

THE EFFECT OF RAW SOYBEAN IN THE FINAL MIXTURES FOR BROILERS ON THE CONFORMATION MEASURES AND SHARE OF MAJOR CARCASS PARTS

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Original scientific paper

Abstract: The experiment of the substitution of soybean meal with raw soybean in the final diet was carried out on Hubbard F15 chickens at the age of 35-42 days. The effect of different levels and varieties of raw soybeans in diets on carcass conformation and share of major carcass parts was determined in a two-factorial experiment 2 x 5 (2 soybean varieties x 5 levels of raw grains in the mixture), ie a total of 10 dietary treatments. At the end of the trial, by a random sample method, 12 chickens (6 males and 6 females) from each group were sacrificed and examined. The results showed that the index of drumstick girth and share of drumstick were under significant ($p < 0.05$) influence of the soybean varieties. The level of raw soybeans in diets had significant effect ($p < 0.05$) on the index of drumstick girth and on the absolute value of the breast depth and breast angle. Shares of breast and thighs of broiler chickens of both sexes were not significantly influenced by the studied factors. It was concluded that the share of raw soybean of 10, 15 and 20% in the final mixtures for broilers hinders the utilization of protein in the ration, resulting in poorer quality of chicken carcasses.

Key words: diet, broilers, raw soybean, conformation measures, major carcass parts

Introduction

An important goal of broiler production, resulting directly from preferences of processors and consumers of chicken meat, is good quality chicken carcasses with the preferred conformation and with as large a share of muscle tissue in the breasts, thighs and drumsticks. Nutrition, in addition to genetics, is a key factor that may affect the achievement of this goal. By composing mixtures that are fully tuned to the nutritional needs of a specific genotype of broiler

chickens, the carcass yield and the yield of major carcass parts can be influenced (*Sinovec and Ševković, 1995*). High-quality protein feeds in the ration are essential for maximum development of muscle tissue, but also the most expensive component of a diet. In the broiler nutrition, soybean is the main component and it is used in the form of soy meal or other heat processed soy products. However, in broiler farms with their own crop production there is a continuing interest in the use of raw soybeans in animal feeding as a cheaper and easier option.

It is known that trypsin inhibitors (TI) present in the raw soybean that reduce utilization of soy protein and are the main anti-nutritional factors that hinder the utilization of nutrients which are contained in this feed (*Zhang et al., 1993*). In addition to TI, lectins are present in soybean which are also important anti-nutritional substances (*Douglas et al., 1999*). The negative effects of increased concentrations of TI in mixtures for broilers on their performance have been confirmed by many authors, *Palacios et al. (2004)*, *Beuković et al. (2010)* and *Petričević et al. (2013)*. The problem can be solved by thermal denaturation of anti-nutritional factors in soybeans before use, or genetic selection/breeding of new TI free varieties. The positive effects of both methods, as well as their possible combination in the diet for non-ruminants, especially in the application of new soybean varieties, are subject to constant research.

The aim of this research was to investigate the effects of partial replacement of heat processed soybean of two local varieties ("Lana" and "Lydia") with raw grain, in the final mixtures for broilers on conformation measures and shares of major carcass parts.

Materials and Methods

The research was conducted at the experimental farm of the Institute for Animal Husbandry in Zemun using Hubbard F15 heavy line hybrid broilers. In the final mixtures for broilers two local varieties were used, variety "Lana" with reduced TI by 50% 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).

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

Effect of different levels of raw soybeans in diets on conformation measures and shares of major carcass parts 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.

At the end of the trial, by method of random sample, 6 broilers for each test treatment and sex (gender), a total of 120 chickens, were slaughtered. The conformation measures were determined according to the method *Pavlovski and Mašić (1983)*:

- Breast depth (which indicates the roundness of the breast and carcass) was measured with a caliper placed between the cranial part of the keel and the dorsal surface above the first thoracic vertebrae.
- Drumstick girth, as an indicator of development of the limbs was measured by a measuring tape at the widest part of the drumstick.
- Breast angle, which is considered the most significant measure of conformation and which is an indicator of the development of breast muscle and its roundness is measured using a protractor vertically relative to the back line.

