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EFFECT OF REPLACING MUNG BEANS (*PHASEOLUS AUREUS*) FOR SOYBEAN MEAL IN DIETS FOR GROWING RABBITS.

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ABSTRACT

One hundred and twenty-five New Zealand White rabbits, 5 weeks old and 634 g average weight, were used to evaluate to which extent raw mung beans can replace soybean meal in rabbit diets. Five replacement levels were investigated (0, 8, 16, 24 and 32%). Parameter studied included growth performance, digestibility, caecotrophy and some blood constituents. Experiments lasted for 7 weeks. Results obtained revealed that DM intake was increased ($P < 0.01$), but live weight gain and feed conversion efficiency were decreased ($P< 0.01$& $P<0.01$) with increasing mung beans level (MBL) in the diets. Diarrhea mortality was low in all levels. Digestibility of DM, CP and CF were decreased ($P< 0.05$& $P< 0.01$& $P< 0.01$ resp.) by increasing MBL, but no significant differences of OM, EE or NFE could be observed. Diet had significant effect on daily soft faeces excretion (12.6 g DM/d) but had no significant differences on DM and CP concentration of soft faeces. CP contribution of soft faeces to total CP intake was decreased ($P< 0.01$) when MBL incrcesed in the diets. Plasma total protein, glucose, cholesterol and triglycerides were significant decrease when MBL increased in diets.

INTRODUCTION

Mung beans (*phaseolus aureus*) is a legume commonly grown in many Asian Countries and recently in Egypt. It was introduced by the Ministry of Agriculture as a new source of legume proteins and can be used as a animal food. Mung beans has about 20-27% crude protein and essential amino acid content comparable to that of soy beans and kidney bean (Fan and Sosulski, 1974; Thompson et al; 1977; Khalaf Allah, 1995). Mung beans do not appear to contain antinutritional factors such as those found in soy beans (Almquist and Merrilt, 1952; Crewell,1981) Also, Chitra et.al.,(1995) found that phytic acid content (mg/g) was higher in soybeans (36.4) than that in mung beans (12.0). The addition of mung beans with levels up to 40% of the diet improved the growth rate in broiler chickens (Creswell, 1981) but reduced the live weight of pig (Luce et al; 1989). The replacement of wheat starch (570 g/kg diet) with mung beans starch caused decreased plasma glucose, Free fatty acid and plasma triacylglycerol levels in rats (Lerer et al., 1996). The aim of this work was to study the effect of a progressive replacing soybean meal by raw mung beans in diets for growing rabbits on productive performance, digestibility, coprophagy and some blood constituents.

MATERIAL AND METHODS

Mung bean seeds(*Phaseolus aureus*)were obtained from the Legume Research Section, Agriculture Research Center, Ministry of Agriculture, Giza,Egypt.

Experimental animals and diets

The experimental work of this study was carried out at Poultry Research Farm belonging to Kafr EL-Sheikh, Fac. of Agric., Tanta University, Egypt. Five groups each of 25 growing New Zealand White unsexed rabbits, aging about 5 weeks and of nearly the same initial body weight (615-660g) were alloted at random to five pelleted experimental diets. Feed intake and live weight were recorded weekly for 7 weeks. A soybean meal-based control diet was formulated to cover all essential nutrient requirements for growing rabbits according to de Blas (1986). The other four diets were formulated to provide similar crude protein with 8, 16, 24 and 34% of mung beans in replacement of soybean meal and barley Table 1.

Digestibility trail

During the last week six male rabbits per diet were kept in individual metabolism wire cages that allowed separation of faeces and urine. The faeces were collected during five consecutive days.

Coprophagy trail

Another six rabbits from each groups weighing 1.8-2kg were used to estimate the excretion and chemical composition of soft faeces. After 7 days of adaptation (ad libitum access) to each diet, a plastic collar to prevent coprophagy was put on each animal, it was removed 24 h later. Feed intake was recorded during collection period. Hard and soft faeces were stored at-20c° for analysis. At the end of experiment,blood samples were taken from six rabbits from each diet to study the influence of dietary treatment on some blood constituents.

Chemical analysis

Chemical analysis was carried out for diets, hard and soft faeces were according to methods of AOAC (1984) for dry matter, ash, CP, CF and ether extract.

Statistical analysis

Data of the present study were subjected to analysis of variance using the GLM Proceduer (SAS,1989).

Table 1: Composition of experimental diets.

