

ISBN 978-86-82431-73-2



11th
INTERNATIONAL
SYMPOSIUM

MODERN
TRENDS
IN LIVESTOCK
PRODUCTION

P R O C E E D I N G S

11th - 13th October 2017 - Belgrade, Serbia

ISBN 978-86-82431-73-2



INSTITUTE FOR ANIMAL HUSBANDRY
BELGRADE - SERBIA

11th
INTERNATIONAL
SYMPOSIUM

MODERN
TRENDS
IN LIVESTOCK
PRODUCTION

P R O C E E D I N G S

11th - 13th October 2017 - Belgrade, Serbia

EDITORIAL COUNCIL

Prof. Dr. Martin Wähler, Faculty of Applied Sciences,
Bernburg, Germany
Dr. Milan P. Petrović, Institute for Animal Husbandry,
Belgrade-Zemun, Serbia
Dr. Zorica Tomić, Institute for Animal Husbandry,
Belgrade-Zemun, Serbia
Prof. Dr. Milica Petrović, Faculty of Agriculture,
University of Belgrade, Serbia
Prof. Dr. Lidija Perić, Faculty of Agriculture,
University of Novi Sad, Serbia
Dr Maya Ignatova, Institute of Animal Science,
Kostinbrod, Bulgaria
Prof. Dr. Kazutaka Umetsu, Obihiro University of
Agriculture and Veterinary Medicine, Obihiro, Japan
Prof. Dr. Dragan Glamočić, Faculty of Agriculture,
University of Novi Sad, Serbia
Prof. Dr. Vigilijus Jukna, Institute of Energy and
Biotechnology Engineering, Aleksandras Stulginskis
University, Kaunas, Lithuania
Dr. Elena Kistanova, Institute of Biology and
Immunology of Reproduction „Kiril Bratanov“, Sofia,
Bulgaria
Prof. Dr. Pero Mijić, Faculty of Agriculture, University
of Osijek, Croatia

Prof. Dr. Marjeta Čandek-Potokar, Agricultural Institute
of Slovenia, Ljubljana, Slovenia
Prof. Dr. Peter Dovč, Department of Animal Science,
Biotechnical Faculty, University of Ljubljana, Slovenia
Dr. Marjeta Čandek-Potokar, Agricultural Institute of
Slovenia, Ljubljana, Slovenia
Prof. Dr. Wladyslaw Migdal, University of Agriculture,
Krakow, Poland
Dr Ivan Bahelka, National Agricultural and Food
Centre – Research Institute for Animal Production,
Lužianky, Slovakia
Prof. Dr. Colin Whitehead, Roslin Institute, University
of Edinburgh, United Kingdom
Prof. Dr. Sandra Edwards, School of Agriculture, Food
and Rural Development, University of Newcastle,
United Kingdom
Prof. Dr. Giacomo Biagi, Faculty of Veterinary
Medicine, University of Bologna, Italy
Prof. Dr. Stelios Deligeorgis, Aristotle University,
Thessaloniki, Greece
Prof. Dr. Hasan Ulker, Turkey
Dr. Catalin Dragomir, National Research and
Development Institute for Animal Biology and
Nutrition (IBNA Balotesti), Balotesti, Ilfov, Romania

Publisher

Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Editor-in-Chief

Milan M. Petrović, PhD, Principal Research Fellow
Director of the Institute for Animal Husbandry, Belgrade-Zemun

EDITORIAL BOARD

Editor

Zdenka Škrbić, PhD, Senior Research Associate
Institute for Animal Husbandry, Belgrade-Zemun

Section Editors

Animal Science

Vlada Pantelić, PhD, Senior Research Associate
Miloš Lukić, PhD, Senior Research Associate
Dragana Ružić-Muslić, PhD, Senior Research Associate
Dušica Ostojić-Andrić, PhD, Research Associate
Čedomir Radović, PhD, Research Associate

Feed Science

Zorica Bijelić, PhD, Senior Research Associate
Violeta Mandić, PhD, Research Associate

Technology and Quality of Animal Products

Prof. Dr. Marjeta Čandek-Potokar, Agricultural Institute of Slovenia, Ljubljana, Slovenia
Nikola Stanišić, PhD, Research Associate

