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Corresponding author: V. Dotas
(vdotas@agro.auth.gr)

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DIETARY EVALUATION OF FABA BEAN SEEDS IN BROILERS

GOURDOUVELIS, D.[1], DOTAS, V.[1], MITSOPOULOS, I. [2], NIKOLAKAKIS, I.[3] and D. DOTAS[1]

[1] Faculty of Agriculture, Aristotle University of Thessaloniki, GR 54124, Thessaloniki, Greece
[2] Technological Educational Institute of Thessaloniki, GR 57400, Thessaloniki, Macedonia, Greece
[3] Technological Educational Institute of W. Macedonia, Florina Branch, GR 53100, Florina, Greece

ABSTRACT

The aim of this study was to estimate the apparent (AME) and true (TMEn) metabolizable energy and the digestibility of crude protein (CP) of faba bean seeds (FBS) of the Greek cultivar "Polikarpi" in broilers diets. Forty eight broilers were randomly allocated into 4 dietary treatments (C, B_{100}, B_{200} & B_{300}) and placed in individual cages. Birds in treatment C were fed on a commercial diet based on wheat, maize and soybean meal, while those in treatments B_{100}, B_{200} & B_{300} were fed on the same diet with a proportion of 100, 200 and 300 g/kg of diet C replaced by FBS, respectively. The equilibrium in Ca, P and methionine-cystine of the test diets was achieved by the addition of monocalcium phosphate and methionine. The experiment lasted 15 days (counting from the 28th d of age). The first 4 days needed for the adaptation of birds in cages, the next 7 days was the duration of the pro-experimental period and the last 4 days needed for the excreta collection. Birds consumed 80 g of feed per day. Metabolic N determination (using Fe_2O_3 as marker) lasted 28 hours. The AME & TMEn and the digestibility of CP of both diets and FBS were determined by the method of difference. Final BW of birds significantly (P<0.05) decreased in B_{300} treatment compared to the other treatments. Apparent and true digestibilities of CP in diets were not significantly affected by the replacement with FBS up to the level of 300 g/kg. Apparent and true digestibility of CP in FBS significantly (P<0.05) decreased at the inclusion rate of 300 g/kg. AME & TMEn of FBS were estimated equal to 11.2 & 11.5 MJ ME/kg, respectively. FBS "Polikarpi" are a worthy alternative protein & energy source for broilers without having any adverse effects in diets digestibility and broilers performance. Feeding trials in large scale units are needed to verify the results of current study.

Keywords: faba bean seeds "Polikarpi", broilers, metabolizable energy, crude protein.

Abbeviations: FBS, faba bean seeds; AME, apparent metabolizable energy; TMEn, true metabolizable energy, corrected to zero nitrogen retention; CP, crude protein.

1. INTRODUCTION

While the inclusion of meat and bone meal in poultry diets has been banned in the European Union (since 2000), the research on vegetable-based protein sources has grown (Diaz et al., 2006; Palander et al., 2006). Because of its high nutritional value, soybean became the main vegetable protein source in poultry nutrition. Throughout Europe today there is also a growing resistance against the use of GMO. Most of legume seeds are worthy alternative sources for energy and protein to soybean meal, so they can be used at various percentages in poultry diets (Gatel, 1994). Faba bean seeds (FBS) (*Vicia faba*) are widely used in the Mediterranean region as source of protein (Larralde et al., 1989; Wiseman et al., 2003). However, the occurrence of some antinutritional factors such as tannins, protease inhibitors, lectins, polyphenols, saponins, phytates, etc., has hampered a wider nutritional utilization of this legume (Gupta, 1987; Wiseman et al. 2003; Palander et al., 2006). FBS energy value and crude protein affected by those factors and their crude fibre (CF) content (Kluth et al., 2005).

The aim of this study was to estimate the nutritive value of a Greek cultivar of FBS by defining their AME & TMEn and their CP digestibility in broiler diets at inclusion rates 100, 200 and 300 g/Kg.

