BOOK OF PROCEEDINGS

AgroSym

VII International Scientific Agriculture Symposium
Jahorina, October 06-09, 2016

agro sym 2016

BOOK OF PROCEEDINGS

VII International Scientific Agriculture Symposium
"Agrosym 2016"

AGROSYM 2016

Jahorina, October 06 - 09, 2016

Impressum

VII International Scientific Agriculture Symposium „Agrosym 2016“

Book of Proceedings

Published by

University of East Sarajevo, Faculty of Agriculture, Republic of Srpska, Bosnia
University of Belgrade, Faculty of Agriculture, Serbia
Mediterranean Agronomic Institute of Bari (CIHEAM - IAMB) Italy
International Society of Environment and Rural Development, Japan
Balkan Environmental Association, B.EN.A, Greece
University of Applied Sciences Osnabrück, Germany
Selçuk University, Turkey
Perm State Agricultural Academy, Russia
Voronezh State Agricultural University named after Peter The Great, Russia
Biotehnical Faculty, University of Montenegro, Montenegro
Institute for Science Application in Agriculture, Serbia
Institute of Lowland Forestry and Environment, Serbia
Academy of Engineering Sciences of Serbia, Serbia
Agricultural Institute of Republic of Srpska - Banja Luka, Bosnia and Herzegovina
Maize Research Institute „Zemun Polje“ Serbia
Institute of Field and Vegetable Crops, Serbia
Institute of Forestry, Podgorica, Montenegro
Balkan Scientific Association of Agricultural Economics, Serbia
Institute of Agricultural Economics, Serbia

Editor in Chief

Dusan Kovacevic

Tehnical editors

Sinisa Berjan
Milan Jugovic
Velibor Spalevic
Noureddin Driouech
Rosanna Quagliariello

Website:

http://www.agrosym.rs.ba

CIP - Каталогизација у публикацији
Народна и универзитетска библиотека
Републике Српске, Бања Лука

631(082)(0.034.2)

INTERNATIONAL Scientific Agricultural Symposium "Agrosym 2016" (7 ; Jahorina)
Book of Proceedings [Elektronski izvor] / VII International Scientific Agriculture Symposium "Agrosym 2016", Jahorina, October 06 - 09, 2016 ; [editor in chief Dušan Kovačević]. - East Sarajevo =Istočno Sarajevo : Faculty of Agriculture =Poljoprivredni fakultet, 2016. - 1 elektronski optički disk (CD-ROM) : tekst, slika ; 12 cm

CD ROM čitač. - Nasl. sa nasl. ekrana. - Registar.

ISBN 978-99976-632-7-6

COBISS.RS-ID 6216984

10.7251/AGRENG1607369

THE EFFECT OF THE USE OF CRUDE SOYBEAN IN THE FINAL MIXTURES FOR BROILER CHICKEN ON CHEMICAL AND AMINO ACID COMPOSITION OF MEAT

Veselin PETRIČEVIĆ[1*], Miloš LUKIĆ[1], Zdenka ŠKRBIĆ[1], Snežana BOGOSAVLJEVIĆ-BOŠKOVIĆ[2], Vladimir DOSKOVIĆ[2], Simeon RAKONJAC[2], Maja PETRIČEVIĆ[1]

[1]Institute for Animal Husbandry, Belgrade-Zemun, Republic of Serbia
[2]Faculty of Agronomy, University of Kragujevac, Čačak, Republic of Serbia
*Corresponding author: veselin5@live.com

Abstract

The aim of this study was to determine the effects of using different varieties and levels of participation of raw soybeans in the final mixtures for broiler chickens on chemical and amino acid composition of dark and white meat. The research was conducted at the experimental farm of the Institute for Animal Husbandry in Zemun using Hubbard F15 heavy line hybrid broilers. A total of 2000 one-day broilers were distributed in 40 equal boxes reared on deep litter (50 chickens per box, 4 boxes replicates per treatment diet). Chickens in all groups had uniform requirements in terms of population density, food area, temperature and light. Until the age of 35 days all birds in the experiment were fed the same diets. The study was carried out on chickens at the age of 35-42 days, according to the principle of two-factorial trial 2 x 5 (2 varieties of domestic varieties x 5 levels of participation of raw grains in the mixture) with a total of 10 treatments. At the end of the experiment, 6 broilers per each tested treatment and gender were randomly selected, a total of 120 chickens, from which the sample of breasts and thigh muscle tissue was taken after the slaughter in order to determine the quality of the meat. It was established that increased concentration of trypsin inhibitor in the final mixtures for chicken had no negative impact on the quality of meat (basic chemical and amino acid composition of dark and white meat).