Food safety and Veterinary Medicine Science

Aleksandar Stanojković, PhD, Research Associate

Language editor

Olga Devečerski

THE EFFECT OF GARLIC ON PRODUCTION INDICATORS AND THE SHARE OF INTERNAL ORGANS IN BROILER CHICKENS

Veselin Petričević¹, Miloš Lukić¹, Zdenka Škrbić¹, Maja Petričević¹, Snežana Bogosavljević-Bošković², Vladimir Dosković², Simeon Rakonjac²

¹Institute for Animal Husbandry, Autoput 16, 11080, Belgrade-Zemun, Republic of Serbia

²Faculty of Agronomy, University of Kragujevac, Čačak, Republic of Serbia

Corresponding author: veselin5@live.com

Original scientific paper

Abstract: The aim of this study was to examine the effect of the addition of different concentrations of garlic in nutrition of broiler chickens on the fattening results and the share of internal edible organs. The trial was performed on 800 chickens divided into 4 groups with 4 repetitions per group. The chickens were fed ad libitum and the composition of the mixture only differed in the quantity of added garlic powder. In the control group (K) no garlic was added. Chickens of group (I) consumed mixtures with the addition of 0.2% garlic powder, in group (II) 0.4% was added, while 0.6% of garlic was added to the mixture consumed by chickens in the group (III). At the beginning (day 1) and at the end of the experimental period (day 42) weight of chickens was measured. Average daily gain, mortality, food conversion ratio and EPEF were determined. At the end of the trial, by random sample method, 12 chickens (6 male and 6 female) were sacrificed in each group in order to determine the share of edible internal organs. The obtained results have shown that the use of garlic in mixtures influences higher body weight and average daily gain as well as more favourable mortality. The food conversion ratio was statistically significantly better ($p < 0.01$) in chickens of II and III group compared to the control group. Statistically significantly lower ($p < 0.01$) value of EPEF was established in the control group compared to II and III group. Heart, liver and stomach shares were not significantly affected by the tested factor.

Key words: broiler chickens, nutrition, garlic, production indicators

Introduction

Consumer demands for high quality poultry products can be ensured by the use of new and appropriate health safe food systems. In the modern production of

chicken meat, the goal is to reduce the use of antibiotics in food because of the more frequent occurrence of resistant strains of bacteria. An alternative to antibiotics is the use of probiotics (*Perić et al., 2010*), and various parts of plants such as garlic (*Puvača et al., 2013*), mint (*Al-Kassie, 2010*), rosemary (*Al-Kassie et al., 2011*) and many others. By using herbal additives in the nutrition of the poultry, the development of the digestive tract and immunity is stimulated in a natural way, while reducing the use of drugs. A group of phyto-genic additives consists of substances originating from medicinal and spice plants. Phyto-genic additives influence the improvement of food consumption and conversion and the gain of broiler chickens (*Stanachev et al., 2011*). Considering the results obtained so far, it is considered that phyto-additives have significant potential in nutrition, but it is necessary to choose the right combination and dose. Some researchers say that the addition of phyto-genic additives to feed mixtures for chickens does not have a significant effect on food intake, consumption, and conversion (*Issa and Omar, 2012*).

Useful effects of garlic have been known since ancient times due to antioxidant and antimicrobial properties (*Konjufka et al. 1997*). Positive effects on the animal body can be attributed to bioactive components. Garlic contains organosulfuric compounds (diallyl sulfide and diallyl trisulfide) (*Kumar and Berwal, 1998*). Allicin is a potentially active component of garlic that provides a distinctive smell and aroma (*Rahmatnejad and Roshanfeker, 2009*). Garlic is known as a remedy for the prevention and treatment of various heart diseases, as well as metabolic and diabetic diseases.

The aim of this research was to study the effect of the garlic supplement in the nutrition of broiler chickens on the fattening results and the share of edible internal organs.

Materials and methods

The experiment for this research was carried out during the month of April and May 2016, at the Institute of Animal Husbandry. As the experimental material, 800 daily broiler chickens of Ross 308 were selected. Chickens were divided into 4 groups and were placed in 16 boxes, so there were 4 repetitions per treatment, and the impact of possible differences in the environment was minimized. During the research broilers were fed with three mixtures, the composition of which is given in Table 1. The diet was ad libitum, the composition of the mixture only differed in the amount of added white garlic powder. In the control group (K) no garlic was added. Chickens of group (I) consumed mixtures with added 0.2% garlic powder, in group (II) 0.4% was added, while 0.6% of garlic was added in group (III).

