 to 7 and from 8 to 14 days.

It was found that there is the highest absolute increase in the second, third and fourth experimental groups, which is respectively 22.9%, 25.3% and 18.2% (P <0.01) in young quails from 15 to 21 days of age.

It should be noted that the 22-28-day experimental poultry the absolute gains were the lowest in the fourth group by 1.6 g or 3.3%.

The 29-35-day females of the second experimental group tended to decrease in absolute growth by 6.2 g. The males of the second and fourth experimental groups lost in absolute weight in 5.9 g (P <0.01) and 6.9 g (P <0.001).

The highest live weight was characterized by females and males of the third experimental group, they exceeded the quails of the control group by 8.5% and 44.4% (P <0.001) for the next growing period (36–42 days).

Table 3

Absolute increase in live weight of quails, g (M ± m, n =50)

Age of quails, days	Group				
	1-control	2-experimental	3- experimental	4- experimental	
1-7	15.0 ± 0.62	15.9 ± 0.59	17.2 ± 0.69*	15.6 ± 0.43	
8-14	40.2 ± 1.57	42.6 ± 2.00	46.0 ± 1.59**	41.8 ± 1.03	
15-21	41.8 ± 2.17	51.4 ± 2.11**	52.4 ± 2.42**	49.4 ± 2.03**	
22-28	49.8 ± 3.09	52.5 ± 3.28	53.0 ± 2.16	48.2 ± 2.92	
29-35	females (n=25)	52.1 ± 2.90	45.9 ± 2.03	54.6 ± 2.72	57.8 ± 2.88
	males (n=25)	18.4 ± 1.75	12.5 ± 1.15**	21.4 ± 1.79	11.5 ± 0.89***
36-42	females (n=25)	55.1 ± 3.87	51.8 ± 2.98	59.8 ± 3.12	55.2 ± 3.55
	males (n=25)	27.7 ± 2.34	22.3 ± 2.40	40.0 ± 2.64***	29.7 ± 2.56
43-49	females (n=25)	38.5 ± 3.46	48.9 ± 4.16	56.9 ± 2.62***	33.0 ± 4.43
	males (n=25)	20.8 ± 2.41	23.4 ± 2.08	26.9 ± 1.69*	31.0 ± 3.32*
50-56	females (n=25)	22.3 ± 2.45	16.0 ± 2.10	17.6 ± 1.93	26.5 ± 3.15
	males (n=25)	9.2 ± 0.98	14.2 ± 1.76*	11.4 ± 1.23	19.1 ± 1.72***
Average for the experiment	females (n=25)	315.0 ± 2.60	325.2 ± 3.15*	357.7 ± 1.43***	327 ± 2.37**
	males (n=25)	222.9 ± 2.21	234.6 ± 2.51**	268.2 ± 1.95***	246.2 ± 3.33***

43-49-day poultry had the increased rates of absolute growth in the third experimental group, in particular in females by 47.7% (P <0.001) and in males by 29.3% (P <0.05) compared to analogues from control. At the same time, in males of the 4th experimental group this indicator was higher by 49.0% (P <0.05) than in the first group.

At the end of the experimental period (50-56 days) the absolute growth decreased by 6.3 g or 28.2% and 4.7 g, or 21.1% under the influence of phytobiotics in females of the second and third experimental groups. However, no significant difference with control was found. These indicators are likely to increase by 5.0 g (P <0.05) and 9.9 g (P <0.001) for males of the second and fourth experimental groups, respectively, compared to the control group.

Thus, the highest absolute gains in live weight of females and males were recorded in the third experimental group, respectively, by 13.5% and 20.3% (P <0.001) compared to control analogues. These animals were additionally fed by the researched feed additive in the amount of 12 mg per kg of body weight.

Feeding by dry extract of *Echinacea pallida* increased the average daily gain in the experimental groups (Table 4).

It was found that quails that consumed the average dose (third group) of *Echinacea pallida* extract with compound feed in the growth period from 1 to 7 and

from 8 to 14 days of age had the highest average daily gains of 14.3% (P <0.05) and 15.8% (P <0.01) compared with the control group.