In addition to absolute values of conformation measures that are result of pre-slaughter body mass of chickens, indices were calculated that represent the ratio of pre-slaughter live weight and the observed measure (g / mm).

In order to determine the share of major carcass parts and the share of muscle tissue in them, carcasses were cut according to the *Regulations on the*

quality of poultry meat (1981). Muscle tissue was obtained by dissecting the breast, thighs and drumsticks.

For statistical analysis software package STATISTICA, version 6 (StatSoftInc.) was used. The level of statistical significance of differences between groups was determined by Tukey test.

Results and Discussion

Absolute and relative carcass conformation measures of broiler chickens are presented in Table 3.

Table 3. Absolute and relative carcass conformation measures

Treatment	Breast depth (BD), mm	Body mass/BD, g/mm	Breast angle, degrees	Drumstick girth (DG), mm	Body mass/DG, g/mm
Soybean variety					
Lana	92.08	23.05	124.32	138.95	15.30 ^a
Lydia	91.18	22.58	122.83	139.43	14.76 ^b
Level of raw soybean. %					
0 (K)	93.04 ^a	23.46	126.38 ^a	139.79	15.64 ^a
5 (I)	93.25 ^a	22.90	123.96 ^{ab}	140.29	15.20 ^{ab}
10 (II)	90.46 ^{ab}	22.97	122.83 ^{ab}	139.25	14.92 ^{ab}
15 (III)	91.79 ^{ab}	22.89	123.21 ^{ab}	140.21	15.00 ^{ab}
20 (IV)	89.63 ^b	21.85	121.50 ^b	136.42	14.39 ^b
p value					
Soybean variety	0.252	0.197	0.130	0.740	0.022
Level of raw soybean	0.014	0.080	0.032	0.423	0.019
Variety x Level	0.796	0.236	0.127	0.222	0.249

* a-b Average values in each column without a common designation are significantly different at the level of 5%

Significantly higher ($p < 0.05$) index of drumstick girth was determined on carcasses of chickens that consumed a mixture containing soybean variety Lana. Other carcass conformation measures were not influenced by the different soybean varieties. The analysis of aggregate data for absolute and relative measures of carcass conformation showed that the level of raw soybeans in diets affected the significant differences ($p < 0.05$) in the index of drumstick girth as well as the absolute value of the breast depth and angle. The differences were not statistically significant under the influence of the interaction of investigated factors.

Data on the share of major carcass parts and share of muscle tissue in broiler chickens of both sexes can be found in Table 4.

Analysis of data on share of breast showed that the use of different soybean varieties and with different levels of raw soybean in chicken diet had no statistically significant influence on this trait. Statistically significant differences ($p < 0.05$) occurred under the influence of soybean varieties for the share of drumsticks. Chicken diet which included soybean with the standard TI level has affected significantly higher shares of drumsticks compared to soybean variety Lana.. The investigated factors and their interaction caused no significant differences in share of drumsticks.

Using different soybean varieties in the final mixtures for broilers had no significant impact on the share of breast muscle tissue, also thigh and drumstick muscle tissue in chickens of both sexes. The level of raw soybeans in diets affected the statistically significant differences ($p < 0.05$) in the share of breast muscle tissue. The highest average share of breast muscle tissue was determined in groups, without the inclusion of raw soybean (K). The shares of drumstick and thigh muscle tissue did not differ significantly under the influence of the level of raw soybeans, nor the interaction of investigated factors had an impact on these properties.

Table 4. Share of major carcass parts and share of muscle tissue, %

Treatment	Breast	Breast meat	Drumstick	Drumstick meat	Thigh	Thigh meat
Soybean variety						
Lana	19.88	15.65	10.22 ^b	6.45	12.34	8.78
Lydia	19.91	15.66	10.74 ^a	6.55	12.45	8.95
Level of raw soybean. %						
0 (K)	20.93	16.86 ^a	10.21	6.46	12.35	8.67
5 (I)	19.96	15.75 ^{ab}	10.36	6.57	12.38	8.48
10 (II)	19.60	15.30 ^b	11.07	6.52	12.48	9.87
15 (III)	19.42	15.21 ^b	10.41	6.56	12.47	8.67
20 (IV)	19.55	15.13 ^b	10.35	6.41	12.30	8.87
p value						
Soybean variety	0.929	0.983	0.042	0.257	0.451	0.954
Level of raw soybean	0.059	0.019	0.234	0.727	0.926	0.332
Variety x Level	0.647	0.487	0.113	0.672	0.891	0.607

