EFFECT OF SUBSTITUTION ROCKET SEED MEAL AS A SOURCE OF PROTEIN FOR SOYBEAN MEAL IN DIETS OF NEW ZEALAND WHITE RABBITS

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ABSTRACT

The present study aimed to evaluate the effect of replacing three levels from rocket seed meal (RSM) as a partial or complete replacement of soybean meal (SBM) protein of the control diet on growth performance, digestibility and blood characteristics in growing New Zealand White (NZW) rabbits. RSM contributed 0, 5, 10.5 and 21 % of the diet. Thirty-six, 8 weeks old growing NZW rabbits were distributed randomly and equally into four experimental groups, each of 9 animals. Each group of rabbits was fed one of four experimental diets (16% crude protein and 12% crude fiber on average). The study lasted for a period of 6 weeks. The results showed that feeding rabbits 10.5% RSM in their diet compared to the control group during the whole experimental period resulted in significant ($P<0.01$) improvement in total weight gain by 15.1% (1042 vs. 905 g), feed conversion ratio by 12.3% (3.84 vs. 4.38), total feed consumption increased by 1.3% (4004 vs. 3953 g). The group fed 21% RSM-diet showed body weight gain and feed conversion ratio not significantly different from those of the control. Viability was similar in all the experimental groups (7 to 8 out of 9). Digestibility coefficients of most nutrients and the nutritive values were significantly ($P<0.01$) improved in the group fed 10.5% RSM-diet as compared to the control (e.g. 77.5 vs. 74.2% for dry matter, 69.1 vs. 66.2% for N and 53.4 vs. 38.4% for crude fiber digestibility). Serum total protein, albumin and cholesterol were significantly affected by different treatments; however, serum urea-N and GPT were not affected. It can be concluded that RSM at 10.5% level of the diet in NZW rabbits had the best results without adverse effects on growth performance, kidney or liver function.

Key words: Rocket seed meal, Performance, Digestibility, Carcass, Blood constituents.

INTRODUCTION

There is a shortage in animal protein in Egypt, rabbits could participate in solving this problem, but feed cost of rabbit production is still expensive. There are a large amount of crops, vegetables and fruit residues could be a new source of feedstuff with low price and high quality proteins which can be used to solve feed shortage and produce least cost diets for rabbits. Production of rocket in Egypt has been stead increased for the strong demand to volatile oils for pharmaceutical purpose. This plant was found to be incarnate the body condition to counteract the stress of illness (Eisenberg *et al.*, 1993). The rocket seeds contain carotenoids, vitamin C, flavonoids such as appiin and luteolin and glucosinolates the precursors of isothiocyanates and sulfaraphene (Talalay and Fahey, 2001), volatile oils like myristicin, apiole β-phellandrene (Bradley, 1992; Leung and Foster, 1996). Glucosinolates were found to have several biological activities including anticarcinogenic, antifungal, antibacterial plus their antioxidant action (Kim *et al.*, 2004). They also contain Zn, Cu, Fe, Mg, Mn and other elements (Abdo, 2003) which increase immune response. After oil removal, rocket seed meal (RSM) could be used as a protein-rich meal for feeding rabbits with crude protein about 32% (El-Nattat and El-Kady, 2007). This product is expected to increase in near future due to high demand of the extracted oil; consequently utilizing the by-product may cause some environmental problems if not adequately utilized. When adequately supplemented, RSM may constitute a good vegetable protein source for use in rabbit diets in region where RSM is readily available and relatively inexpensive. RSM may used to replace the imported SBM and in the main time reduces the cost of rabbits feeding.

The study reported herein was undertaken to investigate the effect of feeding different levels of RSM (0, 5, 10.5 and 21%) on growth performance, digestibility and blood characteristics in growing New Zealand White (NZW) rabbits.

MATERIALS AND METHODS

Animals and experimental design

This work was carried out at the Rabbit Research Laboratory, Department of Animal and Fish Production, Faculty of Agriculture (Saba Basha), Alexandria University. Thirty-six males of growing NZW rabbits of 8 weeks old were distributed randomly and equally into four treatments groups, each of 9 animals. Each group was sub-divided into three replicates with three animals each. Rabbits were housed in wire floor batteries of 45 x 36 x 36 cm and were offered diets for duration of the feeding trial until reaching 14 weeks of age. All animals were kept under similar hygienic conditions. Rabbits were housed in well ventilated block building. Fresh air circulated in the house using exhaust fans. Temperature during the experimental periods varied between 16 and 22°C. The rabbits were kept within a cycle of 16 h light and 8 h dark.

