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THE EFFECT OF REPLACEMENT OF SOYBEAN MEAL WITH LUPINE SEED ON DIGESTION AND BIOCONVERSION OF FOOD IN TURKEYS

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Abstract

Research has been designed to verify to what extent soybean cakes turkey broiler chickens can be replaced partially free alkaloid lupine beans, watching the effect of the alternative sources of protein on digestion, the level and efficiency of feed conversion economic turkey broilers. The experiment was conducted as a completely randomized experimental design consisted of four treatments which involve a control diet consisting of corn - soy grits (LC) and three experimental diets (E_1, E_2 and E_3) at the oil cake proteins from soybean meal were replaced with free lupine alkaloids. White lupine beans (vr. Energy-free alkaloids) obtained in specific climatic conditions of the area west of Romania, after grinding, were introduced in the structure of mixed fodder at a rate of 20% (case E_1), 30% (case E_2) and 40% (case E_3). The turkey chicks PNA (non-starch polysaccharide) of lupine seeds resulted in an increase in viscosity digestive contents in the ileum ($p < 0.05$), with a negative effect on feed intake and feed grade recovery. Compared with the control group, the final weight of the turkey chicks E_3 was lower by 7.80%, feed intake was lower by 3.71%, feed consumption for one kilogram increase in weight was increased by 4.42% and the chest in the housing structure was lower by 1.54 percentage points. Introduction lupine in chickens turkeys and reduce the soy cakes had a positive influence on key economic indicators. Thus, compared with controls (LC), the experimental groups combined price of a kg forage decreased to 14.02% and feed costs per 1 kg gain in weight fell to 10.78% (turkeys in group E_2 lupine beans in food which accounted for 30% by weight of the feed).

Key words: lupine seed, protein, PNA (non-starch polysaccharide), turkey.

INTRODUCTION

In the context of the banning animal flours in diet and the high price of poultry products and by-products of soybean, lupine beans can be a promising alternative for the provision of own production plant protein in feed birds in our country. Climatic conditions of our country provides the prerequisites for obtaining a proper lupine grain production quantity and quality (Mierlita D., 2012). In Romania, cultivation and especially the use of white lupine beans bird feed is promoted as in other countries, though, is a viable alternative to soy grits from imports, both in terms of bio-productive and economically and environmentally . From ecological, white lupine has the advantage that it is not genetically modified, and because it can fix atmospheric nitrogen for fertilizer requires small amounts of chemical fertilizers, is considered as a sustainable culture positive effects on soil fertility and the environment.

Interest in using lupine beans in broiler diets is justified primarily by high protein content (40.08% Pb.), But also by the high energy (2658 kcal ME/kg) (Mierlita D., 2012). Most studies have shown that, by introducing lupine in proportions up to 25% of meat chickens results are similar to those provided by diets based on soya meals (Centeno et al., 1990; Brenes et al. , 1993; Lettner and Zollitsch 1995 Sitko and Cermac, 1998 Egorov et al., 2001 Nalle et al., 2010; Suchy et al., 2010; Mierlita D., 2012). Mierlita et al. (2012) concluded that to maintain growth performance of chickens, lupine flour can be inserted into food to a maximum of 30% and lupine can not fully substitute soy grits diet of broiler chickens.
The use of lupine as the sole source of protein for poultry is limited on the one hand the biological value protein (modest content in methionine, lysine, tryptophan and threonine - Strakova et al., 2006), and the high content in PNA (non-starch polysaccharide) which adversely affects the processes of digestion and recovery of food (Kocker et al., 2000; Brenes et al., 2002; Steenfeldt et al., 2003; Mieczkowski et al., 2004; Choct, 2006). Increasing the recovery of lupine in broiler nutrition can be achieved by using specific enzyme preparations or shelling beans, when they can be substituted 50% of the soy grits used in compound feed structure without modifying bio performance of offspring meat (Suchy et al., 2006).
Research has been designed to verify to what extent soybean meals turkey broiler chickens can be replaced partially free alkaloid lupine beans, watching the effect of the alternative sources of protein intake on digestion and feed conversion degree, and economic results.