Key words: *nutrition, soybean, trypsin inhibitors, broiler chicken, chemical and amino acid composition of meat*

Introduction

The nutrition of broilers, in addition to genetics, is the most important factor that can influence the chemical composition of chicken meat. The soybean in chicken diet is the number one protein component and is valuable feed in terms of amino acid composition (*Tan Wilson et al., 1987; Kho and Lumen, 1988*). In comparison with grains and leguminous species, soybean has the highest percentage of proteins (on average of about 38%, with 2.1 to 2.5% lysine). The nutritional value of raw soybean is reduced by the presence of numerous anti-nutritive substances such as trypsin inhibitors (TI) (*Palacios et al., 2004*) and lectins (*Douglas et al., 1999*). The nutritional value of soybean can be increase by proper heat treatment and deactivation of anti-nutritional factors which are mainly proteins, but this procedure also increases its price.

Selection/breeding work has resulted in soybean varieties with reduced content of certain anti-nutritional substances. Variety Lana was developed by *Srebrić and Perić (2008)* as a result of domestic soybean breeding program aimed at reducing the activity of TI. Variety Lana has a lower TI level by 50% compared to conventional soybean varieties. The use of raw soybeans (especially varieties with reduced TI content) influences primarily the reduction of feeding costs and improves the economy of broiler production.

Comparing the nutritional value of soybeans with lower TI level in the diet of broiler chickens, *Petričević et al. (2015)* have found better production results compared to soybeans with standard level of TI, however no significant differences in the quality of the carcasses were identified. Comparing raw and heat-treated soybeans, *Beuković et al. (2012)* have established better quality of chicken carcass, expressed by dressing percentages, in chickens fed heat-treated soybeans. *Petričević et al. (2016)* have determined that the increased levels of raw soybeans in the final mixtures for broiler chickens hinder the utilization of protein in the ration, resulting in weaker development of the most valuable parts of the carcass, primarily the breast.

The aim of this research was to investigate the effects of replacing a part of heat processed soybean of standard variety "Lydia" and variety with reduced TI content "Lana" with raw soybean grains in the final mixtures for broiler chickens on chemical and amino acid composition of dark and white meat.

Materials and methods

The research was conducted at the experimental farm of the Institute for Animal Husbandry in Zemun municipality (Belgrade, Serbia) using Hubbard F15 heavy line hybrid broilers. In the final mixtures for broilers two local varieties were used, variety "Lana" with reduced TI level and variety "Lydia" with standard TI level, extruded and raw (Table 1).

Table 1. Level of trypsin inhibitor in soybean

Treatment	Raw soybean		Heat-treated (extruded) soybean	
Variety	Lana	Lydia	Lana	Lydia
TI (mg/g)	17.71	36.74	4.38	14.03

A total of 2000 one-day broilers were distributed in 40 equal boxes reared on deep litter (50 chickens per box, 4 boxes replicates per treatment diet). Chickens in all groups had uniform requirements in terms of population density, food area, temperature and light. Until the age of 35 days all birds in the experiment were fed the same diets. Finisher as the final mixture contained 17.5% crude protein and 13.2 MJ/kg metabolic energy in all experimental groups, it was available to broiler chickens from 35 to 42 days and differed for all the tested treatments in regard to soybean varieties and the participation of the heat-treated and the raw soybean. (Table 2).

Effect of different levels of raw soybeans in diets was determined in a two-factorial trial 2 x 5 (2 varieties of soybean x 5 levels of participation of raw grains in the mixture) with 10 dietary treatments.

Table 2. Trial design/plan and extruded and raw soybean ratio in the final mixtures

Treatment	Broilers	% of soybean in the diet (Extruded : Raw)	Soy bean ratio % (Extruded : Raw)
Lana - 0% (K)	200	20% (20% : 0%)	100/0
Lana - 5% (I)	200	20% (15% : 5%)	75/25
Lana - 10% (II)	200	20% (10% : 10%)	50/50
Lana - 15% (III)	200	20% (5% : 15%)	25/75
Lana - 20% (IV)	200	20% (0% : 20%)	0/100
Lydia - 0% (K)	200	20% (20% : 0%)	100/0
Lydia - 5% (I)	200	20% (15% : 5%)	75/25
Lydia - 10% (II)	200	20% (10% : 10%)	50/50
Lydia - 15% (III)	200	20% (5% : 15%)	25/75
Lydia - 20% (IV)	200	20% (0% : 20%)	0/100

At the end of the experiment, broilers were selected randomly, 6 for each test treatment and gender - total of 120 chickens, from which post-slaughter samples of breast and thigh muscle tissue were taken in order to determine the chemical and amino acid composition of meat. The basic chemical and amino acid composition samples of white and dark meat was determined:

- Moisture content was determined according to standard SRPS ISO 1442/1998;
- The content of free fat was determined according to standard SRPS ISO 1444/1998;
- Content of total ash was determined according to standard SRPS ISO 936/1999;
- The nitrogen content was determined according to standard SRPS ISO 937/1992 and protein content according to the following formula: CP (%) = N (%) x 6.25;
- The amino acid composition was determined by HPLC (IC with electrochemical detector).