Four pelleted diets were prepared using rocket seed meal (RSM) as a partial or complete replacement of soybean meal (SBM) of the control diet. RSM contributed 0, 5, 10.5 and 21% of the diet. RSM contained 36.0% crude protein, 7.6% ether extract, 7.6% crude fiber, 41.9% nitrogen free extract and 6.8% ash. Slight modification was done in feed ingredients to make diets nearly iso-nitrogenous and iso-caloric and also to keep the crude fiber percentages of the experimental diets nearly the same. Table 1 shows feed ingredients and chemical analysis of the experimental diets.

Table 1: Feed ingredients and chemical composition of the experimental diets

	RSM 0% (Control)	RSM 5%	RSM 10.5%	RSM 21%
Ingredients (%)				
Clover hay	33.0	32.0	31.0	29.0
Yellow corn	20.0	20.0	18.0	15.0
Wheat bran	15.0	14.5	16.3	19.3
Barley grain	12.3	12.3	12.0	11.0
Soybean meal	15.0	11.3	7.5	-
Rocket seed meal	-	5.2	10.5	21.0
Molasses	3.0	3.0	3.0	3.0
Limestone	1.0	1.0	1.0	1.0
Common salt	0.5	0.5	0.5	0.5
Mineral and vitamin premix[1]	0.2	0.2	0.2	0.2
Chemical composition (%DM):				
Dry matter (%)	93.1	92.9	92.7	92.5
Organic matter	92.8	92.9	92.8	92.6
Crude protein	16.0	15.8	15.8	15.7
Ether extract	2.7	2.9	3.2	3.6
Crude fiber	12.0	12.0	12.0	12.0
Nitrogen free extract	62.2	62.3	61.8	61.3
DE (kcal/kg DM)	3136	3148	3162	3176

[1]Vitamin and mineral premix per kg contained: Vit. A 2.000,000 IU, Vit. D3 150,000IU, Vit. K 0.33 mg, Bit. B1 0.33 g, Vit. B2 1.0 g, Vit. B6 0.33g, Vit. B12 1.7 mg, Pantothenic acid 3.33 g, Biotin 33 mg, Folic acid 0.83, Choline chloride 200 mg, Zn 11.7 g, Mn 5.0 g, Fe 12.5g, Mg 66.7 mg, Se 16.6 mg, Co 1.33 mg, Cu 0.5 g, I 16.6 mg and Antioxidant 10.0 g

Each group of rabbits was fed one of four experimental diets. Fresh water was automatically available at all times through stainless steel nipples for each cage. The experimental diets were offered to rabbits *ad libitum*. Individual body weight and feed consumption were recoded weekly. Blood samples were individually collected at 14 weeks of age from each rabbit in non heparinized glass tubes to estimate blood parameters. Blood serum was separated by centrifugation at 3000 rpm for 15 minutes. The collected serum was stored at –18ºC until analysis. At 15 weeks of age, a digestibility trial was done using three male animals per group.

Chemical analyses

Total protein, albumin, total lipids, cholesterol, glutamic pyrovic transaminase (GPT) and urea-N concentrations in serum were estimated using commercial kits (Bio Merieux, France) according to the procedure outlined by the manufacturer. Chemical analysis of the tested diets and faeces were carried out according to AOAC (1994). Digestible energy (DE) of the experimental diets was calculated according by the equation described by Maertens and De Groote (1987) cited by Fekete (1987).

Statistical analysis

Data were statistically analyzed according to SAS (1994). The significant differences between means were tested by using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The effects of different levels of RSM on rabbit performance are shown in Table 2. The results showed that rabbits fed 10.5% RSM-diet were improved significantly in total weight gain by the value of 15.1%, feed conversion ratio by 12.3%, total feed consumption by 1.3% as compared to control group during the whole experimental period. The group fed 21% RSM-diet recorded the same body weight gain and feed conversion ratio as those recorded in the control group. Also, feed consumption was not different in the groups fed 5, 10.5 and 21% RSM-diets and surpassed the control rabbits by 0.6, 1.3 and 1.4%. Viability was similar in all the experimental groups.

