

Determination of the optimum inclusion level of faba beans in diet of broiler chicks

M SHAMS SHARGH¹ and M AHANI AZARI²

Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

Received: 5 December 2009; Accepted: 31 May 2010

Key words: Antinutritional, Broiler, Faba bean, Heated, Performance

Cultivated faba bean is used as human food in developing countries and as animal feed, mainly for pigs, horses, poultry and pigeons in industrialized countries. Despite its high quality proteins, faba bean contains several possible antinutritional factors that decrease nutritional value of seeds for growing chickens (Rubio *et al.* 1990). These antinutritional factors are uncommon in cooked beans (Lawes 1980). Faba bean contains other objectionable factors including, cyanogens, favogens, phytic acid, tannins, and tripsin inhibitors (Williams *et al.* 1988). The main factors responsible for favism, which can occur in susceptible people, are believed to be glucoside vicine and convicine and their hydrolytic derivatives divicine and isouramil, respectively.

The aim of the present study was to evaluate the effect of adding Barkat variety of faba bean on some growth and carcass traits of broilers. Increasing feed costs (especially imported Soya bean meal), lower price of pest-attacked faba beans in the north of country, and high protein content of faba beans provided considerable reasons for studying possibility of their inclusion in poultry diets.

This study was conducted in experimental station of agricultural faculty of Gorgan University to determine the optimum level of inclusion of raw and heated (20 min in boiling water and dried by hot air) faba beans in diets of broilers. In a completely randomized design, 420 male broiler chicks (Lohman) were distributed in seven treatments with four replicate of 15 birds each. Broiler chicks were fed diets containing 0, 6, 12 and 18% heated and raw faba beans for a period of six weeks (dividing to starter (0–21 days) and growth (22–42 days)). UFFDA software was used to balance rations, having equal metabolizable energy and protein levels. At all times the chicks had access to feed and water freely. Composition of the treatments in starter and finisher periods is presented in Table 1. To evaluate carcass traits (carcass yield %, abdominal fat %, liver and gal bladder %, pancreas % and femur and breast %), in the end of experiment (42nd day), 28 chicks (one from each experimental unit), having

closest weight to the group mean weight, were slaughtered. To analyze studied traits mathematical model 1 was used:

$$Y_{ij} = \mu + \alpha_i + e_{ij} \quad (1)$$

where Y_{ij} , μ , α_i and e_{ij} are the observations (measured traits), total mean, treatment and random error effects respectively. Data were analyzed, using statistical package SAS, and the means were compared by Duncan's method ($\alpha=5\%$).

There are no significant differences in growth rate, feed intake and feed conversion rate (Table 2) in chicks ($P>0.05$).

The results also suggested that, the chicks, which were given diets containing processed faba beans had lower pancreas weight in compare to birds, feeding raw faba beans. Results of comparison of carcass traits in the end of experiment (42nd day) are presented in Table 3. Difference of pancreas weight in treatment containing 18% processed faba beans in comparison to other rations was significant ($P<0.05$). Based on the results, differences of other parts of carcass was nonsignificant ($P>0.05$). However diets containing processed faba beans in comparing to other resulted in lower abdominal fat, liver and gal bladder percents (Table 3).

Although differences between means of growth rate, feed intake and feed conversion rate were nonsignificant ($P>0.05$), but chicks feeding rations containing heated faba beans in comparison to raw faba beans not only had significantly better growth rate and feed conversion rate, but also a lower feed intake. The better growth rate may be because of inactivity of antinutritional factors in heated faba beans or better digestion of NSP, lowering viscosity of digestions in intestine, better availability of digestions by enzymes and better absorption of nutrients. According to Boldaji *et al.* (1986), autoclaving white beans increases AME and TME and significant increase in body weight of chicks in the final week, probably because of elimination of antinutritional factors or deformation of pectin compounds.

There was not any significant difference (Table 3) between abdominal fat and liver percents, but in some cases differences in pancreas % were significant ($P<0.05$). The lowest (0.20) and most values (0.32) of pancreas % are related to rations including 18% processed and raw faba beans respectively. The

Present address: ^{1,2}Department of Animal Sciences, Agricultural faculty (e mail: mojtaba_9@yahoo.com)

Table 1. Contents of the treatments¹ in starter and finisher periods and their nutrients