15–21-day experimental poultry had a probable growth increase. Thus, the average daily gains were higher by 23.7%, 27.1% (P <0.001) and by 20.3% (P <0.01) in the second, third and fourth groups than the control group.

There is a tendency to reduce the average daily increase among quails of the fourth experimental group by 2.8% compared to the control.

Among 29-35-day poultry, the highest average daily gain was recorded in females of the fourth experimental group, it was 10.8%. However, in the second and fourth groups the growth decreased slightly by 30.7% and by 38.4% (P <0.05), according to control counterparts.

Among 36-42-day poultry the average daily gains were largest in the third experimental group (both for females and males) by 8.9% and 46.2% (P <0.001), respectively, compared with the control group.

Thus, on 43-49 day the average daily gains probably increased by 47.2% (P <0.001) and 31.0% (P <0.05) in the third experimental group (both for females and males) compared to the control. The same tendency is observed in the fourth experimental group for males, respectively, by 51.7% (P <0.05).

The average daily increase in live weight of quails, g (M ± m, n =50)

Age of quails, days		Group			
		1-control	2 -experimental	3- experimental	4 - experimental
1-7		2.1 ± 0.08	2.3 ± 0.08	2.4 ± 0.09*	2.2 ± 0.06
8-14		5.7 ± 0.22	6.0 ± 0.28	6.6 ± 0.23**	5.8 ± 0.15
15-21		5.9 ± 0.31	7.3±0.30***	7.5 ± 0.35***	7.1 ± 0.29**
22-28		7.1 ± 0.44	7.5 ± 0.47	7.6 ± 0.31	6.9 ± 0.42
29-35	females (n=25)	7.4 ± 0.52	6.5 ± 0.41	7.8 ± 0.39	8.2 ± 0.50
	males (n=25)	2.6 ± 0.32	1.8 ± 0.31	3.2 ± 0.25	1.6 ± 0.31*
36-42	females (n=25)	7.8 ± 0.55	7.5 ± 0.43	8.5 ± 0.44	7.9 ± 0.51
	males (n=25)	3.9 ± 0.33	3.2 ± 0.34	5.7 ± 0.38***	4.2 ± 0.36
43-49	females (n=25)	5.5 ± 0.49	7.0 ± 0.59	8.1 ± 0.37***	4.7 ± 0.63
	males (n=25)	2.9 ± 0.34	3.3 ± 0.29	3.8 ± 0.24*	4.4 ± 0.47*
50-56	females (n=25)	3.1 ± 0.51	2.3 ± 0.30	2.5 ± 0.28	3.7 ± 0.45
	males (n=25)	1.3 ± 0.15	2.0 ± 0.25*	1.6 ± 0.18	2.7±0.25***
Average for the experiment	females (n=25)	5.6 ± 0.78	5.8 ± 0.85	6.4 ± 0.95	5.9 ± 0.81
	males (n=25)	3.9 ± 0.79	4.2 ± 0.92	4.8 ± 0.90	4.4 ± 0.81

In the last week of growth (50-56 days) the application of different doses of *Echinacea pallida* extract increases the average daily gain 0.7 g ($P < 0.05$) for males of the second experimental group and by 1.4 g for males of the fourth group ($P < 0.001$). Females of the second and third experimental groups tend to decrease the average daily gain.

The highest average daily increase in live weight was recorded in females and males of the third experimental group, respectively, by 0.8 g, or 14.3% and 0.9 g, or 23.1% greater than in control.

According to research results, it is revealed that quails feeding by various doses of the forage additive influences their growth; it also decreases expenses of forages per 1 kg of live weight gain (Table 5).