Table 2: Effect of dietary replacement of SBM by RSM on growth performance and economical efficiency

	Experimental diets				Significance
	RSM 0% (Control)	RSM 5%	RSM 10.5%	RSM 21%	
Initial body weight (g)	942	957	927	921	NS
Total weight gain (g)	905±19.0^{b}	924±39.3^{b}	1042±21.2^{a}	878±47.3^{b}	0.01
Total feed consumption (g)	3953±24.7^{b}	3978±19.4^{ab}	4004±8.8^{a}	4008±4.9^{a}	0.01
Feed conversion ratio	4.38±0.40^{ab}	4.21±0.19^{b}	3.84±0.36^{c}	4.57±0.25^{a}	0.01
Viability (n)	8/9	7/9	8/9	8/9	-

Digestion coefficients values presented in Table 3 showed that 10.5% RSM-diet brought a significant improvements in dry matter (DM) by 4.4%, organic matter (OM) by 4.7%, crude protein (CP) by 4.4% and crude fiber (CF) by 39.1% and also the nutritive values of this group were more efficiently as the digested crude protein (DCP) increased by 2.8% and metabolizable energy (ME) by 4.3% in comparison with control).

The group fed 21% RSM-diet was not significantly different from the control group in digestion coefficients of CP, CF, EE and NFE. Our results were in agreement with those of EL-Nattat and EL-Kady (2007). They indicated that 9% RSM in the diet gave the best final body weight and feed conversion ratio compared to control. These improvements may be attributed to the properties of this material that act not only as antibacterial, antiprotozoal and antifungal but also as antioxidant (Bradley, 1992; Leung and Foster, 1996).

Serum total protein and globulin of rabbits fed 10.5% RSM-diet were significantly higher than those fed the control diet, while, serum albumin and total lipids were not significantly affected by different treatments. Serum cholesterol was significantly increased in the groups fed diets containing RSM – diets in comparison with the control group; however, serum glutamic pyrovic transaminase (GPT) was insignificantly decreased with increasing level of RSM in the diet. Abdo (2003) reported that including RSM in the diet resulted in significant decrease in serum GOT and GPT activities. This decrease may be due to their antioxidant status as reported by Bradley (1992).

Table 3: Effects of dietary replacement of SBM by RSM on nutrients digestibility coefficients and diets nutritive value

	Experimental diets				Significance
	RSM 0%	RSM 5%	RSM 10.5%	RSM 21%	
Apparent digestibility coefficients:					
Dry matter (DM)	74.2±3.1[b]	74.0±1.5[b]	77.5±2.2[a]	70.8±2.1[c]	0.01
Organic matter (OM)	73.8±1.4[b]	73.6±2.5[b]	77.3±0.8[a]	70.0±1.9[c]	0.01
Crude protein (CP)	66.2±1.0[b]	68.9±1.4[a]	69.1±0.8[a]	66.0±1.3[b]	0.01
Ether extract (EE)	82.3±2.8	85.5±3.6	84.3±1.0	81.5±1.4	NS
Crude fiber (CF)	38.4±2.1[c]	49.6±0.6[b]	53.4±2.2[a]	40.1±0.9[bc]	0.01
Nitrogen free extract (NFE)	80.2±3.1[ab]	78.8±1.9[ab]	83.6±2.7[a]	76.2±1.2[b]	0.05
Nutritive value:					
Digestible protein (%)	10.6±0.11[b]	10.9±0.20[a]	10.9±0.13[a]	10.4±0.14[b]	0.05
ME (kcal/kg DM)[1]	3047±77[b]	3040±75[b]	3178±33[a]	2921±77[c]	0.01

[1]according to Maertens and de Groote (1987)

Table 4: Effect of dietary replacement of SBM protein by RSM protein on carcass traits and serum blood constituents

	Experimental diets				Significance
	RSM 0% (Control)	RSM 5%	RSM 10.5%	RSM 21%	
Total protein (gm/dl)	6.07±0.06[c]	6.47±0.16[b]	6.92±0.09[a]	6.15±0.03[c]	0.05
Albumen (gm/dl)	4.42±0.24	4.77±0.04	4.91±0.05	4.51±0.24	NS
Globulin (gm/dl)	1.68±0.22[b]	1.70±0.12[b]	2.00±0.11[a]	1.64±0.21[b]	0.01
Total lipids (mg/dl)	264±3.52	259±5.81	254±0.87	256±2.05	NS
Cholesterol (mg/dl)	69.9±0.95[b]	72.2±0.37[a]	73.1±0.38[a]	73.6±0.07[a]	0.05
Urea-N (mg/dl)	30.2±1.26	30.1±0.58	29.9±0.80	30.7±0.42	NS
GPT (U/ml)	33.5±7.77	32.0±4.24	29.1±2.90	29.0±1.79	NS

CONCLUSIONS

It can be concluded that rocket seed meal at 10.5% level of the diet in NZW rabbits had the best results without adverse effects on the growth performance, kidney or liver function, however further studies are needed in this aspect.

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