

# INFLUENCE OF THE PREBIOTIC SALGARD AND A HERB MIXTURE ON PEKIN DUCKLINGS IN ORGANIC POULTRY PRODUCTION

## I. GROWTH PERFORMANCE AND BLOOD BIOCHEMICAL PARAMETERS

V. Gerzilov<sup>1</sup>, N. Bozakova<sup>2</sup>, A. Bochukov<sup>1</sup>, G. Penchev<sup>3</sup>, M. Lyutskanov<sup>4</sup>, S. Popova-Ralcheva<sup>3</sup>, V. Sredkova<sup>3</sup>

<sup>1</sup>Department of Animal Science, Agricultural University, 4000, Plovdiv, Bulgaria

<sup>2</sup>Department of Animal Husbandry, Trakia University, 6000, Stara Zagora, Bulgaria

<sup>3</sup>Department of Veterinary Anatomy, Histology and Embriology, Trakia University, 6000, Stara Zagora, Bulgaria

<sup>4</sup>Department of Veterinary Microbiology, Infectious and Parasitic Diseases, Trakia University, 6000, Stara Zagora, Bulgaria

<sup>5</sup>Institute for Information Serving of the System, Agricultural Academy, Sofia, Bulgaria

Corresponding author: [v\\_gerzilov@abv.bg](mailto:v_gerzilov@abv.bg)

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**Abstract:** The purpose of this study was to follow out the influence of the prebiotic Salgard and of an herb mixture (rosemary, thyme, basil, oregano and cinnamon) on the growth performance and blood biochemical parameters of Pekin ducklings in an organic production system. In this study, 72 one-day-old Pekin ducklings reared up to the age of 63 days were used. They were divided into 3 groups of 24 birds each and sexed (12 ♂ and 12 ♀) as followed: group I (control) fed a standard feed; group II – fed the same feed supplemented with the prebiotic Salgard at a concentration of 0.15 %, and group III – fed the same feed supplemented with 0.15 % of a herb mixture in an equal proportion (0.03% of each herb – rosemary, thyme, basil, oregano and cinnamon) from the first day of age to the end of the experiment. The individual live weight of the birds and the feed conversion ratio were controlled throughout the experiment at 1, 28 and 63 days of age. By the end of the study, blood serum ASAT, ALAT, GGT, triglycerides (TG), total and HDL cholesterol, and creatinine were assayed. The addition of Salgard to the feed of Pekin ducklings increased live weight with 4.94 % in males and with 4.67 % in females. The addition of the herbal mixture of rosemary, thyme, basil, oregano, cinnamon to the feed had a positive effect on the live weight. It is increased with 3.75 % in males and insignificantly in females. A significant reduction in the blood serum concentrations of triglycerides ( $P < 0.01$ ) and total cholesterol ( $P < 0.01$ ) was established, which could be related with the anti stress effect of the herbal mixture on Pekin ducklings.

**Key words:** duck, prebiotic Salgard, herb mixture, growth performance, serum biochemical parameters

## Introduction

During the last decade, the production of high-quality healthy food from healthy animals, bred without the usage of nutritive antibiotics and anabolic stimulants has steadily become more significant (Eilers, 2006; Wald, 2004; Levic, et al., 2008).

As an alternative to antibiotics ban in the European Union (Regulation 1831/2003/EC), contemporary agriculture uses mostly probiotics, prebiotics, organic acid mixtures, herbs, spices, essential oils and plant extracts that, added to the feed and water, produce a stimulating effect on the productivity, health and welfare of poultry. This is possible due to the inhibiting effect of these natural substances on microbial pathogens in the alimentary tract and their positive effect on the digestion and the growth (Rodenburg et al., 2004, 2005; Wald, 2004; Kijlstra and Eijck, 2006; Levic, et al., 2008; Abd El-Hakim et al., 2009; Van de Weerd et al., 2009; Crandall, et al., 2009).

There are little data about the effects of prebiotics and herbs on health, welfare and growth of Pekin ducklings in organic production systems, thus motivating the current study.

The aim of the current research was to study the influence of the prebiotic Salgard and the herb mixture - rosemary, thyme, basil, oregano and cinnamon on the growth performance traits and blood biochemical parameters.

## Material and Methods

**Experimental birds and diet.** The study was carried out at the poultry farm of Department of Animal Science at the Agricultural University – Plovdiv, in the period from August to October 2008. Three groups of 24 one-day-old ducklings each were formed, sexed and marked by gender (12 ♂ and 12 ♀). Throughout the experiment, all birds were fed *ad libitum* with diet prepared at the poultry farm. The combined feed of the ducklings from the first group (control) contained the ingredients described in Table 1. The second group's feed was supplemented with the prebiotic Salgard at a concentration of 0.15 %, while the ducklings from the third group received 0.15 % of the combination: rosemary (*Rosmarinus officinalis*), thyme (*Thymus serpyllum*), basil (*Ocimum basilicum*), oregano (*Origanum vulgare* L.), cinnamon (*Cinnamomum verum*) in an equal proportion (0.03% of each herb) from the 1<sup>st</sup> day of age to the end of the experiment.

