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INFLUENCE OF CMP-3 PREPARATION ON THE QUAIL GROWTH AND DEVELOPMENT

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Abstract

The scientific paper presents the experimental results of the use of a biologically active complex microbial preparation (CMP-3) for the growth of quail chicks. The experiment lasted 30 days and was carried out on two groups of Phoenix quails. During the period of 1-30 days the quails in the control group consumed combined feed, and those in the experimental group - combined feed with the addition of the 0.5% complex microbial preparation. The adding of the complex microbial preparation in the daily ration of quails ensured the viability of chicks of 100% compared to 91% in the control group, a significant increase in the body mass of chicks by 13.46% compared to the control, achieving economic efficiency of 0.23 €/head.

Key words*: body mass, microbial preparation, quails, weight gain, viability.*

INTRODUCTION

For healthy growth and development, quails require a constant supply of nutrients and biologically active substances. The traditional source of energy in the quail ration is cereals: wheat, barley, rye, oats (Timoncheva M.S., Bodrova L.F., 2015). Currently, poultry farming is faced with a lack of highly nutritious feed resources. Therefore, in order to reduce production costs and increase the economic efficiency of the branch, poultry farmers opt for cheap local cereals, flour milling waste (bran), non-traditional feeds (Nikolaev et al., 2018; Karapetyan et al., 2019), as well as biologically active substances (Ulrikh et al., 2018; Kazachkova et al., 2024).

Yeasts, especially from the genus *Saccharomyces* (Doolam et al., 2024) and cyanobacteria *Arthrospira* (*Spirulina*) *platensis* (Bortolini et al., 2022; Sinetova et al., 2024) are natural sources of various biologically active substances with potential for practical use.

In the conditions of the Republic of Moldova, which is a wine-growing country, interest presents research on the valorization of *Saccharomyces* wine yeast biomass, which accumulates in considerable quantities in primary wineries, as a source of biologically active substances for use in various fields, especially the zootechnical sector (Chioru et al., 2023). The biologically active preparations obtained from the sediments of wine yeasts are rich in proteins, essential and immunoactive amino acids, carbohydrates, manoproteins, anthocyanins, wide range of minerals, macro, microelements, have antioxidant and enzymatic activity, being attractive for implementation in agriculture, especially in animal husbandry, food and cosmetic industry (Beshliu et al., 2022).

In coastal areas of the seas, marine algae are successfully used as feed additives (Marareni et al., 2023; Oliveira et al., 2023). Among them, microalgae of the genus *Chlorella*, *Scenedesmus* (Lysenko, 2015; Saadaoui et al., 2021) are of particular interest, which have nutritional value, antimicrobial action, influence body mass, viability of birds and reduce specific consumption.

Spirulina biomass used as a feed additive has a significant positive effect on the resistance of the chicken body to the action of unfavorable environmental factors (Kulikova, 2004).

The high content of proteins, minerals and vitamins in *Spirulina* biomass helps to improve growth performance, meat quality, immune function, antioxidant status and intestinal microbiota composition of chickens (Irshad et al., 2024). For example, supplementing broiler diets with *Spirulina* biomass, particularly at 0.5%, can improve productivity and profitability by promoting weight increase, feed utilization, antioxidant status, immunity, and

gastrointestinal health of birds (Abdelfatah et al., 2024).

However, the administration of high concentrations (15%) of *Spirulina* biomass in the diet of broiler chickens for 35 days has the effect of reducing the growth performance of the birds (Spínola et al., 2024).

In this context, based on extracts from *Saccharomyces* wine yeast biomass and *Spirulina* (*Arthrospira*) *platensis* biomass, the complex microbial preparation coded CMP-3 was obtained, which was used for 28 days in the 4% concentration as an additive in the daily feed ration. This preparation manifests a positive effect on the viability, intestinal microbiome and body weight of chickens in clostridial infections (Caraman et al., 2024).

The aim of the current research was to evaluate the effect of CMP-3 preparation on the growth, development, morbidity and mortality rate of quail chicks during the period 1-30 days of life.

MATERIALS AND METHODS

Object of study

As research objects served: 200 quails Phoenix breed, one day old and the complex biologically active microbial preparation CMP-3. Only chicks that hatched on the 1st day were included in the experiment. Chicks that hatched on the 2nd and 3rd day as well as those on the 1st day, but had various limb pathologies, meconium plugs and were passive were maintained separately.

Feed rations

The quails in the control group (CG), during the experiment, consumed combined feed (CF) consisting of corn - 50%, soybean meal - 30%, wheat - 16%, premix - 2%, feed calcium - 2%, and those in the experimental group (EG), consumed CF supplemented with 0.5% of CMP-3 preparation. Feeding was carried out *ad libitum*.

CMP-3, is a natural microbial complex containing biologically active compounds, derived from *Spirulina* (*Arthrospira*) *platensis* biomass and *Saccharomyces* yeast biomass, is the combination of three biologically active extracts, two cyanobacterial: lipid and peptidoglycan extracts and the mannoprotein extract obtained from yeast biomass from sediments from the production of red Merlot wine. CMP-3 is the dark green powder with 97.47±0.12% d.w. and moisture of 2.53±0.12%, containing 80% peptidoglycan extract, 10% mannoprotein extract and 7% lipid extract.