The software package STATISTICA Version 6 (StatSoftInc.) was used in the statistical analysis.

Results and discussion

Table 1 shows data on the basic chemical composition of dark and white meat of broiler chickens of both genders.

Table 3. Chemical composition of chicken meat (%)

Treatment	Dark meat				White meat			
	Water	Fat	Ash	Protein	Water	Fat	Ash	Protein
Soybean variety								
Lana	76.41	2.58	1.09	20.32	75.04	0.69	1.17	23.07
Lydia	76.15	2.63	1.11	19.90	75.29	0.68	1.16	23.17
Level of raw soybean, %								
0 (K)	75.52	2.71	1.09	20.52	74.85	0.54	1.18	24.16
5 (I)	77.43	2.38	1.09	20.15	75.25	0.68	1.15	22.92
10 (II)	76.07	2.74	1.08	19.68	75.30	0.70	1.16	22.81
15 (III)	76.14	2.74	1.10	20.00	75.10	0.74	1.16	22.99
20 (IV)	76.25	2.45	1.12	20.21	75.32	0.77	1.16	22.73
p value								
Soybean variety	0.571	0.749	0.381	0.056	0.075	0.855	0.386	0.783
Level of raw soybean	0.129	0.338	0.675	0.180	0.181	0.143	0.740	0.078
Variety x Level	0.237	0.118	0.984	0.709	0.406	0.499	0.609	0.683

Statistical analysis of the data obtained for the chemical composition of dark and white meat of broiler chickens of both genders showed absence of significant differences under the

influence of investigated factors (p>0.05). The use of raw soybean with reduced TI levels in mixtures for broilers did not affect the significant changes in the content of water, fat, ash and protein in the dark and white meat compared to soybean of variety Lydia. Increasing the level of raw soybeans in the final mixture did not cause poorer quality of meat. Also, the interaction of investigated factors did not influence the chemical composition of meat.

The quality of chicken meat is determined by sensory properties and nutritional value i.e. chemical composition (water content, protein, minerals and fats). The favourable chemical composition, high content of protein with low fat content, is what makes the chicken meat very desirable food of animal origin (*Kralik et al., 2007*). The chemical composition of poultry meat, in addition to diet, can be influenced by other factors: genotype, age, gender (*Ristić et al., 2008*). In the literature, there are few results that are directly related to the impact of increased TI concentrations on the chemical composition of chicken meat. Similar to our results, *Sardary (2009)* have found no statistically significant differences in the chemical composition of dark and white meat of chickens fed diets with different amounts of heat-treated whole soybean and raw soybean. *Marcu et al. (2009)* and *Haščík et al. (2011)* have found a slightly higher water content and lower content of fat in the breast meat as compared to our results. *Lonergan et al. (2003)* suggest that breast meat contains 24.02% protein, 73.42% water and 1.08% fat. *Ristić (2007)* point out that the protein content of the breast meat is by 3.5% higher than in the thigh meat, which is consistent with our results.

Data for the amino acid composition of chicken meat of broilers of both genders under the influence of tested factors are shown in Table 2. The contents of valine, leucine, lysine and tryptophan in dark and white meat are determined.

Table 4. Amino acid composition of chicken meat (%)

Treatment	Dark meat				White meat			
	Valine	Leucine	Tryptoph.	Lysine	Valine	Leucine	Tryptoph.	Lysine
Soybean variety								
Lana	1.04	1.59	0.24	1.81	1.03	1.57	0.24	1.80
Lydia	1.05	1.61	0.25	1.81	1.04	1.59	0.24	1.81
Level of raw soybean, %								
0 (K)	1.04	1.59	0.25	1.81	1.06	1.61	0.25	1.82
5 (I)	1.03	1.61	0.25	1.82	1.03	1.57	0.25	1.82
10 (II)	1.05	1.61	0.26	1.82	1.05	1.60	0.23	1.80
15 (III)	1.06	1.58	0.24	1.82	1.01	1.55	0.23	1.78
20 (IV)	1.06	1.62	0.25	1.82	1.05	1.57	0.25	1.81
p value								
Soybean variety	0.461	0.530	0.451	0.756	0.373	0.353	0.516	0.564
Level of raw soybean	0.339	0.438	0.275	0.346	0.292	0.148	0.370	0.194
Variety x Level	0.185	0.218	0.382	0.619	0.152	0.254	0.339	0.484

The analysis of the data reveals that the soybean variety and different levels of soybean grain in chicken final mixtures exerted no statistically significant impact on the amino acid composition of dark and white meat (p>0.05). It was also determined that the interaction effect of studied factors had no significant effect on the content of valine, leucine, tryptophan and lysine in the dark and white meat.