The ducklings in the three groups were reared in the same conditions in a closed premise with free access to small yards for walks. Each duckling was provided with 0.205 m<sup>2</sup> of the total covered area (4.8 birds / m<sup>2</sup>) and 9.2 m<sup>2</sup> of the yard. By 14 days of age, the ducklings in the three groups were provided with local brooders. The birds had free access to water for drinking and bathing.

**Table 1. Composition of diets (%) of Pekin ducklings (as-fed basis)**

Ingredients	Starter from 1 to 28 days of age	Finisher from 29 to 63 days of age
Ground yellow maize	48.53	54.90
Ground wheat	25	25
Soybean meal (44% CP)	19	15
Fish meal (72% CP)	4	2
L – lysine(99% purity)	0.06	-
DL – methionine (99% purity)	0.11	0.1
Sodium chloride	0.3	0.3
Limestone	1.5	1.4
Dicalcium phosphate	1.5	1.3
<i>Calculated analysis</i>		
Metabolisable energy, (MJ/kg)	12.4	12.7
Crude protein, %	18.6	16
Crude fibre, %	2.9	2.7
Crude fat, %	3.1	3.1
Linoleic acid, %	1.3	1.4
Calcium, %	1	0.85
Total phosphorous, %	0.69	0.61
Metabolisable phosphorous, %	0.44	0.37
Lysine	1	0.75
Methionine +cystine	0.75	0.66
Tryptophane	0.21	0.17
Treonine	0.68	0.57
Arginine	1.12	0.94
Histidine	0.46	0.4
Phenylalanine + tyrosine	1.43	1.27
Leucine	1.6	1.42
Isoleucine	0.8	0.67
Valine	0.9	0.76
Glycine+serine	1.7	1.43

**Growth performance and slaughter evaluation.** The individual live weight of the ducklings (with  $\pm 0.01$  g accuracy), as well as the consumption of feed (with  $\pm 5$  g accuracy) were controlled throughout the experiment at 1, 28 and 63 days of age.

At the end of the experiment, slaughter evaluation of the birds was performed with three male ducklings at average gender weight from each group.

The weighing was performed on an electronic scale OHAUS 2000 with  $\pm 0.01$  g accuracy.

**Blood biochemical examination.** Blood for analysis (5 ml) was sampled from v. subcutanea ulnaris of six ducks from each group on the 63<sup>rd</sup> day. The blood was allowed to clot for one hour at room temperature (25°C) and the samples were centrifuged at 2000 g for 10 min.

Blood serum ASAT, ALAT, GGT, triglycerides (TG), total and HDL cholesterol, and creatinine were determined with an automated biochemical analyzer “Cobas mira” at an accredited biochemical lab in the Diagnostic and Consultation Medical Centre “St. George”- Plovdiv.

**Statistical analyses.** Results were expressed as a mean and standard error. Data were subjected to one-way analysis of variance (ANOVA) using GraphPad InStat 3.06 software to determine the level of significance among mean values.

## Results and Discussion

Growth development indicated that at the age of 28 days Pekin ducklings from group I (control) and group II (Salgard addition) attained nearly the same live weight for both sexes (Table 2). In the third group (supplemented with the herb mixture), a lower live weight was observed, compared to group I and II ( $P < 0.001$ ). It is believed that the cause of this was the more difficult adaptation of birds to the feed containing herbs (rosemary, thyme, basil, oregano and cinnamon), which had a strong scent and unusual taste. According to some authors (*Loo and Richard, 1992; Frankič et al., 2009*) most herbs give feed specific odours and tastes. *Jugl-Chizzola et al. (2006)* noticed that weaned pigs consumed significantly less feed if it was supplemented with either thyme or oregano. If pigs in this experiment had the possibility to choose among feed with or without these spices, they would choose the non-supplemented feed.

**Table 2. Body weight gain (BW) of Pekin ducklings**

Age	Sex	Group I	Group II	Group III
1 day	♂	52.33±1.15	52.00±1.00	52.08±1.06
	♀	53.17±1.35	53.42±1.15	53.42±1.08
28 days	♂	971±27 a <sub>1</sub>	987±32 a <sub>2</sub>	836±16 a <sub>1</sub> , a <sub>2</sub>
	♀	991±27 a <sub>1</sub>	963±27 a <sub>2</sub>	832±26 a <sub>1</sub> , a <sub>2</sub>
63 days	♂	2105±42	2209±78	2120±53
	♀	2076±39	2173±54	2154±44

Note:  $P < 0.001$  at a<sub>1</sub>- a<sub>1</sub>, a<sub>2</sub>- a<sub>2</sub> in the same rank

Therefore, animals most probably needed more time to get accustomed to the taste of their feed, which was observed in the initial period with the ducklings who received the herb-supplemented feed.