	Levels of mung beans (%)				
Ingredients%	**0**	**8**	**16**	**24**	**32**
Berseem hay	40	40	40	40	40
Barley	36.6	33.6	30.6	27.5	24.3
Soybean meal 44%	20	15	10	5	-
Mung beans	-	8	16	24	32
Limestone	1.8	1.8	1.8	1.8	1.8
Bone meal	1.0	1.0	1.0	1.0	1.0
DL-methionine	0.2	0.2	0.2	0.2	0.3
L-Lysine	00	00	00	0.1	0.2
Salt	0.2	0.2	0.2	0.2	0.2
Premix*	0.2	0.2	0.2	0.2	0.2
Total	100	100	100	100	100
Chemical analysis (% as Fed):					
Dry matter (DM)	90.2	89.6	90.1	89.8	89.9
Ash	10.8	10.8	10.6	10.7	11.1
Crude protein (CP)	18.2	18.1	17.6	17.9	17.7
Crude Fiber (CF)	12.5	12.3	12.1	11.7	11.8
Ether extract (EE)	1.49	1.45	1.42	1.37	1.35
N- Free extract (NFE)	47.2	46.9	48.4	48.1	47.9
Neutral detergent fiber (NDF)**	37.1	37.0	36.9	36.6	36.7
Digestible energy kcal/g (DE)***	2.54	2.54	2.55	2.56	2.56

Mung beans chemical composition

DM 89.9%, Ash 5.6%, CF 5.3%, CP 25.1%, EE 1.29%,lysine 0.76%, methionine0.26%(air dry basis)

* Each kg of premix contains: Vit. A2.000.000iu; Vit. D3 1500iu; Vit. E 8.339 g; Vit. K0.33g; Vit. Bl 0.33g; Vit. B_2, 1.0g; Vit. B_6 0.33g, Vit. B_9 8.33 g;Vit. B_{12} 107 mg; Pantothonic acid 3.33g; Bitine 33 mg; Mg 66.7 mg; Folic acid 0.83; Choline Chloride 200 gm; Zn 11.7g; Fe 12.5 g; Cu 0.5g; Se 16.6 mg and Mn 59mg.

** NDF = 28.294+0.657 (% CF)

*** Digestible energy (DE) was calculated according to Cheeke (1987).

DE (kcal/g) = 4.36 - 0.0491 (% NDF)

RESULTS AND DSCUSSION

Growth Performance

Growth response of rabbits fed diets with different contents of mung beans is presented in Table 2. Inereasing MBL in the diets led to increase (P< 0.01) DM intake, with highest conumption at the level 32% and also decease (P< 0.01&p<0.01) live weight gain and feed conversion efficiency . Similar results were found in gilts fed a diet containing high level of mung beans. (Luce et al., 1989; Liener,1990). On the contrary, David,(1981) found no significant effect of MBL on weight gain or feed conversion by chickens. Diarrhea mortality was low in all levels and was not related to the treatments.

Table 2. Effect of mung beans level on rabbit performance (LSM ± SEM)

	Levels of mung beans (%)						
Parameters	**0**	**8**	**16**	**24**	**32**	**SEM**	**S**
No. of rabbits	23	25	24	24	25	-	-
Initial body weight (g)	620	635	640	615	660	9.52	NS
Final body weight (g)	2080^{a}	2070^{a}	2060^{a}	2030^{b}	2000^{c}	12.37	**
Live weight gain (g/d)	34.8^{a}	34.2^{b}	33.8^{c}	33.7^{c}	31.9^{d}	0.59	**
DM intake (g/d)	93^{a}	97^{a}	103^{b}	106^{ab}	110^{c}	4.98	**
Feed/ gain (g/g)	2.96^{a}	3.16^{b}	3.37^{c}	3.50^{c}	3.86^{d}	0.37	**
Mortality (N)	2	0	1	0	0	-	-

LSM = Least squar mean, SEM = standard error of means.
NS = non significant, ** = P< 0.01. S = significance
a.b.c.d
Means in the same row the different supercipts are significantly different (P<0.01).

Digestion Trial

The data on digestibility of nutrients as shown in Table 3, revealed that all nutrients of soybean meal (SB) were digested more than that in the raw mung beans (MB). Digestibility of DM, CP and CF in the experimental diets were significantly decreased (P< 0.05& P < 0.01 & P < 0.01 resp.) by increasing MBL, but no significant effect on digestibility coefficients of OM, EE or NFE could be observed. The reduce in CF digestibility may be attributed to its different sources in diets more than to chemical composition (de Blas and Villamide 1988). The decrease in protein digestibility with increasing MBL in the diets may be due not only to lower digestibility of this legume protein, but also to the presence of anti-nutritional factors(Falcao e Cunha and Freire 1996). Also, Jansman et al.,(1993) found that the effect of tannins on CP digestibility was higher in the ileal than in the faecal fraction in pigs fistulated at ileum.