MATERIAL AND METHODS

The experiment was conducted as a completely randomized experimental design consisted of four treatments which involve a control diet consisting of corn - soybean meals (LC) and three experimental diets (E_1, E_2 and E_3) at the oil cake proteins from soybean meal were replaced with free lupine alkaloids. This alternative source of protein for broiler chickens turkey was included in the structure of mixed fodder at a rate of 20% (case E_1), 30% (case E_2) and 40% (case E_3); thus substituting lupine seed up to 77% (stage 0-3 weeks), 81% (phase 3-9 weeks), 97% (stage 9-12 weeks) and 100% (after 12 weeks until slaughter) of proteins provided grits, soybean (table 1).
In experiment were used grain white lupine variety Energy (improved in France), cultivated in the climatic conditions of the region west of Romania, using seeds imported from Holland. All diets were formulated to contain similar levels of metabolisable energy, crude prteina and limiting amino acids (lysine and methionine + cystine), providing specific nutritional requirements of hybrid.

Table 1

The experimental design

Group	Treatment	Objectives
LC	Soybean meals	• influence of lupine grain on feed intake and digestion; • lupine beans influence the degree of bioconversion of feed; • influence of lupine grain on feed costs relative to 1 kg increase in weight.
E_1	Lupine seed – **20%**	
E_2	Lupine seed – **30%**	
E_3	Lupine seed – **40%**	

A total of 36 broiler turkeys, male, aged one day (Hybrid Grade Maker, imported from Austria) were divided randomly into four groups. Feed was administered at discretion, the amount of feed consumed was determined for each batch of chicken and that for each growth period (0-3, 3-6, 6-12 and 12-18 weeks) weighing. At slaughter control individual samples were collected from the small intestine digestive contents (ileum) in order to determine the viscosity of digestive Chile, which can give clues on the degree of digestion non-starch polysaccharide (PNA) present in lupine seeds. To determine the viscosity of the viscometer was used Brofild.
In order to determine the economic efficiency of soybean cakes partial substitution of broiler chickens turkey with Lupin, we calculated the total cost. To calculate the price of a kg of feed separate phases of growth, we considered commodity prices recorded in December 2013 on their free market. As an indicator of economic efficiency were considered incumbent feed costs for one kg increase in weight, given that all other costs were the same in all groups of chickens (the chickens a day, heating costs and providing conditions microclimate, labor costs, costs of veterinary actions, etc.

RESULTS AND DISCUSSION

The turkey chicks non-starch polysaccharide of lupine seeds resulted in an increase in viscosity digestive contents in the ileum ($p < 0.05$), with a negative effect on feed intake and feed grade recovery (Table 2). Similar results were obtained and Kocher et al. (2000); Steenfelddt et al. (2003) and Mierlita D., (2012) in previous research conducted on broiler chickens.

Table 2

Influence of lupine grain on viscosity of intestinal contents (cP)

Issue	Group			
	LC	E_1	E_2	E_3
Ileon	$1,43 \pm 0,21^{c}$	$1,87 \pm 0,14^{b}$	$2,07 \pm 0,41^{b}$	$2,68 \pm 0,32^{a}$

Lupin, although it has a high fat content, yet has a low energy value due to the high content in PNA (Kocker et al., 2000). It has been calculated that for every percentage of lupine in the diet of chicks, its energy value decreases

by 0.288 MJ ME/kg (Sipsas and Glencross, 2005) and by adding specific enzymes in food, apparent digestibility of energy increased by 3.2 percentage points (Boguslaw et al., 2010) and improves the use of proteins and amino acids (Wiryawan and Dingle, 1999; Kluge et al., 2002).
The introduction of lupine flour in large proportions in chickens turkey (40% - E_3) had a negative influence on feed intake but also on the degree of recovery of the food (Table 3, Table 4). The daily feed intake relative to the entire experimental period, decreased in the groups to which the feed was introduced lupine flour compared with LC group, with up to 3.7%. The average consumption of forage combined to achieve a kilo in weight based on the whole growth period (0-18 weeks) was almost equal to that in the control group, the experimental groups E_1 and E_2 which beans Lupin were within 30% of food structure and increased 4.43% when lupins accounted for 40% of fodder structure (where E_3).

Table 3

Influence of partial substitution of soybean meals white lupine, on feed intake.

Group	g feed/day/bird				Average for the period (0-18 week)
	0-3 week	3-6 week	6-12 week	12-18 week	
LC	46,1	162,3	364,0	788,7	419,0
E_1	47,1	172,1	359,9	766,8	412,1
E_2	45,3	168,9	346,5	764,1	405,9
E_3	45,6	160,5	333,5	773,9	403,5

LC – Control; E_1 – 20% lupin seed; E_2 – 30% lupin seed; E_3 – 40% lupin seed.

Table 4

Influence of partial substitution of soybean meals with white lupine beans, the degree of recovery of food on turkey broilers.