In the period between 29 and 63 days of age a tendency for higher growth was observed in birds of both sexes that received the prebiotic Salgard (group II) and the herbal mixture (group III), compared to controls (group I). The intensity of live body weight gain was stronger in the ducklings from the 3<sup>rd</sup> group, which compensated for their delayed growth in the preceding period. At the experiment's end, the ducklings that took Salgard (group II) had the highest live weight, followed by those that received the herbal mix with their combined feed (group III), and the control group at the lower end.

We assume that the higher live mass of the ducklings that received Salgard with their combined feed, compared to control ducklings (4.94 % higher weight gain in males and 4.67 % in females) was due to its positive effect on digestion. The released organic acids, included in Salgard, have a strong antibacterial and antifungal effect.

Pekin ducklings from the 3<sup>rd</sup> group compensated for their delayed growth after the 28<sup>th</sup> day. This was probably related to accommodation to the unusual smell and taste of the herb-containing feed, as well as to the positive complex effect on the digestion in the poultry. On one hand, the positive effect is due to the oregano essential oil, which improves digestion, resorption and nutrient utilization (*Jamroz et al., 2003, 2006; Lee et al., 2003; Bampidis et al., 2005; Mikulski et al., 2008*).

Regarding the carcass characteristics, no significant differences between the different groups could be found. In groups I, II and III the grill was  $65.74 \pm 0.18$  %,  $65.47 \pm 0.63$  % and  $65.13 \pm 2.13$  %, respectively, and the **bratfertig** –  $71.75 \pm 0.14$  %,  $69.91 \pm 2.61$  %, and  $71.61 \pm 1.19$  % (Figure 1).

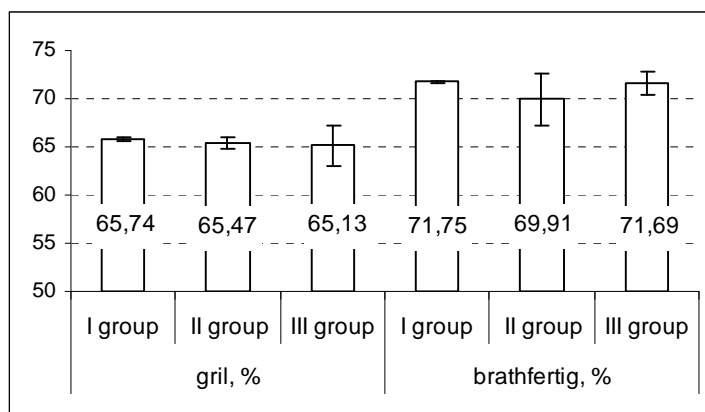


Figure1. Slaughter characteristic of 63-day-old ducklings

The positive effects of the used herbal mixture on the live weight of the ducklings could be explained with its antimicrobial, antifungal and antioxidant properties (Faleiro et al., 2005; Hazzit et al., 2006).

According to us, the better feed conversion per unit weight gain in group III, compared to the other two, for the period between 29<sup>th</sup> and 63<sup>rd</sup> days of age could result from the improved activity of digestive enzymes, the stimulation of the beneficial and suppression of the pathogenic microflora in the alimentary tracts. As a result, the absorption and utilization of nutrients is reported to be improved (Pasqua et al., 2006; Castillo et al., 2006; Windisch et al., 2008; Frankič et al. 2009).

For the entire period, the best combined feed conversion ratio was observed in ducklings from the group II vs. group I – by 9.03% and vs. group III – by 8.18% (Table 3). In our opinion, this was due to the positive effect of the prebiotic on the normal digestive microflora of birds and the microbicide effect. This is a reason for better utilization of feed, and an improvement in the poultry health, growth, and welfare.

**Table 3. Feed intake (FI) and feed conversion ratio efficiency (FCE)**

Age	Group I	Group II	Group III
Feed intake (FI) - g/bird			
1-28 day of age	2276	2165	2130
29-63 day of age	4808	4782	4913
1-63 day of age	7084	6947	7043
Feed conversion ratio efficiency (FCE) - FI/ 1 kg BW gain			
1-28 day of age	2452	2250	2868
29-63 day of age	4337	3933	3783
1-63 day of age	3478	3190	3451

Regarding the examined blood biochemical indicators, many authors have found that the increase of total serum cholesterol and triglyceride concentrations are reliable indicators of stress in birds (Puvadolpirod and Thaxton, 2000a,b c; Popova–Ralcheva et al., 2002a,b).