Table 3. Effect of mung beans level on apparent digestibility (%) (LSM ±SEM)

			Levels of mung beans (%)						
Nutrient	***SB***	***MB***	**0**	**8**	**16**	**24**	**32**	**SEM**	**S**
DM	78.6	76.2	71.7^{a}	70.2^{b}	69.8^{b}	68.6^{c}	67.5^{c}	0.89	*
OM	80.2	78.1	68.7	67.5	67.1	66.9	66.6	1.35	NS
CP	84.6	72.6	76.1^{a}	75.4^{ab}	74.5^{b}	73.3^{c}	71.9^{d}	0.77	**
CF	35.4	27.2	32.7^{a}	31.6^{b}	30.2^{c}	29.1^{d}	26.6^{e}	0.65	**
EE	81.1	77.4	81.2	80.4	80.1	79.8	78.9	1.69	NS
NFE	86.1	82.7	78.6	77.2	76.9	76.4	75.9	2.02	NS

a.b.c.d.e
Means within a row with different superscripts are significantly different (P< 0.05)
NS = Non significant, * = P< 0.05, ** = P< 0.01. S = significance.
SB= soy bean meal, MB= raw mung beans

Coprophagy Trial

Results presented in Table 4 showed that the diet caused a significant increase (P< 0.05) in DM intake. However, a significant decrease (P< 0.05) was detected in soft faeces excretion (12.6gDM/d) when MBL increased in the diets. This reduction in the quantity of soft faeces excreted may be due to a decrease in microbial activity in the caecum as a result to presence of anti-nutritional factors such as tannins (Falcao e Cunhal,1996). The concentration of DM and CP of soft faeces were not significantly different among all levels, but a slight decrease in CP concetration was noticed due to mung beans effects. The MBL had significant effect (P< 0.01) on DM contribution of soft faeces to total DM intake, due to differences (P< 0.05) in DM intake among the levels. The highest contribution of soft faeces to CP intake (P< 0.01) was obtained in the absence of mung beans (20.7%) as a result of increased soft faeces excreted. While the lowest value was observed in the diet with 32% mung beans (14.7%).

Table 4: Effect of mung beans level on the excretion and chemical composition of soft faeces to total intake of dry matter (DM) and crude protein (CP) (LSM ± SEM).

	Levels of mung beans (%)						
Items	**0**	**8**	**16**	**24**	**32**	**SEM**	**S**
DM intake g/d	89^{e}	92^{de}	96^{cd}	94^{de}	101^{c}	3.13	*
Soft faeces excretion gDM/d	14.2^{c}	13.5^{c}	12.4^{d}	12.2^{d}	10.7^{e}	0.98	*
Chemical composition:							
DM %	35.9	35.6	36.4	35.8	37.1	1.37	NS
CP % DM	33.2	32.6	33.1	32.8	31.9	1.29	NS
Relative contribution of soft faeces to:							
DM intake [a]	13.8^{c}	12.8^{d}	11.4^{e}	11.5^{e}	9.6^{f}	0.84	**
CP intake [b]	20.7^{c}	19.1^{d}	17.9^{e}	17.6^{e}	14.7^{f}	0.75	**

[a,b] Calculated using the equations of Fraga et al., 1991.
[a] As ((soft faeces excretion, g DM/d)/(feed intake, g DM/d + soft feces excretion, g DM/d))x 100
[b] As ((CP excreted in soft faeces, g/d)/(CP ingested in feed, g/d + CP excreted in soft faeces, g/d))x 100.
NS = non significant, ** = P< 0.01 * = P< 0.05 S = significance.
[c,d,e,f] Means in the same row the differnt supercrips are significantly different (P< 0.01).

Blood constituents

Table 5 shows that the differences in plasma creatinine was not significant among the all levels. However, plasma total protein was signifcantly decreased (P< 0.05) with increasing MBL. This might be due to the lower digestibility of CP in this legume (EL-Husseing et al., 1997). The same trend was observed for plasma glucose, cholesterol and triglycerides which were decreased (P< 0.01& P< 0.001& P< 0.001resp.) when MBL increased, This may be due to changing the source of starch in the diets. These results are in agreement with Lerer et al.,(1996). Who reported that the replacement of wheat starch (570g/kg diet) with mung beans starch resulted in decreased plasma glucose and free fatty acid levels in normal rats and a reduction in plasma triacylglycerol concentration in normal and diabetic rats.

Table 5: Effect of mung beans level on some blood constituents of rabbits (LSM ± SEM)

Item	Levels of mung beans (%)						
	0	8	16	24	32	SEM	S
Total protein (g/dl)	6.87^{a}	6.56^{ab}	6.38^{b}	5.92^{c}	5.84^{c}	0.38	*
Cholesterol (mg/dl)	172^{a}	158^{b}	146^{c}	136^{d}	125^{e}	1.36	***
Glucose (mg/dl)	189^{a}	176^{b}	165^{c}	160^{cd}	152^{d}	3.16	**
Triglycerides (mg/dl)	163^{a}	154^{b}	136^{c}	128^{d}	115^{e}	2.89	***
Creatinine (mg/dl)	1.18	1.14	1.10	1.08	1.09	0.09	NS

* = P< 0.05 ** = P< 0.01 *** = P< 0.01

S = significance NS = non significant

In conclusion, it could be possible to include up to 24 % of mung beans in growing rabbits diets as substitute for soybean meal without any problems. Higher levels may affect growth performance, CP digestibility and soft faeces excretion. More research is needed to evaluate the use of raw mung beans in adult rabbits diets.

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