Body weight of chicken was measured at the beginning (day 1), and at the end of the experiment (day 42). On the basis of differences in weight of chickens,

average daily gain was calculated. Food consumption control included measuring the amounts of complete mixtures given to broiler chickens as well as the food remains for each box. Based on data on food consumption and chicken gain, food conversion ratio was calculated. Based on data on body weight, food conversion ratio and mortality, the European Production Efficiency Factor (EPEF) was calculated according to the formula:

$$\text{EPEF} = \frac{\text{Body weight (kg)} \times \text{Vitality (\%)} \times 100}{\text{Duration of fattening (days)} \times \text{Feed conversion (kg/kg)}}$$

At the end of the trial, by method of total random selection, 6 male and 6 female chickens were selected, measured and slaughtered after 12 hours of starvation. After slaughter, measurements of the weight of the heart, liver and stomach were performed. The obtained masses were placed in relation to the pre-slaughter weight of the chickens. In this way, the shares of these internal organs were obtained.

Table 1. The raw material and chemical composition of the broiler diet during trial

Components, %	Starter	Grower	Finisher
	(0-10 days)	(11-24 days)	(25-42 days)
Maize	50.0	53.0	56.0
Wheat bran	3.0	3.0	4.0
Soybean cake	25.0	20.0	14.0
Soybean grit	12.0	17.0	20.0
EKOFISH*	6.0	3.0	-
Soybean oil	-	-	2.0
Calcium carbonate	1.4	1.4	1.3
Mono calcium phosphate	1.2	1.2	1.1
Sodium chloride	0.2	0.2	0.3
MINAZEL PLUS**	0.2	0.2	0.3
Premix	1.0	1.0	1.0
Σ	100	100	100
Chemical composition			
ME. MJ/kg	12.7	13.0	13.4
Crude protein, %	23.3	21.0	18.7
Moisture, %	11.2	11.3	11.8
Crude fat, %	7.5	7.8	9.5
Crude fibre, %	4.0	4.3	4.3
Calcium, %	0.9	0.85	0.8
Total phosphorus, %	0.7	0.7	0.6
Sodium, %	0.2	0.2	0.2

Statistical processing of the obtained data was performed using the software package "STATISTICA". Variance analysis and F-test were used to determine the presence of statistically significant differences. The Tuckey test served to determine the statistical significance of the differences between individual mean values.

Results and discussion

Table 2 shows the production traits of chickens. Chickens fed mixtures with added garlic powder had higher body weight compared to chickens of the control group, but the established differences were not statistically significant. The highest mortality was found in the control group (3.5%), while the percentage of mortality in the groups that consumed garlic was lower. The average daily gain of chickens does not significantly differ under the influence of the garlic supplement. The lowest average gain was recorded in chickens of the control group and the highest in III group of chickens. The food conversion ratio differed statistically significantly ($p < 0.01$) under the influence of the garlic supplement. With the reduction in the share of garlic in mixtures, food conversion was worse. Chickens of II and III groups (1.80 and 1.79 kg) had statistically significantly better food conversion ratio compared to chickens of the control group (1.93 kg). Better feed conversion ratio of chickens fed mixture containing garlic can be attributed to antimicrobial activities, which influence the better utilization of nutrients in the digestive tract of chickens. EPEF, as the most comprehensive production indicator, was under statistically significant impact ($p < 0.01$) of the examined factor. With the increase in the proportion of garlic in the mixtures, the EPEF gradually increased. Statistically significantly lower EPEF was found in the control group (238.82) compared to groups II and III (271.76 and 275.82).

Table 2. Production traits

Production parameters	Groups				p-value
	K	I	II	III	
Body weight, g	2005.8±403.9	2035.9±355.4	2079.1±324.6	2080.3±344.8	0.113
Mortality, %	3.50	0.50	1.00	0.50	
Average gain, g	46.82±9.16	47.54±8.26	48.57±7.93	48.59±7.21	0.132
Feed conversion, kg	1.93 ^a ±0.03	1.85 ^{ab} ±0.03	1.80 ^b ±0.02	1.79 ^b ±0.03	$p < 0.01$
EPEF	238.82 ^b ±14.28	261.25 ^{ab} ±9.07	271.76 ^a ±8.48	275.82 ^a ±5.23	$p < 0.01$

* a-b The average values in each column without common marks are significantly different at the level of 1%

Results of the share of internal organs of broiler chickens are shown in Table 3. The shares of heart, liver and stomach were not statistically significantly affected by the examined factor.