2. MATERIALS AND METHODS

In this study were used FBS of the Greek cultivar "Polikarpi".

Table 1. The content of faba bean seeds "Polikarpi" in nutrients.

Nutrients	g/kg DM
Crude protein	265.7
Ether extract	14.5
Crude fibre	77.3
Ash	52.0
Ca	1.0
P (total)	5.5
Lysine	15.8
Methionine+Cystine	5.7

Forty eight (48) COBB-500 broilers (24 male & 24 female) were used. Birds were randomly separated into four equal dietary treatments with 6 male and 6 female broilers in each of them. The broilers were placed in individual cages in vertical decks of a digestibility chamber. Birds consumed 80 g/d of four diets (each per treatment, C, B_{100}, B_{200} & B_{300}). Fe_2O_3 was used as indigestible marker (3g/kg). The procedure for the endogenous nitrogen losses estimation lasted 28h and was divided in 4 sub-periods, as following: Allowance of diet with marker for 4h, fasting period of 16h, allowance of N-free diet for 4h and finally re-allowance of diet with marker for another 4h. The composition of N-free diet was the following: sucrose (815 g/kg), corn seed oil (100 g/kg), ground wheat straw (30 g/kg) and vitamins & trace minerals premix (55 g/kg).
Metabolizable energy (ME) of FBS was estimated by the method of difference. Crude protein was determined according to experimental procedure described by Bragg et al. (1969). Colorless excreta derived from N-free diet were used for the determination of endogenous nitrogen determination.

Table 2. Composition and proximate analysis[1] of experimental diets.

Ingredients (g/kg)	*C*	*B_{100}*	*B_{200}*	*B_{300}*
Corn	420.00	378.00	336.00	294.00
Soybean meal	320.00	288.00	256.00	224.00
Wheat	160.00	144.00	128.00	112.00
Faba bean seeds		100.00	200.00	300.00
Soybean oil	15.00	13.50	12.00	10.50
Vegetable fat	14.00	12.60	11.20	9.80
Skimmed milk	15.00	13.50	12.00	10.50
$CaCO_3$	16.00	14.40	12.80	11.20
Monocalcium phosphate	12.50	11.25	10.00	8.75
Sodium carbonate	3.00	2.70	2.40	2.10
Salt	3.00	2.70	2.40	2.10
L-Lysine-HCL	3.50	3.15	2.80	2.45
D,L Methionine (99%)	3.00	2.70	2.40	2.10
Threonine	2.00	1.80	1.60	1.40
Formic acid	2.50	2.25	2.00	1.75
Vitamin + Trace minerals premix	2.50	2.25	2.00	1.75
Probiotic	2.00	1.80	1.60	1.40
Xylanase	2.00	1.80	1.60	1.40
Phytase	2.00	1.80	1.60	1.40
Coccidiostatic	2.00	1.80	1.60	1.40
Calculated copmosition (g/kg)				
Crude protein	226.2	227.2	228,3	229,3
Ether extract	66.7	61.3	56.0	50.6
Crude fibre	33.2	36.8	40,3	43.9
Ash	54.6	54.3	54,1	53.8
Lysine	14.0	14.2	14.4	14.6
Methionine+Cystine	10.0	9.6	9.2	8.8
Calcium	10.0	9.1	8.2	7.3
P (total)	6.9	6.8	6.6	6.5
Metabolizable energy(MJ/kg)	13.17	12.89	12.62	12.34

3. RESULTS

Final BW of birds was significantly (P<0.05) reduced in treatment B_{300}. Endogenous N showed a significant increase (P<0.05) as the inclusion rates of FBS were increased (Table 3). Apparent and true (total tract) CP digestibility of FBS showed a linear reducing tendency by increasing inclusion rates of FBS. This reduction was significant (P<0.05) at the level of 300 g/kg FBS. This tendency was similar in both male and female birds. It was also not detected significant interaction between diet x sex as far as $CATTD_{CP}$ & $CTTTD_{CP}$ of FBS were concerned.

