IMPACT OF USING PEA VINES AS NON-CONVENTIONAL FEEDSTUFF ON GROWTH PERFORMANCE OF RABBITS

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ABSTRACT

The aim of this work was to study the effect of partial and total substitution of clover hay by pea vines (PV) in rabbit diets and their effects on growth performance and fecal digestibility of New Zealand White rabbit. Forty five rabbit, six weeks old with an average body weight 728.2 g were randomly divided into five groups. Each group consisted of three replicates (of three rabbits each). Results of growth trail revealed that 50% PV fed group achieved significantly ($P<0.05$) better LBW by 11.5%, ADG by 18% and FCR by 4.1% compared with control group. Regarding to fecal digestibility's, the recorded values for control and 50% PV diets were 64.99% vs. 69.25% for DM; 67.09% vs. 71.36% for OM.; 65.08 vs. 72.36% for CP.; 44.49 vs. 51.40% for CF and 73.28 vs. 75.31% for NFE, respectively. The same trend for fecal digestibility were significant found ($P<0.05$) between 75% compared with control group, being 64.99% vs. 67.59% for DM and 65.08% vs. 68.56% for CP, respectively. Rabbit group fed 50% PV recorded the highest values of DCP, TDN and DE in comparison with other experimental groups. It could be concluded that incorporation pea vines as non traditional fiber source in rabbit diets at 25, 50, 75 and 100% has no negative effect on growth performance and digestibility of most of nutrients and nutritive values of tested diets.

Key words: Pea vines, rabbits, digestibility, growth.

INTRODUCTION

Rabbit production has potential in many developing countries as a mean of supplying cheap, high quality animal protein within the shortest possible time using diets based mainly on forages. The need of fiber is more particularly expressed during the post-weaning period. Low fiber intake without variations of fiber nature or origin involves lower growth rate during the two weeks after weaning that are often associated with intake troubles or digestive disorders. (Gidenne, 2000). Rabbit is a non-ruminant herbivorous animal and its digestive physiology is well adapted to high intake of plant cell walls and digestible dietary fiber supply is essential to prevent digestive disorders. Therefore, dietary fiber is the main constituent of a rabbit feed (even in intensive production) and NDF content could be ranged from 27 to 42%of the diet dry matter (Gidenne, 2003). Clover hay is the most common source of fiber used in rabbit diets in Egypt and accounting for 30-40% of the rabbit. Therefore, substituting clover hay by other fiber sources such as locally vegetable crops residues can reduce feeding costs (Pote et al. 1980).

The main objective of this work was to study the possibility of substitution of clover hay by pea vines in rabbit diets at 0, 25, 50, 75 and 100% levels and their effects on growth performance and digestibility of New Zealand White rabbit.

MATERIALS AND METHODS

This experimental work was carried out at Gezeeret El-Sheir Experimental Station, El-Kanater El-Khayria, Kalyobia Governorate, Ministry of Agriculture, Egypt.

Animals and experimental diets

Forty five rabbit, six weeks old with an average live body weight 728.2 g were randomly divided into five groups. Each group consisted of three replicates (three rabbits each) representing the five experimental diets. Feed and water were offered *ad libtium*. Animals were individually weighed every week, consumption of fed was recorded while feed conversion was calculated as a ratio of gram of feed per gram of gain (in a basis of replicates). Five experimental diets were formulated; the first used as control diet (Zero pea vines) while other four diets, formulated to replace clover hay at levels of 25, 50, 75, 100% by pea vines. All the experimental diets were formulated to be iso-nitrogenous, iso-caloric, and to meet all the essential nutrient requirements of growing rabbits according to NRC, (1977) as shown in Table 1.

Table 1: Feed ingredients and chemical composition of pea vines experimental diets (%DM basis).

