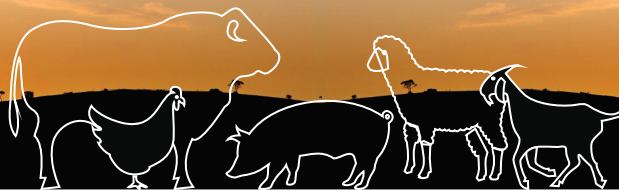


ISBN 978 - 86 - 82431 - 71 - 8

4th INTERNATIONAL CONGRESS

PROCEEDINGS

**NEW PERSPECTIVES AND CHALLENGES
OF SUSTAINABLE LIVESTOCK PRODUCTION**



Belgrade, Serbia 7th - 9th October 2015

THE EFFECT OF RAW SOYBEAN IN THE FINAL MIXTURES FOR BROILER CHICKENS ON THE PERFORMANCE AND CARCASS YIELD

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Invited paper

Abstract: The aim of this study was to point out the possibility of replacing a portion of thermally treated soybean of standard variety "Lydia" and variety with reduced trypsin inhibitor "Lana" with raw grain in the final mixes for broiler chickens. The trial was conducted in the last week of the experiment (age 35-42 day). At the beginning (day 35) and at the end of the experimental period (42 day) body mass of chickens, the average daily gain, feed conversion and consumption were determined. At the end of the trial, a random sample of 12 chickens from each group was taken (6 male and 6 female) in order to obtain dressing percentage indicators. The results showed that the increased concentration of TI in mixtures caused significant decrease of average daily gain. Consumption of food was not influenced by the studied factors. Feed conversion was significantly better in chickens fed diets containing soy with lower TI. The share of raw soybean in diets of 15 and 20% resulted in a significantly lower feed conversion. Carcass yields of broiler chickens were significantly influenced by the level of raw soybean in the mixture. The share of abdominal fat was not influenced by the studied factors.

Key words: broiler chickens, soybean, trypsin inhibitor, production performance, carcass yield

Introduction

Soybean is the most important protein component in poultry nutrition. The anti-nutritive substances present in raw soybeans reduce the thermal treatment. As a result of the use of raw soybeans in poultry nutrition products depression in performance results occurs *Douglas et al. (1999)*. The presence of anti-nutritional

substances in soybeans can be reduced through selection and breeding, creating varieties with reduced content of some anti-nutritive matters. In our agroecological conditions, variety Lana has been created with lower levels of trypsin inhibitor.

Comparing the nutritional value of soybean varieties with lower TI in experiments conducted on chickens (*Han et al., 1991; Jokić et al., 2004; Beuković et al., 2010a; Petričević et al., 2013*), hens (*Zhang et al., 1991; Petričević et al., 2014a; Petričević et al., 2014b*) and pigs and chickens (*Palacios et al., 2004*) authors have reported better results compared to varieties with a standard level of TI.

The objective of this research was to investigate the effects of replacing a part of thermally processed soybean of variety with a standard level of TI and variety with reduced TI, with raw soybean grain of said varieties in the final mixtures for broiler chickens on performance, carcass yield and share of abdominal fat. By determining the replacement level of heat treated soybean with raw soy grain, which has no negative impact on the performance and the quality of the product, a significant reduction in production costs can be achieved resulting in the improved economical efficiency.

Materials and methods

The research was conducted at the experimental farm of the Institute for Animal Husbandry in Zemun on broiler chickens of heavy line hybrid Hubbard F15. In the nutrition of boilers, in the final mixtures, two local varieties of soybean were used - "Lana" with reduced trypsin inhibitor and standard variety "Lydia", thermally treated and raw. The effect of different levels of raw soybeans in diets on the performance of broiler chickens and yields was determined by two factorial experiment 2 x 5 (two soybean varieties x 5 levels of participation of the raw grain in mixture) with 10 nutrition treatments. 2000 one day old chicks were divided into 40 boxes, so there were four replicates per treatment.

By the 35th day of the experiment, all broilers were fed the same feed mixtures according the recommendations for the studied hybrid. Finisher as the final mixture, containing 17.5% crude protein and 13.2 MJ/kg metabolizable energy, was available to broiler chicks from 35 to 42 days, and differed in all the tested treatments in the soybean varieties used and the participation of thermally treated and raw soybean. The share of thermally processed grain of both soybean varieties accounted for 20% of the mixture and was included in the two control treatments (K). In the groups (I), 15% of the total of 20% of full-fat soybean in the mixture was heat-treated and 5% of soybean was raw. In groups (II), 10% of heat-treated and 10% of raw soybean was added to the mixture. In the groups (III), of

20% of full-fat soybean grains in the mixture, 5% was thermally treated and 15% was raw. In groups (IV), 20% of the raw soybeans was incorporated in the diet.

Measurement of body weight of chickens was carried out at the beginning (day 35), and at the end of the experiment (day 42). Based on the difference in body weight of chickens the average daily gain was calculated. Control of food consumption included also measuring of the amount of complete mixtures given to broiler chicks and the rest of the food for each box. On the basis of data on food consumption and gain of chickens, the feed conversion ratio was calculated.