The calculations and estimations concerning apparent and true metabolizable energy values of experimental diets and FBS (AME and TME_n, respectively) are shown in Table 4. From this table it can be conducted that AME of the diets showed a linear decrease which was significant in diets B_{200} & B_{300} as compared to B_{100} ones.

Table 3. Nitrogen balance (g/bird/day) of FBS in broiler diets.

		FBS inclusion (g/kg)		
Parameters		**100**	**200**	**300**
Number of birds[2] (n)		12	12	12
Feed intake (g/bird/day)		8.00	16.00	24.00
Dietary nitrogen (N)		0.290	0.580	0.870
N in excreta	M	0.061[a]	0.135[b]	0.220[c]
	F	0.066[a]	0.143[b]	0.232[c]
	T	**0.064[a]**	**0.139[b]**	**0.226[c]**
Endogenous N	M	0.013[a]	0.028[b]	0.035[c]
	F	0.012[a]	0.026[b]	0.033[c]
	T	**0.013[a]**	**0.027[b]**	**0.034[c]**
$CATTD_{CP}$[3]	M	0.788[a]	0.768[ab]	0.747[b]
	F	0.772[a]	0.753[ab]	0.733[b]
	T	**0.780[a]**	**0.760[ab]**	**0.740[b]**
$CTTTD_{CP}$[4]	M	0.834[a]	0.816[ab]	0.787[b]
	F	0.814[a]	0.798[ab]	0.771[b]
	T	**0.817[a]**	**0.807[ab]**	**0.779[b]**

[1] Means.
[2] Total number of birds per treatment (6 male, 6 female).
M: Male, F: Female, T: Total.
[3] $CATTD_{CP}$: Coefficient of apparent total tract digestibility of CP.
[4] $CTTTD_{CP}$: Coefficient of true total tract digestibility of CP.
[a, b, c] Means in the same row sharing a different superscript are significantly different (P<0.05).

Table 4. Apparent (AME) and true (TME_n) metabolizable energy (kcal/kg) of experimental diets and FBS.

		Treatments			
		C	*B_{100}*	*B_{200}*	*B_{300}*
Parameters					
Total number of birds[2] (n)		12	12	12	12
AME of diet	M	3113[a]	3049[ab]	2985[b]	2924[c]
	F	3081[a]	3014[ab]	2950[b]	2890[c]
	T	**3097[a]**	**3031[ab]**	**2967[b]**	**2902[c]**
AME of FBS	M		2790[a]	2725[b]	2630[c]
	F		2690[a]	2611[b]	2550[c]
	T		**2740[a]**	**2668[b]**	**2590[c]**
			$\bar{x}$ = 2666 kcal or 11.18 MJ/kg		
TME_n of FBS	M		2850[a]	2763[b]	2677[c]
	F		2782[a]	2715[b]	2535[c]
	T		**2816[a]**	**2739[b]**	**2656[c]**
			$\bar{x}$ = 2737 kcal or 11.48 MJ/kg		

[1] Means.
[2] Each group was consisted of 12 birds (6 male, 6 female).
M: Male, F: Female, T: Total.
[a,b,c] Means in the same row with a different superscript are significantly different (P<0.05).

4. DISCUSSION

The results of this study concerning the $CATTD_{CP}$ values of FBS (mean 0.760) are in general agreement with those of other researchers who estimated values from 0.765 in adult layers (Gruhn & Zander, 1990) to 0.790 (Brenes *et al.*, 1993).
Our results concerning AME and TME_n values of FBS are in general agreement with those suggested in other researches (Brenes et al., 1993) in which the calculated values of AME varied from 10.23 to 11.59 MJ/kg.

5. CONCLUSION

FBS of the Greek cultivar "Polikarpi" are a valuable energy and protein source in broilers diets and did not significantly affect their performance and digestibility at inclusion rates till 200 g/kg, adding the advantage of the natural alternative feed resources use.