Nutritional and energy value of the feed ration: Metabolizable Energy - 2919 kcal/kg; Gross protein -19.89%; Gross fat - 2.67%; Gross cellulose - 3.3%; Calcium - 0.996%; Phosphorus - 0.393%. Supplementing the ration with 0.5% of CMP-3 preparation did not modify its nutritional value.

Monitored parameters

Weight gain and body mass during the investigations were determined according to specific investigation methods (Egorov et al., 2013). The dynamics of body mass of chicks from both groups was assessed by individual weighing every 10 days. Body weight was determined periodically (every 10 days) by weighing each quail individually, using a precision scale (four decimal places - 0.0000) and calculating the average weight of one head. Weight gain was calculated by comparing the average weights at the different stages of the experiment.

Microbiological indices

The bacteriological study of the feces was carried out according to standard methods (Netrusov, 2005; Carp-Cărare et al., 2014; Licker et al., 2019).

Microbiological tests of the quantitative and qualitative compositions of the intestinal tract were performed in 3 repetitions, according to the provisions of (SM EN ISO 4833-1:2014/A1:2022). Isolation, identification and determination of the amount of *E coli*, *Lactobacillus* spp., *Bifidobacterium* spp., *Bacillus* spp. was performed according to the usual methods set out in (SM EN ISO 7218:2007/A1:2016) and (SM EN ISO 6887-1:2017/A1:2024). The microbial cell amount cultivated on Petri dishes was reported to 1 g of intestinal content and expressed in decimal logarithms (log CFU/g)

For microbiological investigations were used culture media HiMedia (India):

Nutrient Agar M001; HiCrome ECC Agar M1293; HiCrome *E. coli* Agar M1295; Anaerobic Agar M228; HiCrome *Bacillus* Agar Base M1651; HiCrome Kligler Iron Agar M078; HiCrome Endo Agar, Special M029R; *Lactobacillus* MRS Agar M641; HiCrome *Streptococcus* Lactis Differential Agar Base

M925; *Streptococcus* selection Agar M304. Fungal determination was performed using nutrient media: HiCrome *Candida* Differential Agar M1297A, HiCrome Sabouraud Dextrose Agar M063.

Kits for staining smears according to the Gram method and microorganism differentiation kits: Colorant Gram Stains-Kit K001-1KT; HiDip PA - H_2S Medium HD012; HiIMViC Biochemical Test Kit KB001 -10KT; Kovac`s reagent strips; Lead acetate paper strips.

Statistical indices

Statistical processing of the results was performed using the MO Excel and Statistics 9.0 software suite. The results were expressed by calculating the mean, standard deviation and confidence interval for an average of three repetitions. All differences were considered statistically significant for $P \leq 0.01$ and $P \leq 0.001$.

RESULTS AND DISCUSSIONS

The most difficult period of raising quail chicks is represented by the first three days after hatching (Costăchescu, 2019). During this period the problem is related to providing water and avoiding crowding of chicks, especially around the drinking bowl, because chicks that wet their plumage risk to die if no action is taken to dry them.

According to the results of clinical observations made daily, the general state of the chicks in the EG was satisfying, no behavioral deviations or adverse reactions were reported. The chicks were active throughout the experiment. The viability of the chicks in the CG was 91%, and that of those in the EG was 100%. The mortality of the chickens in the CG was recorded in the first two weeks of life and was determined by colibacillosis, manifested by diarrhea and lethargy.

The body temperature of quails is with 2-3°C higher than that of other farm birds, which contributes to the more intense metabolism and makes them less susceptible to bacterial and viral diseases (Arif et al., 2022).

During the experiment, there was no intervention of drug treatment with antibacterial preparations, nor were preparations administered for prophylactic purposes.

Thus, in addition to nutritional efficiency, CMP-3 preparation has beneficial physiological effects, reducing the risk of colibacillosis of quails in the first 30 days.

This effect is probably due to the presence in CMP-3 of peptidoglycan and lipid extracts from *Spirulina*, as these cyanobacteria and various extracts based on them are known to maintain the health of the microbiota, which digests feed and regulates the bird metabolism (Ahmed M. Abd El-Hady et al., 2022).

These results are in accordance with those of other researchers, who established comparable results in broiler chickens fed with native *Spirulina* biomass (Hanafy, 2022) and quails (Fedekar, 2012; Yusuf et al., 2016).

Microbiological investigations of 10-day-old chick feces determined that the use of CMP-3 in the chick feed ration decreases the amount of *E. coli* by 8.64% ($P<0.01$), from 7.41±0.09 to 6.77±0.05 logCFU/g, *Clostridium* spp. by 3.08% ($P<0.01$) and significantly increases the amount of beneficial microorganisms *Lactobacillus* spp. by 9.07% ($P<0.01$), from 7.17±0.08 to 7.82±0.07 logCFU/g, *Bifidobacterium* spp. by 5.83% ($P<0.01$) and *Bacillus* spp. by 3.86% in the feces of chicks from EG compared to those from CG (Table 1).