At the end of the experiment, a sample of 6 broiler for each studied treatment and sex was randomly selected, a total of 120 chickens. After a fasting period of 12 hours, body weights were measured and subsequently chickens were slaughtered. Post slaughter, carcasses were chilled to 4°C for 24 hours and then processed in accordance with the *Rulebook on quality of poultry meat (Pravilnik o kvalitetu mesa, 1981)*. In this way the following carcasses were obtained: - "conventional dressing" – carcass with head, neck, legs and edible internal organs (heart, lungs, liver, gizzard, kidneys and spleen); – "ready to roast" – carcass without head and legs but with neck and edible internal organs; - "ready to grill" – carcass without head, legs, neck and edible internal organs. In processing of the carcasses the abdominal fat was separated. The resulting weights of carcass and abdominal fat were placed in relation to pre slaughter body weight of chickens. In this way, the carcass yields and the share of abdominal fat in the carcass were obtained.

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

Results and discussion

Table 1 shows the production performance traits of broilers. Chickens fed diets containing soybean with lower TI had a higher average gain at the age from 35 - 42 days, compared to chickens fed a diet containing soybean with a standard level of TI, where established differences were not statistically significant. With increasing levels of raw soybeans in diets for chickens in the final stage of fattening, the average gain statistically significantly ($p < 0.05$) decreased. Interaction of studied factors had no significant effect on this production indicator. Consumption of food of broiler chickens showed no significant differences under the influence of varieties and the level of raw soybeans in the mixture.

Table 1. Production performance

Treatment	Daily gain, g	Feed consumption, g	Feed conversion, kg
	35-42 day		
Soybean variety			
Lana	76.97	196.96	2.57 ^b
Lydia	73.92	202.62	2.77 ^a
Level of raw soybean, %			
0 (K)	82.37 ^a	194.4	2.36 ^c
5 (I)	80.86 ^a	198.51	2.45 ^{bc}
10 (II)	76.18 ^{ab}	205.17	2.70 ^{ab}
15 (III)	70.50 ^b	199.65	2.84 ^a
20 (IV)	67.32 ^b	201.22	3.00 ^a
p value			
Soybean variety	ns	ns	0.001
Level of raw soybean	0.001	ns	0.001
Variety x Level	ns	ns	0.001

a-b Average values in each column with no common designation are significantly different at the level of 5%

Palacios et al. (2004) have reported significantly lower ($p < 0.05$) values of the average gain of chickens fed diets containing raw soybeans compared to chickens fed diets based on soybean meal. *Jokić et al. (2004)* have determined a significantly lower gain of chickens fed diets containing the raw standard soybean variety, compared to mixtures based on heat-treated soybean. *Loeffler (2012)* found no statistically significant effect of increasing concentrations of TI in mixtures for broiler chickens on feed consumption which is consistent with the results obtained in our study. Also, *Anderson-Hafermann et al. (1992)* and *Zhang et al. (1993)* have found significant differences in feed intake of chicks fed diets containing soybean with different levels of TI. *Douglas et al. (1999)* report that chickens fed diets containing raw soybean with a standard level of TI consumed the same amount of food as chickens fed diets containing soybean with lower TI and soybean with lower levels of lectins. Contrary to these results *Sardary (2009)* states significantly lower feed consumption of broiler chickens that have used a mixture with 20% share of raw soybeans compared to the control group that consumed the mixture without the participation of raw soybean grains.

Using soybeans with a standard level of TI in the final mixes for feeding of broiler chickens resulted in the significantly lower feed conversion ratio ($p < 0.05$) compared to chickens fed diets containing soybean with reduced levels of TI (Table 1). Differences in feed conversion were statistically significant under the influence of the level of raw soybean in mixtures. The best feed conversion is recorded in chickens that consumed mixtures without raw soybean. With the increase in the share of raw soybean in the final mixtures for broiler chickens, feed

conversion ratio was worse. The interaction of investigated factors resulted in statistically significant differences ($p < 0.05$). The worst feed conversion ratio was recorded in group of chickens with maximum share of raw soybeans.

Rand et al. (1996) have found poorer feed conversion ratio of chickens fed diets with the raw soybean share of 20% (2.65 kg) compared to chickens fed diets containing the same amount of soy grits (2.38 kg). *Beuković et al. (2010b)* also points out the negative effect of the use of raw standard soybeans in chicken nutrition in the sixth week of the experiment (2.73 kg) compared to raw soybeans with lower TI level (2.31 kg). A higher concentration of TI in mixtures for broiler chickens caused a significantly poorer feed conversion according to *Palacios et al. (2004)*. Data on feed conversion in our study are consistent with the results which were obtained by *Douglas et al. (1999)* and *Sardary (2009)*.

Table 2 shows the yields of broiler chickens and share of abdominal fat in the carcass. A ratio between the absolute values of the yield of dressed carcasses and pre-slaughter body weight allows for objective examination of the influence of the studied factors. Carcass yields of broiler chickens were not significantly influenced by soybean varieties. Chickens fed diets containing a higher percentage of raw soybeans had significantly lower ($p < 0.05$) yield values. Interaction of investigated factors resulted in significant differences in average values for yield.