Table 3. The shares of internal organs

Shares, %	Groups				p-value
	K	I	II	III	
Heart	0.52±0.07	0.51±0.09	0.53±0.07	0.53±0.04	0.811
Liver	1.75±0.21	1.75±0.36	1.75±0.25	1.66±0.22	0.159
Stomach	1.97±0.24	1.86±0.14	1.95±0.19	1.99±0.22	0.349

The share of hearts ranged from 0.51% in the I group to 0.53% in the II and III groups. The smallest share of liver (1.66%) was found in group III, while in other groups the same value for this trait was determined (1.75%). The highest share of stomachs was in chickens of the group III (1.99%) and the lowest in chickens of the group I (1.86%).

Similar to our results, *Fayed et al. (2011)* state better production results (final weight, mortality and food conversion) of chickens fed garlic, however, the authors have not established differences in the weight of edible offal (heart, liver, and stomach). Investigations of *Puvača et al. (2015)* show that the addition of garlic in the amount of 0.5 kg/t and 1 kg/t has positive effects on the production characteristics of broiler chickens. *Fadlalla et al. (2010)* show that the addition of garlic in the diet of fattening chickens significantly improves the conversion of food. Unlike them *Ashayerizadeh et al. (2009)* has found no significant differences in food conversion. *Milošević et al. (2013)* have found significantly higher liver and heart shares in broiler chickens fed with mixtures in which the share of garlic was 1.5 and 3%. *Petričević et al. (2013)*, similar to the results obtained in this study, have not revealed significant differences in the share of edible chicken offal fed with mixtures with a different share of raw soybean grain.

Conclusions

Based on the results of the study of the effect of the addition of garlic powder on the production results and the share of the edible internal organs of broiler chickens, we can conclude that:

- The use of garlic in mixtures affects both body weight and average daily gain, as well as more favourable mortality. Statistically significantly better ($p < 0.01$) food conversion and a significantly higher EPEF values were

found in groups consuming mixtures with an addition of 0.4 and 0.6% of garlic compared to the control group.

- The negative effects of using garlic on the share of edible ingredients have not been determined.
- On the basis of the established production characteristics, positive effects of the use of garlic can be concluded.

Efekat upotrebe belog luka na proizvodne pokazatelje i udeo unutrašnjih organa brojlerskih pilića

Veselin Petričević, Miloš Lukić, Zdenka Škrbić, Maja Petričević, Snežana Bogosavljević-Bošković, Vladimir Dusković, Simeon Rakonjac

Rezime

Cilj ovih istraživanja bio je da se ispita uticaj dodatka različite koncentracije belog luka u ishrani brojlerskih pilića na rezultate tova i udele unutrašnjih jestivih organa.

Ogled je izveden na 800 pilića koji su podeljeni u 4 grupe sa 4 ponavljanja po grupi. Pilići su hranjeni po volji a sastav smeša se jedino razlikovao u količini dodatog belog luka u prahu. U kontrolnoj grupi (K) nije dodavan beli luk. Pilići (I) grupe su konzumirali smeše sa dodatkom 0.2% belog luka u prahu, u grupi (II) dodato je 0.4% dok je u grupi (III) dodato 0.6% belog luka. Na početku (1. dana) i na kraju oglednog perioda (42. dana) izvršeno je merenje telesnih masa pilića. Utvrđen je prosečni dnevni prirast, mortalitet, konverzija hrane i EPEF. Na kraju ogleda metodom slučajnog uzorka iz svake grupe žrtvovano je po 12 pilića (6 muških i 6 ženskih) u cilju utvrđivanja udela jestivih unutrašnjih organa.

Dobijeni rezultati su pokazali da korišćenje belog luka u smešama utiče na veće telesne mase i prosečne dnevne priraste kao i na povorniji mortalitet. Konverzija hrane je bila statistički značajno bolja ($p < 0.01$) kod pilića II i III grupe u odnosu na kontrolnu grupu. Statistički značajno manja ($p < 0.01$) vrednost EPEF utvrđena je u kontrolnoj grupi u odnosu na II i III grupu. Udeli srca, jetre i želudca nisu bili pod značajnim uticajem ispitivanog faktora.

Ključne reči: brojleri, ishrana, beli luk, proizvodni parametri

Acknowledgments

The research was funded by the Ministry of Education, Science and Technological Development, Republic of Serbia, project TR-31033.