Table 1. Titer of microorganisms from different genus in the quail feces, logCFU/g, age of 10 days

Microorganisms	CG	EG
E. coli	7.41±0.09	6.77±0.05**
Enterococcus spp.	7.49±0.01	8.43±0.15**
Clostridium spp.	8.76±0.04	8.49±0.01**
Lactobacillus spp.	7.17±0.08	7.82±0.07**
Bifidobacterium spp.	8.40±0.06	8.89±0.05**
Bacillus spp.	8.28±0.20	8.60±0.02
TNF (total number of fungi)	7.23±0.08	7.32±0.05

Note: **- $P \leq 0.01$

For the appropriate growth and development of quails, several authors recommend respecting microclimate conditions, in particular, the temperature regime, ventilation and airing (Malorodov et al., 2022).

Microclimate and hygienic conditions were ensured according to the norms provided for this age category. Thus, during the period of 1-14 days, the quail chicks were maintained at the temperature of 37ºC (under an incandescent infrared lamp) and the 24-hour light regime. In the third week, the chicks were switched to the temperature regime of 18ºC and the 22-hour light regime, and in the fourth week the light

regime was 20 hours. The air humidity in the room oscillated within the range of 62-63%.

The body mass of one-day-old quails was on average of 9.7±0.09 g in CG and 9.71±0.12 g in EG. The significant variations (P<0.001) in the weight gain were observed to quails at 10, 20 and 30 days of life (Table 2). The gross weight gain of quails in the CG, during the period of 1-10, 10-20, 20-30 days, was 12.98, 63.67 and 156.07 g, respectively, and that of those in the EG was 20.99, 91.51 and 152.84 g. Although the growth intensity of chicks at the age of 20-30 days is practically the same in both groups, the body mass of chicks in the EG exceeded the mass of chicks in the CG by 13.46% (Table 2).

Table 2. Body mass of quails according to age

Age, days	CG (n=30), g	EG (n=30), g
1	9.7±0.09	9.71±0.12
10	22.68±0.79	30.70±0.59 ***
20	86.35±1.73	122.21±1.59 ***
30	242.42±1.99	275.05±3.34 ***

Note: ***- P≤0.001.

The average weight gain of chicks in the EG was 8.83 g/day, and that of those in the CG was 7.75 g/day, being 13.93% lower (Table 3).

Therefore, supplementing the quail feed ration by 0.5% of CMP-3 significantly increases the body weight of chicks in the EG compared to the CG. This result reflects the efficiency of using CMP-3 preparation as a feed additive for the growth and development of young quails. Similar results of increasing the viability rate and body weight of quails were obtained to the using of *Spirulina* biomass as a supplement in the poultry feed ration (Cheong et al., 2016).

Table 3. Growth indicators of the quail chicks

Group	Body weight at 30 days of age		Daily gain	Spec. cons.	Viability
	g	%	g	kg	%
CG	242.42 ±1.99	100	7.75	1.15	91
EG	275.05 ±3.34***	113.46	8.83	1.07	100

Note: ***- P≤0.001.

Over 30 days, the quail chicks in CG consumed 266.7 g/head of feed, and those in EG by 6.82% more (Table 4).

Feed consumption is influenced by its chemical composition, ambient temperature, form of feed presentation (granules, etc.) and physiological state of the animals (Verdelhan, 2006).

Table 4. Feed consumption, g/head/week

Age, days	CG	EG
1-7	25.90	28.7
8-14	47.60	51.80
15-21	93.10	98.7
22-30	100.10	105.7
Total 1-30	266.7	284.9

In our experiment feed consumption was influenced only by the nutritional value of the feed, the other factors being identical for both groups of quails. Specific feed consumption was lower in EG of 1.07 kg compared to CG of 1.15 kg or with 7.5% lower (Table 3). This proves that the biologically active substances in CMP-3 preparation ensure more efficient assimilation of nutrients from feed in the quail organism, which is reflected in the lower specific feed consumption. The economic efficiency of using CMP-3 in the daily ration of young quails was 0.23 €/head.

The beneficial action of CMP-3 preparation on the productive parameters and gastrointestinal microbiome of quail chicks is due to the presence in its composition of cyanobacterial lipid and peptidoglycan extracts, which represent a natural source, rich in compounds with biological activity (Abdel-Wareth & Lohakare, 2023; Maddiboyina et al., 2023), among which are proteins, fatty acids, vitamins, antioxidants, minerals (Boutin et al., 2019; Su et al., 2023). At the same time, the mannoprotein extract from wine yeast, which is the component of CMP-3 preparation, possesses significant antioxidant activity, catalase and superoxide dismutase enzymes and nutritional value, which is evidenced by the content of essential and immunoactive amino acids, the presence of macro-, microelements and anthocyanins (Besliu et al., 2022).

CONCLUSIONS

In conclusion, we can mention that CMP-3 perparation is a harmless one for quails, which significantly influences the microbiota of the gastrointestinal tract of birds, ensures 100% viability of chicks, allows the statistically significant increase (P<0.001) by 13.46% of the

body mass of chicks and decrease with 7.5% in specific feed consumption.

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