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FURTHER TRIALS ON THE USE OF CHICK-PEAS IN GROWING RABBIT FEEDING

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ABSTRACT

Chick-peas of Calia variety, with a protein concentration of 23.8, were introduced in balanced growing rabbits diets at 10% and 20% levels. They replaced part of the soybean meal of the control diet.

A feeding trial was conducted on 78 WNZ rabbits about 45 days old of both sexes, divided in three groups and fed ad libitum in individual cages for 49 days.

A digestibility trial in vivo was effected on three groups of 11 male WNZ rabbits, initially weighing about g 2,250.

Nitrogen balance was conducted on three groups of 5 male WNZ rabbits with an average live weight of about g 1,650.

The partial substitution of soybean meal in diets with 10% or 20% chick-peas allowed a significatively lower digestibility of protein in comparison with the control diet (64.5% and 62,4% vs 69.1%), but it did not determine any variation on the global nitrogen utilization (Retained N/Ingested N).

The productive performances of the growing rabbits were not influenced by the different feeding treatments.

In conclusion the results indicate that inclusions of 10% and 20% chick-peas are possible when chick-peas is not the only proteic source in diets for growing rabbits; in fact the presence of a part of soybean in the chick-peas diets determines productive performances analogous to the control diet fed rabbits'.

INTRODUCTION

In a previous trial (Alicata et al. 1991), diets with 20% chick-peas of two varieties, the Calia and a local variety, with high protein levels (27.6% and 26.6%), determined lower productive performances in growing rabbits than the control diet containing soybean meal as main protein source.

This result was probably affected by the difference between chick-peas and soybean meal protein quality (Lebas 1988).

Therefore the conclusion was that a lower inclusion level of highly proteic chick-peas in the diet, allowing only a partial substitution of soybean meal, should bring about a

better aminoacids balance.

The object of this experiment is to evaluate the effects of the inclusion of two levels (10% and 20%) of CALIA chick-peas with a protein concentration of 23.8% in growing rabbits diets. In this case the chick-peas replaced only part of the soybean meal of the control diet.

MATERIAL AND METHODS

10% and 20% CALIA chick-peas were included in two balanced diets that were in comparison with a control diet.

A feeding trial was conducted on 78 New-Zealand White rabbits about 45 days old, divided into homogeneus groups according to diet and sex; they were placed in individual cages and fed ad libitum.

The control of weight gain, by weighing the subjects, and of food intake, was carried out weekly.

The trial lasted 49 days, after which all the animals, which had not eaten for 24 hours, were slaughtered.

In order to determinate the digestibility coefficients and nutritive value of the feed, at the fifth week of trial, the faeces of 11 New Zealand White male rabbits for each feeding treatment, were collected for 7 days; the rabbits weighed about g 2,250. For analytical determinations the individual faeces of the subjects of each group were unified in a single sample, according to a procedure recently confirmed (Grandi and Battaglini 1991).

Nitrogen balance was conducted on three groups of 5 New Zealand White young male rabbits, placed in metabolic cages and fed ad libitum; the preparatory phase lasted 7 days, whereas the faeces and urine collection was effected for 10 days. During its collection a 4M solforic acid solution was added to the urine, and then the sample was stored at -20°C.

The chemical compositions of chick-peas, diets, urine and faeces were determined by ASPA methodologies (1980).

The values of GE and DE of the diets were estimated using the equations of Schiemann et al. (1972).

Statistical analyses of data were performed with analysis of variance, by conversion of percentage variables in angular values (arcosen √%), employing the linear models:

a) $y_{ij} = \mu + \alpha_i + e_{ij}$

for digestibility and nitrogen balance parameters;

b) $y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + e_{ijk}$

for fattening trial parameters;

where: y_{ij} e y_{ijk} = individual variables

μ = average effect

α_i = diet effect (i= 1: 10% Calia diet; 2: 20% Calia diet; 3: control diet)

β_j = sex effect (j= 1: male; 2: female)

e_{ij} ed e_{ijk} = error.

Multiple comparisons between averages were performed using the Tukey test, for 0.05 and 0.01 probability levels.

RESULTS AND DISCUSSION

The percentage composition of the diets is presented in table 1. The chick-peas inclusion at both levels (10% and 20%) in the diets involved a partial substitution of the soybean meal of the control diet, and a different distribution of feedstuffs, in order to obtain balanced diets.

The formulated diets contain practically the same percentages of protein, crude fiber and gross energy (table 2).

The digestibility coefficients and the nutritive values of the diets are shown in table 3. The protein of the control diet had a digestibility coefficient higher than the protein of the experimental diets, with a significant difference ($P<0.01$); in the chick-peas diets the protein digestion was lower in the 20% chick-peas diet ($P<0.05$).

The digestibility of crude fiber and various fiber fractions of the chick-peas diets resulted superior, though the differences from the control diet were not statistically significant, with the exception of cellulose.