Group	Kg feed/kg weight gain				Average for the period (0-18 week)
	0-3 week	3-6 week	6-12 week	12-18 week	
LC	1,510	1,694	2,327	3,125	2,664
E_1	1,528	1,732	2,355	3,100	2,657
E_2	1,527	1,764	2,351	3,147	2,689
E_3	1,585	1,823	2,402	3,254	2,782

LC – Control; E_1 – 20% lupin seed; E_2 – 30% lupin seed; E_3 – 40% lupin seed.

In most studies published in the international literature says that the introduction of lupine beans broiler chickens in the amount up to 250 g/kg (without shelling beans without the use of enzyme preparations) did not affect growth performance and feed recovery if the diet is balanced in amino acids and mainly sulfur amino acids (Teixeira, 1995; Olver and Jonker, 1997; Roth-Maier and Paulicks, 2003), considering that the amount of sulfur amino acids in lupine beans are just 1/3 of that found in soy grits (0.5 vs. 1.5 g/100 g protein, Degussa, 1996). Introducing lupine beans in the diet of

broiler chickens, in proportions greater than 35%, reduce their production performance (Gilbert et al., 2000; Roth-Maier and Paulics 2003; Steenfeld et al., 2003) negative influence of lupine is attributed to the large amounts of PNA (non-starch polysaccharide). Analyzing the influence of partial substitution of soybean meals turkey chickens lupine flour, the average cost price of fodder, it is clear superiority in food E_3 which used the highest proportion of lupine and 40% (Table 5). Thus, compared with the control group (LC), the experimental groups combined price of a kg forage decreased to 14.02% and the chicken feed costs have dropped by 17.23%.

Table 5

The influence of introducing grain white lupine on the cost price of fodder (Ron/kg).

Issue	Group			
	LC	E_1	E_2	E_3
0 – 3 week	2,420	2,268	2,211	2,149
3 - 6 week	2,239	2,097	2,037	1,976
6 - 9 week	1,820	1,707	1,636	1,567
9 – 12 week	1,698	1,586	1,508	1,431
12 – 15 week	1,517	1,384	1,318	1,290
15 – 18 week	1,396	1,268	1,217	1,217
The average price (Ron/kg)	1,612	1,491	1,425	1,386
Differences from LC: - Ron/kg	-	-0,121	-0,187	-0,226
- %	-	-7,51	-11,60	-14,02

*specific prices of December 2013

LC – Control; E_1 – 20% lupin seed; E_2 – 30% lupin seed; E_3 – 40% lupin seed.

Introducing lupine beans in turkey broiler chickens at a rate of 30% and a corresponding reduction in the share of soybean meals resulted in lower feed costs for one kilogram increase in weight by 10.78% and 0.463 Ron/kg gain, thus totaling a savings of approx. 9 Ron slaughtered turkey (Table 6). Increasing the share of fodder lupine in structure to 40%, ensuring a significant reduction in feed costs for achieving a kilo (10.2% compared to controls), but due to significant reduction in the average weight of turkeys at slaughter age (with approx. 1.5 kg/turkey from the control group), we believe that there is an optimal solution for feeding broiler turkeys.

Table 6

Influence of white lupine beans introduction of feed costs accruing 1 kg increase in weight (Ron/kg gain).

Specificare	Lotul			
	LC	E_1	E_2	E_3
0 – 3 week (Ron/period)	2,343	2,241	2,100	2,054
3 - 6 week (Ron/period)	7,631	7,576	7,223	6,659
6 - 12 week (Ron/period)	26,891	24,885	22,877	20,986
12 – 18 week (Ron/period)	48,246	42,701	40,674	40,743
TOTAL (0-18 week) - Ron/period	85,111	77,403	72,874	70,442
- %	-	90,94	85,62	82,76
Expenses feed (Ron/kg gain)	4,294	3,961	3,831	3,856
Difference from LC: - Ron/kg	-	-0,333	-0,463	-0,438
- %	-	-7,75	-10,78	-10,20

LC – Control; E_1 – 20% lupin seed; E_2 – 30% lupin seed; E_3 – 40% lupin seed.

CONCLUSIONS

Substituting soy protein meals in broiler chickens turkey by inserting white lupine beans free of alkaloids in structure combined feed rate of up to 30% (% by weight) has no negative effect on intake, processes digestion and the degree of recovery of the food, but the advantage that feed costs per 1 kg gain in weight decreases by up to 10.78%.

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