Table 2. Carcass yield and share of abdominal fat

Treatment	Carcass yield			Share of abdominal fat, %
	Conventional dressing, %	Ready to roast, %	Ready to grill, %	
Soybean variety				
Lana	82,7	76,4	67,7	0,80
Lydia	83,1	76,8	68,2	0,78
Level of raw soybean, %				
0 (K)	83,6 ^a	77,2 ^a	68,9 ^a	0,75
5 (I)	83,4 ^a	77,2 ^a	68,4 ^{ab}	0,83
10 (II)	82,5 ^b	76,3 ^b	67,5 ^{ab}	0,82
15 (III)	82,4 ^b	76,2 ^b	67,7 ^{ab}	0,84
20 (IV)	82,5 ^b	76,0 ^b	67,3 ^b	0,70
p value				
Soybean variety	ns	ns	ns	ns
Level of raw soybean	0,022	0,035	0,012	ns
Variety x Level	ns	ns	ns	ns

* a-b Average values in each column with no common designation are significantly different at the level of 5%

In experiments conducted on broiler chickens of genotype Hubbard (Petričević *et al.*, 2011; Petričević *et al.*, 2012) similar values of all three dressing percentages were found, same as in this study. Subuh *et al.* (2002) found no significant differences in carcass yield of broiler chickens fed diets with different amount of full-fat soybean. Sardary (2009) found no statistically significant differences between groups for carcass yield of chickens fed diets containing raw and heat-treated soybean. The author states that the yield ranged from 69.8% to 72.2%.

Abdominal fat is an important indicator of carcass quality of broiler chickens given the high and positive correlation with the total amount of fat in the carcass. Feeding broiler chickens mixtures containing domestic soybean varieties with different levels of TI had no statistically significant impact on changes in the share of abdominal fat. The analysis of the impact of the level of raw soybeans in diets showed no statistically significant differences between groups in the share of abdominal fat. Also, the interaction of investigated factors did not result in the significant differences in the share of abdominal fat (Table 2).

Beuković *et al.* (2012) found a statistically significantly lower share of abdominal fat (0.76%), when using raw soybean in the diet of chickens, compared to the share of abdominal fat of chicks fed diets containing heat-treated soybean (1.04%).

Conclusions

With the reduction of the share of raw soybeans in diets, the average daily gain of chickens increased significantly. Feed consumption was not significantly different under the influence of the examined factors and their interactions. Feed conversion was significantly influenced by soybean varieties and levels of raw soybean in mixtures. Food consumption per unit of gain was significantly better in chickens fed diets containing soybean with lower TI level than the standard soybean variety. With increasing levels of raw soybeans in diets feed conversion worsened.

Carcass yields of broiler chickens were significantly influenced by the level of replacement of heat treated with raw soybean. Carcass yields "conventional dressing" and "ready to roast" were significantly higher in the group with no raw soybean and groups with 5% of raw soybean in the diet, compared to the group fed diets with 10%, 15% and 20% of raw soybean. In case of "grill ready/ready to grill", the differences were statistically significant between the groups of chickens fed diet without raw soybeans and groups that were fed with a mixture of 20% raw soybean.

Mass and share of abdominal fat in carcass of broiler chickens were not significantly influenced by the studied factors.

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 brojerskih pilića na proizvodne pokazatelje i randmane

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Rezime

Cilj ovih istraživanja bio je da ukaže na mogućnost zamene jednog dela termički obrađenog sojinog zrna standardne sorte „Lidija“ i sorte sa smanjenim sadržajem tripsin inhibitora „Lana“, sirovim zrnom u završnim smešama za ishranu brojerskih pilića.

Ogled je izveden u poslednjoj nedelji tova (35-42. dan uzrasta). Tokom istraživanja svakodnevno je evidentirana količina utrošene hrane. Na početku (35. dana) i na kraju oglednog perioda (42. dana) izvršeno je merenje telesnih masa pilića, utvrđivanje prosečnih dnevnih prirasta, konzumacije i konverzije hrane. Na kraju ogleda metodom slučajnog uzorka iz svake grupe žrtvovano je po 12 pilića (6 muških i 6 ženskih) u cilju dobijanja klaničnih pokazatelja.

Dobijeni rezultati su pokazali da povećana koncentracija TI u smešama utiče na značajno smanjenje prosečnih dnevnih prirasta. Konzumacija hrane nije bila pod uticajem ispitivanih faktora. Konverzija hrane je bila statistički značajno bolja kod pilića hranjenih smešama koje sadrže soju sa nižim nivoom TI. Učešće sirove soje u smešama od 15 i 20% uticalo je na značajno lošiju konverziju hranu. Randmani brojerskih pilića su bili pod značajnim uticajem nivoa sirovog zrna soje u smeši. Udeo abdominalne masti nije bio pod uticajem ispitivanih faktora.

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