Table 5

Feed consumption and feed payment by quail growth, kg

Group		Feed consumption, kg				Per 1 kg of gain		Payment by quail growth	
		for experiment		per one head		total, kg	± control	Total, feed units	± control
		total	± control	total	± control				
1-control	females (n=25)	36.4	-	1.45	-	4.62	-	0.21	-
	males (n=25)	32.2	-	1.28	-	5.77	-	0.17	-
2-experimental	females (n=25)	35.9	-0.5	1.43	-0.02	4.41	-0.21	0.22	+0.01
	males (n=25)	32.8	0.6	1.31	0.03	5.59	-0.18	0.18	+0.01
3- experimental	females (n=25)	35.2	-1.2	1.40	-0.05	3.93	-0.69	0.25	+0.04
	males (n=25)	35.0	2.8	1.40	0.12	5.21	-0.56	0.19	+0.02
4- experimental	females (n=25)	36.0	-0.4	1.44	-0.01	4.39	-0.23	0.22	+0.01
	males (n=25)	33.6	1.4	1.34	0.03	5.45	-0.32	0.18	+0.01

According to our research, the average dose (third group) of *Echinacea pallida* extract was the most effective in the quails' diets, which reduces feed consumption by 1 kg increase by 0.69 kg and 0.56 kg and increases feed payments by 19.0% and 11.8% for both males and females.

Conclusions and prospects for further research.

It was found that the additional use of the average dose of the *Echinacea pallida* extract in the amount of 12 mg / kg live weight increases live weight by 13.3% ($P < 0.001$), daily average growth by 14.3% and absolute growth of females by 13.5% ($P < 0.001$) and males by 19.7% ($P < 0.001$), 23.1% and 20.3%, respectively than control counterparts. It should be noted that for quails fed a phytobiotic supplement from the dry extract of *Echinacea pallida* feed costs per 1 kg increase by 14.9% compared to the control group. It was also

found that the use of *Echinacea pallida* extracts in the quails feeding increases the safety of livestock by 4% relative to control.

Thus, it was found that additional feeding of plant supplements from the extract of *Echinacea pallida* increases productivity and reduces feed costs for quails.

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PRODUCTIVITY OF MEAT QUAILS FED BY BETAINES FEED ADDITIVE AS A PART OF DIETS

Abstract.

It was found that the betaine application for quails feeding causes an increase in live weight of 42-day females by 8.2% and males by 6.0%, female gain per kg of growth decreased by 0.38 kg, and male gain per kg of growth decreased by 0.29 kg of feed. Slaughter rates were characterized by an increase in chest muscle weight of 11.4% and thigh muscles by 7.9% with the use of betaine feed supplement. Increased metabolism with an increase in hemoglobin by 2.9% was also found.

Keywords: *quails, feeding, compound feed, productivity, slaughter parameters, morphological and biochemical parameters of blood.*

Introduction

Many researchers are constantly looking for effective growth stimulants of natural origin [2-4, 11, 13, 14]. Betaine should be noted among such feed additives, it is insufficiently researched in animal husbandry [5-7].

It was found that the replacement of choline with betaine led to an increase in breast weight and a decrease in internal fat in broilers. A research conducted by Colorado Quality Research, USA, confirmed improved feed conversion in broilers and increased breast meat yield when choline was replaced by betaine and unchanged methionine levels. In laying hens, betaine helped to reduce the number of eggs that were too large in the later stages of laying [9].

Korean researchers Sun Jin Hur, Han Sul Yang, Gu Boo Park and Seon Tea Joo *Asian-Aust. J.* [7] conducted an experiment to determine the effect of dietary glycine betaine on the quality of pork in different muscle types. It has been studied that in the fatty acid composition dietary glycine betaine helps to increase the ratio of saturated fatty acids (SFA) and reduce unsaturated fatty acids (USFA) in the pigs thighs.

Material and methods of research

The aim of the experiment was to determine the effect of feed additive Betaine on productivity, slaughter quality and hematological parameters of quails.

Zootechnical, statistical, physiological and economic research methods were used to solve these problems.

The use of Betaine in premixes and concentrates significantly improves the preservation of vitamins, increases the shelf life of feeds, concentrates and premixes. Betaine is a donor of methyl groups and acts as an osmoprotector.

One-day quails of the Pharaoh breed were selected on the principle of analogue groups [10], where the breed, age and live weight were taken into account. Two groups were formed, each group included 20 heads.

Quails consumed basic diet (BD) of the Multigain trademark. Betaine was additionally fed to the experimental group of poultry.

The experiment lasted 42 days. The equalization period is 5 days and the main period is 37 days (Table 1).