The constant superiority of digestibility coefficients of fiber fractions in the 10% chick-peas diet is presumably due to a more favourable combination among the fiber fractions of the feedstuffs of the diet.

A higher ether extract utilization was noticed in the control group ($P < 0.05$).

The estimated value of DE resulted analogous for the three diets.

From the data of the nitrogen balance, summarized in table 4, it is evident that the nitrogen utilization did not differ statistically among the groups: the three formulated diets had presumably equivalent biological values of protein.

The results of the feeding trial are reported in tables 5 and 6. The feeding treatment did not significantly influence the performances of the three groups of rabbits.

The males presented superior daily weight gain and carcass weight in comparison with the females ($P < 0.05$).

In conclusion, the partial substitution of soybean meal with chick-peas in exsperimental diets, though it recorded a lower protein digestibility, more evident with the 20% inclusion level, did not affect, on the basis of nitrogen balance, the global nitrogen utilization (Retained N/Ingested N).

Therefore, keeping in the diets an amount of soybean meal

appears to ensure, even at the higher chick-peas level, the portion of essential amino acids necessary for exploiting the proteins.

In fact the rabbits fed with the chich-peas diets showed productive performances analogous to the control diet fed subjects'.

CONCLUSION

The results confirm the hypotheses drawn from the previous trial (Alicata et al. 1991), that chick-peas cannot constitute the only proteic source in diets destined to growing rabbits; it is necessary to ensure an amount of high biological value protein, such as soybean protein, for 10% and 20% inclusion levels of chick-peas not to lower the productive performances of growing rabbits.

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TABLE 1: Percentage composition of the diets.

	DIETS		
	10% CHICK-PEAS	20% CHICK-PEAS	CONTROL
Calia chick-peas	10.0	20.0	
Maize	13.0	10.0	16.0
Barley	15.0	12.0	18.0
Soybean meal	8.0	5.0	11.0
Dehydrated lucerne meal	35.0	36.0	34.0
Wheat middlings	12.0	11.0	13.0
Wheat straw	6.0	5.0	7.0
Vitamin premix (1)	0.5	0.5	0.5
Dicalcium phosphate	0.2	0.2	0.2
Salt	0.3	0.3	0.3

(1) Composition (for kg): vit.A U.I. 4,000,000; vit.D3 U.I. 400,000; vit.E mg 3,500; vit.B1 mg 400; vit.B2 mg 800; vit.B6 mg 400; vit.B12 mg 3; pantothenic acid mg 2,000; vit.K mg 50; vit.PP mg 8,000; choline mg 150,000; cobalt mg 400; iron mg 20, 000; iodine mg 300; manganese mg 20,000; cupric mg 8,000; zinc mg 20,000; support to g 1,000.

TABLE 2: Chemical composition (% d.m.) of Calia chick-peas and diets.

		DIETS		
	CALIA CHICK-PEAS	10% CHICK-PEA	20% CHICK-PEAS	CONTROL
Dry matter	88.2	91.0	90.9	91.6
Crude protein	23.8	17.9	18.1	17.7
Ether extract	5.6	3.5	3.7	3.6
Crude fiber	3.5	15.1	14.7	15.2
Ash	3.4	6.6	6.6	6.5
N-free extract	63.7	56.9	56.9	57.0
NDF	9.1	27.4	26.1	28.1
Hemicellulose	3.6	7.6	7.0	8.0
ADF	5.5	19.8	19.1	20.1
ADL	0.1	3.7	3.8	3.9
Cellulose	5.4	15.7	14.6	15.6
DE (kcal/kg d.m.) (1)		4447	4456	4454

(1) Estimations from multiple regression equation of Schiemann et al. (1972).

TABLE 3: Digestibility coefficients (%) and nutritive value of diets (mean ± SD).

	DIETS			Residual variance (30 D.F.)
	10% CHICK-PEA	20% CHICK-PEAS	CONTROL	
Dry matter	64.1 ± 1.0	64.4 ± 1.8	63.7 ± 1.5	0.81
Organic matter	64.2 ± 1.0	64.6 ± 1.8	64.0 ± 1.5	0.80
Crude protein	64.5 ± 1.0 Aa	62.4 ± 1.9 Ab	69.1 ± 1.3 Bc	0.78
Ether extract	68.4 ± 0.9 A	68.9 ± 1.6 A	71.5 ± 1.2 B	0.62
Crude fiber	17.8 ± 2.2	17.9 ± 4.2	14.7 ± 3.6	7.10
Ash	63,0 ± 1.0 A	61.9 ± 2.0 AB	60.2 ± 1.7 B	0.90
N-free extract	76.1 ± 0.6 ABa	77.1 ± 1.2 Ab	75.1 ± 1.1 Ba	0.45
NDF	14.5 ± 2.3	13.7 ± 4.4	12.9 ± 3.7	9.03
Hemicellulose	2.0 ± 2.7	1.0 ± 5.1	2.0 ± 4.2	22.80
ADF	19.3 ± 2.2	18.4 ± 4.2	17.3 ± 3.5	6.36
Cellulose	26.6 ± 2.0 A	23.3 ± 3.9 AB	20.9 ± 3.4 B	4.78
DE kcal/kg d.m. (1)	2769	2792	2782	
DCP/DE g/Mcal	41.7	40.4	44.0	

(1) Estimations from multiple regression equation of Schiemann et al. (1972).