Feed components	Starter (0–21 days)				Finisher (22–42 days)			
	Control	6%	12%	18%	Control	6%	12%	18%
Corn (CP=8.15%)	61.21	58.58	54.14	49.74	67.50	58.58	54.14	49.74
SBM (CP=47%)	33.77	31.18	28.90	26.62	27.54	31.18	28.90	26.62
Faba bean (CP=23.68%)	0.00	6.00	12.00	18.00	0.00	6.00	12.00	18.00
Crude soybean oil	0.30	0.36	1.05	1.73	0.20	0.36	1.05	1.73
DCP	1.44	1.43	1.42	1.41	1.02	1.43	1.42	1.41
CACO ₃	1.27	1.28	1.28	1.29	1.34	1.28	1.28	1.29
Salt	0.42	0.41	0.40	0.39	0.32	0.41	0.40	0.39
Vit. and Min. supplements ² (0.25 + 0.25%)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
DL-methionin	0.13	0.15	0.17	0.19	0.04	0.15	0.17	0.19
Antioxidants	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Salinomycine	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sand	0.88	0.03	0.05	0.05	1.46	0.03	0.05	0.05
Total	100	100	100	100	100	100	100	100
Calculated Me and nutrients								
ME (Kcal/kg)	2900	2900	2900	2900	2950	2950	2950	2950
Protein	20.86	20.86	20.86	20.86	18.44	18.44	18.44	18.44
Ca	0.91	0.91	0.91	0.91	0.83	0.83	0.83	0.83
Available P	0.45	0.41	0.41	0.41	0.32	0.32	0.32	0.32
Na	0.18	0.18	0.18	0.18	0.14	0.14	0.14	0.14
Lysine	0.16	0.16	0.17	0.18	0.99	0.99	1.00	1.00
Methionin	0.47	0.47	0.48	0.48	0.35	0.35	0.35	0.36
Met.+cystine	0.82	0.82	0.82	0.82	0.67	0.66	0.66	0.66

¹Besides of controls, only diets containing raw faba beans are present. Composition of diets containing heated faba beans is the same as in diets with raw cases and there are not any other differences; ²Including 0.25% vitamin supplement plus 0.25% mineral supplement.

Every 2.5 kg of vitamin supplement included 9000000 IU vit. A, 2000000 D₃, 18000 E, 2000 mg K₃, 1800 mg B₁, 6600 mg B₂, 10000 mg B₃, 30000 B₅, 3000 B₆, 1000 B₉, 15 mg B₁₂, 100 mg H₂, 500000 mg coline chloride; and every 2.5 kg mineral supplement included 100000 mg Mn, 50000 mg Fe, 100000 mg Zn 10000 mg Cu, mg I, 200 mg Se.

Table 2. Effect of treatments on growth rate, consumed feed and feed conversion rate

Treatments	Starter (0–21 days)			Finisher (22–42 days)			Whole period (0.42 days)		
	GR ³ (g)	FI ⁴ (g)	FCR ⁵ (g)	GR (g)	FI (g)	FC (g)	GR (g)	FI (g)	FCR (g)
Control	612.02	931.28	1.52	1509.23	3005.46	1.99	2121.25	3906.31	1.84
6% RFB ¹	617.50	922.17	1.49	1520.17	3010.49	1.98	2137.67	3898.64	1.82
6% PFB ²	619.42	911.55	1.47	1540.04	3037.86	1.97	2159.46	3909.96	1.81
12% RFB	618.20	928.40	1.50	1534.56	3039.44	1.98	2152.76	3918.29	1.82
12% PFB	622.90	916.70	1.47	1576.09	3092.22	1.96	2198.99	3991.20	1.81
18% RFB	619.16	936.94	1.51	1541.67	3072.93	1.99	2160.83	3978.92	1.84
18% PFB	619.87	906.04	1.46	1542.14	3025.60	1.96	2162.01	3870.98	1.79
S.E.	9.80	28.30	0.03	50.40	68.20	0.04	55.20	72.60	0.03

*There are no significant differences between different treatments ($P>0.05$), in spite of that any common alphabets is used avoiding noises in the Table.

1, Raw faba beans; 2, procesed (heated) faba beans; 3, growth rate; 4, feed take; 5, feed conversion rate.

increased pancreas relative weight in rations containing 18% raw faba beans probably concerns to more content of dietary trypsin inhibitors of seeds. Rubio *et al.* (1989) reported increase of relative pancreas weight in chicks, induced by this factor, but Ahmed *et al.* (1991) showed pancreatic hypertrophy in chicks consuming diets containing tannins.