The chicken meat is a rich source of biologically valuable protein, essential amino acids, minerals and vitamins in the human consumption. Compared to other types of meat chicken meat represents a significant source of essential polyunsaturated fatty acids, especially omega-3 (*Losso, 2002*).

Conclusions

Based on the results of the study of the individual impact of the variety and level of participation of raw soybeans and interactive influence of both factors in the diet of broiler chickens aged from 35 to 42 days, it can be concluded that the increased concentration of trypsin inhibitors in the final mixtures for chickens had no negative impact on the quality of chicken meat. The use of soybean of variety Lana did not influence ($p>0.05$) achieving of more favourable chemical and amino acid composition of dark and white meat compared to soybean with a standard TI level. The 20% of raw soybean grains in mixtures did not cause poor results of the tested parameters of chicken meat quality in relation to groups with lower participation and without the raw soybeans ($p>0.05$).

Acknowledgments

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

References

Beuković, D, Beuković, M, Ljubojević, D, Stanaćev, V, Bjedov, S, Ivković, M, (2012). Effect soybean heat treatment on broiler slaughter traits, Third International Scientific Symposium "Agrosym Jahorina 2012", 541-547.

Douglas, M, Parsons, C, Hymowitz, T, (1999). Nutritional evaluation of lectin-free soybeans for poultry, Poultry Science, (78), 91-95.

Haščik, P, Kačaniova, M, Bobko, M, Pochop, J, Mihok, M, Arpasova, H, (2011). Effect of probiotic preparation for chemical composition of meat cocks different combinations of hybrid chicks, Acta Universitatis Agriculturae et Silviculturae Mendeleianae Brunensis (5), 83-94.

Kho, C, Lumen, B, O, (1988). Identification and isolation of methionine-cysteine rich proteins in soybean seed Jurnal Nutrition, (134), 1213-1219.

Kralik, G, Škrtić, Z, Maltar, Z, Hanžek, D, (2007). The properties of meat production and meat quality of Ross 308 and Cobb 500 chickens , Krmiva 49 (2), 59–71.

Lonergan, S, M, Deeb, N, Fedler, C, A, Lamont, S, J, (2003). Breast Meat Qualit And Composition in Unique Chicken Populations, Poultry Science, 82 (12), 1990-1994.

Losso, N, J, (2002). Preventing degenerative diseases by anti-angiogenic functional foods, Food technology, 56 (6), 78-87.

Marcu, A, Vacaru-Opris, I, Marcu, A, (2009). The influence of feed protein and energy level on meat chemical composition from different anatomical regions at "Cobb 500" hybrid, Lucrari stiintifice Zootehnie si Biotehnology, 42 (1), 147-150.

Palacios, M, F, Easter, R, A, Soltwedel, K, T, Parsons, C, M, Douglas, M, W, Hymowitz, T, Pettigrew, J, E, (2004). Effect of soybean variety and processing on growth performance of young chicks and pigs, Jurnal Animal Science, (82), 1108–1114.

Petričević, V, Lukić, M, Škrbić, Z, Bogosavljević-Bošković, S, Dosković, V, Rakonjac**, S,** Petričević M. (2016). The effect of raw soybean in the final mixtures for broilers on the conformation measures and share of major carcass parts, Biotehnology in Animal Husbandry, 32 (1), 37-44.

Petričević, V, Lukić, M, Škrbić, Z, Jokić, Ž, Vitorović, D, Rakonjac**, S,** Petričević, M, Stanojković, A, (2015). The effect of raw soybean in the final mixtures for broiler chickens on the performance and carcass yield, Proceedings of the 4rd International congress "New perspectives and challenges of sustainable livestock production" Belgrade, Republic of Serbia 7-9 October 2015, 176-184.

Ristić M., Freudenreich P., Damme K. (2008). Chemical composition of poultry meat - a comparison broiler chickens, turkeys, ducks and geese, Meat Technology, 49 (3-4), 94-99.

Ristić M. (2007). The chemical composition of broiler meat depending of origin and production, Meat technology, 48 (5-6), 203-207.
Sardary, S, Y, T, (2009). Performance of broiler chickens fed locally grown full-fat soybean based diets in Iraq, Jurnal Animal Science, 5 (1), 111-125.
Srebrić, M, Perić, V, (2008). Breeding of Kunitz-free soybean genotypes, Proceedings of 18th Eucarpia General Congress Modern Variety Breeding for Present and Future Needs, Valencia, Spain, 9-12 September 2008, 640.
Tan Wilson, A, L, Chen, J, C, Duggan, M, C, Chapman, C, Obach, R, S, Wilson, K, A, (1987). Soybean Bowman–Birk trypsin isoinhibitors: Classification and report of a glycine-rich trypsin inhibitor class, Journal of Agricultural and Food Chemistry, 35 (6), 974–981.