A, B: $P < 0.01$;

TABLE 4: Nitrogen Balance (means ± SD).

		DIETS			Residual variance (12 D.F.)
		10% CHICK-PEA	20% CHICK-PEAS	CONTROL	
No. of rabbits		5	5	5	
Days on trials	d	10	10	10	
Average live weight	g	1711.9 ± 45.8	1576.2 ± 86.3	1674.4 ± 194.4	15775.7
Daily weight gain	g/d	24.5 ± 4.5	27.8 ± 4.3	28.5 ± 5.9	24.9
Dry matter intake	g/d	87.8 ± 7.3	94.7 ± 5.1	95.8 ± 18.3	138.4
Feed conversion ratio		3.6 ± 0.6	3.4 ± 0.4	3.4 ± 0.3	0.2
Ingested N	g/kg l.w.	14.5 ± 1.3 a	17.6 ± 1.0 b	16.4 ± 2.1 ab	2.4
Fecal N	"	4.2 ± 0.7 a	5.9 ± 0,9 b	4.7 ± 1.1 ab	0.9
Urinary N	"	3.1 ± 0.5	3.1 ± 0.3	3.3 ± 0.4	0.2
Digested N	"	10.3 ± 0.9	11.7 ± 0.9	11.7 ± 1.0	0.9
Retained N	"	7.2 ± 1.2	8.6 ± 0.9	8.3 ± 1.1	1.2
Dig.N /Ing.N	%	71.0 ± 3.5	66.6 ± 4.8	71.5 ± 3.8	6.5
Ret.N/Ing.N	%	49.2 ± 5.0	48.7 ± 4.5	50.5 ± 4.7	7.5
Ret.N/Dig.N	%	69.3 ± 7.1	73.1 ± 3.4	70.7 ± 5.0	11.2

a, b: $P < 0.05$.

TABLE 5: Feed intake, weight gain and conversion ratio of fattening rabbits (means ± SD).

		DIETS			SEX		Residual variance (70 D.F.)
		10% CHICK-PEAS	20% CHICK-PEAS	CONTROL	MALES	FEMALES	
No. of rabbits		25	26	25	38	38	
Initial live weight	g	970.2 ± 172.9	972.1 ± 165.3	984.2 ± 165.7	987.2 ± 161.0	963.6 ± 171.9	29196.1
Final live weight	g	2582.5 ± 313.2	2578.4 ± 289.3	2515.7 ± 357.5	2623.6 ± 281.6	2494.5 ± 342.3	100038.0
Daily weight gain	g/d	32.9 ± 4.9	32.8 ± 4.1	31.2 ± 5.5	33.4 ± 4.2 a	31.2 ± 5.3 b	22.7
Dry matter daily intake	g/d	117.7 ± 16.0	116.8 ± 13.1	112.1 ± 18.9	117.8 ± 15.1	113.3 ± 17.0	264.3
Feed conversion ratio		3.6 ± 0.5	3.6 ± 0.4	3.6 ± 0.3	3.5 ± 0.3	3.7 ± 0.4	0.2

a, b: $P < 0.05$.

TABLE 6: Slaughter data (means ± SD).

		DIETS			SEX		Residual variance (70 D.F.)
		10% CHICK-PEAS	20% CHICK-PEAS	CONTROL	MALES	FEMALES	
Carcass weight	g	1465.2 ± 184.8	1467.5 ± 202.3	1455.9 ± 246.0	1513.4 ± 179.1 a	1412.5 ± 227.7 b	44105.3
Warm dressing out	%	60.0 ± 2.0	60.8 ± 2.2	60.8 ± 2.5	60.9 ± 2.2	60.2 ± 2.2	1.6
Net dressing out	%	65.4 ± 1.6	66.1 ± 1.3	65.8 ± 1.9	65.9 ± 1.6	65.6 ± 1.7	0.9
percentages on carcass:							
Liver	%	4.4 ± 0.6	4.6 ± 1.0	4.7 ± 0.8	4.6 ± 0.9	4.6 ± 0.7	1.1
Internal organs (1)	%	2.4 ± 0.2	2.3 ± 0.3	2.4 ± 0.3	2.4 ± 0.3	2.3 ± 0.3	0.3
Fat (2)	%	2.7 ± 0.9	2.6 ± 0.8	2.3 ± 0.7	2.4 ± 0.7	2.7 ± 0.9	2.1

(1) Kidney, heart, lungs. (2) Perirenal fat and retroscapular fat.

a, b: $P < 0.05$.