**Table 4. Blood serum biochemical parameters in 63-day-old Pekin ducklings (n=6)**

Biochemical parameters	Group		
	I	II	III
ASAT, U/L	85.5 ± 9.51	97.33 ± 6.25	86.83 ± 6.20
ALAT, U/L	29.33 ± 0.76	37.67 ± 4.59	33.33 ± 2.20
GGT, U/L	15.35 ± 1.45	16.68 ± 2.75	11.63 ± 2.26
TG, mmol/L	6.90 ± 0.41 b <sub>1</sub>	6.39 ± 0.84	4.05 ± 0.28 b <sub>1</sub>
Total cholesterol, mmol/L	5.25 ± 0.40 b <sub>2</sub>	4.71 ± 0.14	3.92 ± 0.20 b <sub>2</sub>
HDL cholesterol, mmol/L	1.93 ± 0.23	1.81 ± 0.15	2.11 ± 0.10
Creatinine, µmol/L	13.67 ± 1.65	12.00 ± 1.59	15.00 ± 0.73

Note: P<0.01 at b<sub>1</sub>- b<sub>1</sub> in the same rank

The significantly lower serum concentrations of triglycerides (P<0.01) and total cholesterol (P<0.01) in ducklings who received the herbal mix could be related to the complex antistress, antioxidant and antimicrobial effect of rosemary, thyme and oregano, included in the feed supplement (*Faleiro et al., 2005; Hazzit et al., 2006; Windisch et al., 2008*) – Table 4. The antioxidant properties of these herbs are due to the effect of their phenols, flavonoids and hydrolyzed tannins, involved in neutralizing free radicals or activating antioxidant enzymes – superoxide dismutase, catalase, glutathione peroxidase and glutathione reductase (*Halliwell et al., 1995; Craig, 2001; Ćetković et al., 2004; Škerget et al., 2005; Bakirel et al., 2008; Fasseas et al., 2008; Frankič et al., 2009*).

## Conclusion

1. The addition of Salgard or the herbal mixture (rosemary, thyme, basil, oregano, cinnamon) in a concentration of 0.15 % respectively to the diet of Pekin ducklings contributed to an increase in the live weight and the conversion of feed.

2. The addition of herbal mixture (rosemary, thyme, basil, oregano, cinnamon) decrease the blood serum concentrations of triglycerides (P<0.01) and total cholesterol (P<0.01), which could be related with their anti stress effect.

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# Uticaj prebiotika Salgard i biljne smeše u ishrani pekinških pačica u organskoj žvinaarskoj proizvodnji

## I. Proizvodni rezultati i biohemijski parametri krvi

*V. Gerzilov, N. Bozakova, A. Bochukov, G. Penchev, M. Lyutskanov, S. Popova-Ralcheva, V. Sredkova*

### Rezime

Cilj ovog ispitivanja je bilo praćenje uticaja prebiotika Salgarda i biljne smeše (ruzmarin, majčina dušica, bosiljak, origano i cimet) na porast i biohemijske parametre krvi pekinških pačica u organskom proizvodnom sistemu.

U ovom istraživanju, 72 jednodnevna pačeta su odgajana do uzrasta od 63 dana. Podeljeni su u 3 grupe od po 24 ptice u svakoj (12 ♂ i 12 ♀) na sledeći način: grupa I (kontrola) hranjena standardnom hranom; grupa II – hranjena istom hranom uz dodatak prebiotika Salgard u koncentraciji od 0.15%, i grupa III – hranjena istom hranom uz dodatak 0.15% biljne smeše u jednakim proporcijama (0.03% svake biljke - ruzmarin, majčina dušica, bosiljak, origano i cimet) od prvog dana do kraja eksperimenta.

Kontrolisani su telesna masa ptica i konverzija hrane tokom čitavog eksperimenta i to 1., 28. i 63. dana uzrasta. Na kraju ispitivanja, krvni serum ASAT, ALAT, GGT, trigliceridi (TG), ukupni i HDL holesterol, i kreatinin su analizirani.

Dodavanje Salgarda u hranu za pekinške pačice je uticalo na povećanje telesne mase za 4.94 % kod muških i za 4.67 % kod ženskih pačica.

Dodavanje biljne smeše koja se sastojala od ruzmarina, majčine dušice, bosiljka, origana i cimeta u hranu je imalo pozitivan uticaj na telesnu masu, koja se povećala za 3.75% kod muških grla, a kod ženskih povećanje nije bilo signifikantno. Značajno smanjenje u koncentracijama triglicerida ( $P < 0.01$ ) i ukupnog holesterola ( $P < 0.01$ ) u krvnom serumu je utvrđeno, što može biti dovedeno u vezu sa anti stres efektom biljne smeše na pekinške pačice.

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