* a-b Average values in each column without a common designation are significantly different at the level of 5%

The term carcass conformation means the physical shape which is directly related to the amount and distribution of body muscles, especially the breasts, thighs and drumsticks, ie. the slaughter value and leanness (*Pavlovski et al., 2006*).

The carcass conformation can largely be influenced by genotype and sex (gender) (Bhardway and Mohapatra, 1996). The share of main carcass parts, in addition to diet, depends on other factors: genotype, sex, age and housing system. In the literature, there are few results that are directly related to the impact of increased concentrations of TI on conformation and shares of chickens' major carcass parts. Similar to the results obtained in our study Sardary (2009), using 20% of raw soybeans in diets for chickens at the age of 42 days has established by 1% lower share of breasts compared to chickens fed a diet containing 20% of cooked soybeans. The differences were not statistically significant. Petričević et al. (2015) have found significantly lower values of carcass yield with an increase in the share of raw soybean in the final mixtures for chickens. Comparing raw and heat-treated soy in the chicken diet, Beuković et al. (2012) have found statistically significantly higher yield in case of conventional carcass dressing, carcass „ready to roast“ and „ready to grill“ and share of breast in the carcass of chickens fed heat-treated soybeans compared to raw soybeans.

Conclusions

Based on the research results of the individual impact of the variety and level of participation of raw soybeans and interactive influence of both factors in the diet of broilers aged 35 to 42 days, the following can be concluded:

- The analysis of the impact of soybean varieties on carcass conformation measures showed significantly lower ($p < 0.05$) index value of drumstick girths in chickens fed diets which included soybean variety Lydia. For other conformation measures as well as shares of major carcass parts, it was determined that the use of Lana variety soybean did not affect the higher values of these parameters in relation to soybean with a standard level of TI.
- the share of 20% raw soybean in diets had negative effect ($p < 0.05$) on the values of the breast depth, breast angle and drumstick girth index compared to the group without the raw soybean in the mixture.
- In general it can be concluded that the level of raw soybean, 10, 15 and 20% in the final mixtures for broiler chickens hinders the utilization of protein in the ration resulting in weaker development of the most valuable parts of the carcass, primarily the breast.

Acknowledgments

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

Efekat upotrebe sirove soje u završnim smešama za ishranu brojlerskih pilića na mere konformacije i udele vrednijih delova trupa

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Rezime

Ogled je izveden na pilićima hibrida Hubbard F15 u uzrastu od 35-42. dana. Efekat upotrebe različitog nivoa sirove soje u smešama na konformaciju trupa i udeo vrednijih delova trupa utvrđen je dvofaktorijalnim eksperimentom 2 x 5 (2 sorte soje x 5 nivoa učešća sirovog zrna u smeši) sa 10 tretmana ishrane. Na kraju oglada metodom slučajnog uzorka iz svake grupe žrtvovano je po 12 pilića (6 muških i 6 ženskih) u cilju utvrđivanja mera konformacije i udele vrednijih delova trupa.

Dobijeni rezultati su pokazali da je indeks obima bataka bio pod značajnim ($p < 0,05$) uticajem sorte soje. Nivo sirove soje u smešama imao je značajnog uticaja ($p < 0,05$) na indeks obima bataka kao i na apsolutnu vrednost dubine grudi i grudnog ugla. Udeo bataka je bio pod značajnim ($p < 0,05$) uticajem sorte soje. Udeli grudi i karabataka brojlerskih pilića oba pola nisu bili pod značajnim uticajem ispitivanih faktora.

Zaključeno je da učešće sirove soje od 10, 15 i 20% u završnim smešama za ishranu brojlerskih pilića otežava iskorišćavanje proteinskog dela obroka, što rezultira slabijim kvalitetom pilećih trupova.

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