Meanwhile, the least relative liver and abdominal fat

weights in chicks feeding diets containing 18% processed faba beans are observed ($P<0.05$). Other studies support reduction of relative weights of these organs in enzyme added feeds (Brenes *et al.* 2002). Salih *et al.* (1991) reported increasing in the liver size of chicks fed rations with high level of NSP concerns to more activity of this organ to produce more gal bladder acids. Differences of relative

Table 3. Comparison of carcass traits at the end of experiment (42nd day)

Treatments	Carcass	Abdominal	Liver	Pancreas %	Femur %	Breast %
Control	76.87	2.66	2.85	0.24 ^{bc*}	28.25	32.85
6% RFB ¹	77.13	2.80	2.94	0.24 ^{bc}	28.62	32.60
6% PFB ²	77.27	2.67	2.60	0.23 ^{bc}	28.10	32.84
12% RFB	76.42	2.90	2.97	0.28 ^{ab}	28.15	33.39
12% PFB	76.84	2.58	2.62	0.25 ^{abc}	28.70	32.90
18% RFB	76.29	2.70	2.90	0.32 ^a	28.91	33.35
18% PFB	78.36	2.46	2.61	0.20 ^c	28.50	33.02
S.E.	0.33	0.21	0.26	0.023	0.51	0.81

1, Raw faba beans; 2, processed (heated) faba beans; *means with different superscript differ significantly.

weights of femur and breast in all treatments were nonsignificant ($P>0.05$) (Table 3).

Totally on the basis of results, it is possible to include faba beans, especially processed faba beans, in the broiler rations without any reductions in performance of the chicks. Over the past few years the feed costs have increased and now-a-days feed costs amount to about 70% of the total production costs of broiler meat, so according to the findings of this study it is wise and economical to substitute some of Soya bean meals content by faba beans, which is cheaper and abundant in the North of Iran without any reduction in gain and carcass traits of broiler chicks.

SUMMARY

This study was conducted to determine the optimum level of raw and processed (boiled in water for 20 min) faba beans in broiler diets. Male Lohman chicks (420) were fed with different levels of faba beans in a period of 42 days and their performance were compared in a completely randomized design with seven treatments and four replications of 15 chicks for each treatment. The diets contained 0, 6, 12 and 18% raw and processed faba beans and all of them had the same metabolizable energy and protein level and other nutrients recommended by NRC. Although, no significant differences were found between treatments, but gains and feed conversions were apparently better in the groups fed with processed faba beans than other treatments. Relative weight of pancreas of the groups fed with processed faba beans than other treatments. Relative weight of pancreas of the groups fed with processed faba bean were lower than that of the groups fed with raw faba beans. Meanwhile any significant differences in carcass characteristics were not found between different treatments ($P>0.05$).

REFERENCES

- Ahmed A E, Smithard R and Ellis M. 1991. Activities of enzymes of the pancreas and the lumen and mucosa of the small intestine in growing broiler cockerels fed on tannin containing diets. *British Journal of Nutrition* **65**: 189–97.
- Boldaji F, Goeger M P, Nakaue H S, Savage T F and Arcsott G H. 1986. Effect of autoclaving and cooking on true metabolizable energy (TME) and N-corrected TMEn content of white lupin, yellow peas and faba beans. *Nutrition Reports International* **34**: 159–64.
- Brenes A, Marquardt R R, Guenter W and Viverost A. 2002. Effect of enzyme addition on the performance and gastrointestinal tract size of chicks fed lupin seed and their fractions. *Poultry Science* **81**: 670–78.
- Lawes D A. 1980. Recent developments in understanding, improvement and use of *Vicia faba*. (Eds), *Advances in Legumes Science. Proceedings of the International Legume Conference*. Summerfield R J and Bunting A H. p. 625–36. Kew, 31 July–4 august 1978. Royal Botanic Garden, Kew, the Missouri Botanical Garden, and the University of Reading, UK.
- Rubio L A, Brenes A and Castano M. 1990. The utilization of raw and autoclaved faba beans (*Vicia faba* L., var. *minor*) and faba bean fractions in diets for growing boiler chickes. *British Journal of Nutrition* **63**(3): 419–30.
- Rubio L A, Brenes A and Castano M. 1989. Histological alterations to the pancreas and the intestinal tract produced by raw faba bean (*Vicia faba* L. *minor*) diets in growing chicks. *British Journal of Poultry Science* **30**(1): 101–14.
- Salih M E, Classons H L and Campbell G L. 1991. Response of chickens fed on hull-less barley to dietary β -glucanase at different ages. *Animal Feed Science and Technology* **33**:139–49.
- Williams, P C, Bhatta R S, Deshapande S S, Hussein L A and Savage G P. 1988. Improving quality of cool season food legumes. *World Crops: Cool Season Food Legumes*. p.113–29. (Ed.) Summerfield R J. Kluwer Academic Publishers, Dordrecht, the Netherlands.