References

- AL-KASSIE G. A. M. (2010): The role of peppermint (*Mentha piperita*) on performance in broiler diets. *Agriculture and biology journal of North America*. 1(5), 1009-1013.
- AL-KASSIE G. A. M., AL-JALEEL R. A. A, MOHSEEN A. M. (2011): The effect of a mixture of anise and rosemary on broiler performance. *Agriculture and biology journal of North America*. 2(9), 1279-1282.
- ASHAYERIZADEH O., DASTAR B., SHAMS S. M., ASHAYERIZADEH A., RAHMATNEJAD E., HOSSAINI S. M. R. (2009): Use of garlic (*Allium sativum*), black cumin seeds (*Nigella sativa* L.) and wild mint (*Mentha longifolia*) in broiler chicken diets. *Journal of Animal and Veterinary Advances* 8, 1860-1863.
- FADLALLA I. M. T., MOHAMMED B. H., BAKHIET A. O. (2010): Effect of feeding garlic on the performance and immunity of broilers. *Asian Journal of Poultry Science* 4, 182-189.
- FAYED R. H., RAZEK A. H. A., JEHAN M. O. (2011): Effect of dietary garlic supplementation on performance, carcass traits and meat quality in broiler chickens. *Animal hygiene and sustainable livestock production Proceedings of the 15 International Congress of the International Society for Animal Hygiene, Vienna, Austria, 3-7 July 2011*, 1, 471-474.
- ISSA K. J., OMAR J. M. A. (2012): Effect of garlic powder on performance and lipid profile of broilers. *Open Journal of Animal Sciences* 2, 62-68.
- KONJUFKA V., PESTI G., BAKALLI R. (1997): Modulation of cholesterol levels in broiler meat by dietary garlic and copper. *Poultry Science* 76: 1264-1271.
- KUMAR M, BERWAL J. S. (1998): Sensitivity of food pathogenes to garlic (*Allium Sativum*). *J. Appl. Microbiol.*, 84, 213-215.
- MILOŠEVIĆ, N., STANAČEV V., PERIĆ L., ĐUKIĆ STOJČIĆ M., VELJIĆ M. (2013): Effects of different levels of garlic powder in the diet on production parameters and slaughter traits of broiler chickens. *European Poultry Science* 77, 254-259.
- PERIĆ, L., MILOŠEVIĆ N., ŽIKIĆ D., BJEDOV S., CVETKOVIĆ D., MARKOV S., MOHNL M., STEINER T. (2010): Effects of probiotic and

- phytogenic products on performance, gut morphology and cecal microflora of broiler chickens. *Archiv fur Tierzucht-Archives of animal breeding* 53, 350-359.
- PETRIČEVIĆ V., JOKIĆ Ž., LUKIĆ M., ŠKRBIĆ Z., PAVLOVSKI Z., VITOROVIĆ D., PETRIČEVIĆ M. (2013): Effect of use of raw soybean in the final mixtures for broiler chickens on body weight, relative weight of the pancreas and the edible inner organs. *Proceedings of the 10th International Symposium "Modern Trends in Livestock Production"* Belgrade, Republic of Serbia 2-4 October 2013. (CD of Proceedings. ISBN: 987-86-8243169-5 p 902-910).
- PUVAČA N., KOSTADINOVIĆ LJ., LJUBOJEVIĆ D., LUKAČ D., LEVIĆ J., POPOVIĆ S., NOVAKOV N., VIDOVIĆ B., ĐURAGIĆ O. (2015): Effect of garlic, black pepper and hot red pepper on productive performances and blood lipid profile of broiler chickens. *European Poultry Science* 79, 1-13.
- PUVAČA, N., STANAČEV V., GLAMOČIĆ D., LEVIĆ J., PERIĆ L., STANAČEV V., MILIĆ D. (2013): Beneficial effects of phytoadditives in broiler nutrition. *World's Poultry Science Journal* 69, 27-34.
- RAHMATNEJAD E., ROSHANFEKR H. (2009): Evaluation the effect of several non-antibiotic additives on growth performance of broiler chickens. *Journal of Animal and Veterinary Advances* 8, 1757-1760.
- STANAČEV V., GLAMOČIĆ D., MILOŠEVIĆ N., PUVAČA N., STANAČEV V., PLAVŠA N. (2011): Effect of garlic (*Allium sativum* L.) in fattening chicks nutrition. *African Journal of Agricultural Research* 6, 943-948.