Feed Ingredients (%)	Substitution level of clover hay by pea vines				
	Control (0%PV)	25%PV	50%PV	75%PV	100%PV
Clover hay	35	26.25	17.5	8.75	--
Pea vines	--	8.75	17.5	26.25	35
Yellow corn	12	11	11	11	11
Ba rley	9	9	9	9	9
Soybean meal (44%CP)	14	14	14	14	14
Wheat bran	24	25	25	25	25
Molasses	3.0	3.0	3.0	3.0	3.0
Di- Ca- phosphate	2.0	2.0	2.0	2.0	2.0
Dl-Methionine	0.4	0.4	0.4	0.4	0.4
Salt	0.3	0.3	0.3	0.3	0.3
Vit.-Min. premix*	0.3	0.3	0.3	0.3	0.3
Chemical composition(%DM basis)					
DM	88.90	88.20	88.68	87.98	87.88
OM	91.99	91.88	91.60	91.79	91.40
CP	16.10	16.23	16.30	16.37	16.43
CF	13.21	13.09	12.90	12.71	12.51
EE	2.47	2.46	2.45	2.44	2.43
NFE	60.21	60.10	59.95	60.27	60.03
Ash	8.01	8.12	8.40	8.21	8.60
NDF	29.93	30.33	30.42	30.49	30.57
ADF	16.67	16.94	17.11	17.27	17.44
ADL	3.64	3.71	3.74	3.78	3.82
Methionine	0.64	0.64	0.64	0.64	0.64
Lysine	0.83	0.83	0.83	0.83	0.83
Calcium	1.01	1.01	1.01	1.01	1.01
Phosphors	0.65	0.66	0.65	0.65	0.64
Digestible energy(Kcal/Kg DM)	2783.70	2773.03	2774.17	2775.31	2776.40

(1) ***Each kg vitamins and minerals premix contains***:Vit. A. 2.00000IU,10.000mg, $B_1$400mg, $B_2$1200mg, B_6,400mg, B_{12}.2mg, K_3 400 mg, D_3 200000IU, Choline chloride 240mg pantothenic acid 400mg, Niacin 1000mg, Folic acid 1000 mg, Biotin 40 mg, Manganese 1700 mg, Zinc 14000 mg, Iron 1500mg, copper 500 mg, selenium 20 mg, Iodine 40 mg and Magnesium 8000 mg.

A digestibility trial was conducted to determine the digestibility's coefficients and the nutritive values of the experimental diets according to (Fekete, 1985). Fifteen adult male New Zealand White rabbits, 7 months

of age with an average live body weight ranged from 2178 to 2227g, were used in digestibility evaluation and allotted randomly to five groups of three rabbits. Rabbits were housed in individual metabolism cages and fed the experimental diets for a period of 7 days (preliminary period) for adaptation then faeces were collected every 24 hours for 5 consecutive days (collection period). Total digestible nutrients (TDN) were calculated as follows: % digestible crude protein + % digestible crude fiber + % digestible nitrogène free extract (NFE) + 2.25 % digestible ether extract (EE). Digestible energy (DE, Kcal/Kg diet)) was calculated as follow: TDN × 44.3 according to Schneider and Flatt (1975).

Chemical analysis

Chemical analysis were performed as recommended by A.O.A.C (1990) for determining moisture, crude protein (CP), crude fiber (CF), ether extract (EE), nitrogen free extract (NFE), ash and minerals for the raw materials, diets and feces and calcium by atomic absorption spectrophotometer and phosphorous was determined clorimetrically using spectrophotometer, neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) were determined sequentially according to Van Soest *et al*. (1991) at the Laboratory of By-products Research Department of Animal Production Research Institute. Pea (*Pisum sativum*) vines (leaves and stems) were obtained from farms in El-Kalubia Governorate. Pea vines was dried by sun-drying method to nearly 10% moisture content, then ground by hammer mill and kept for mixing and pelleting. Oxalate content (anti-nutritional factor) was determined according to Oke (1969), tannins were determined using vanillin hydrochloric acid method as described by Burn (1971) and saponin was determined by using the method of Shany *et al.,* (1970) and phytic acid and phytate were determined clorimetrically using DU 7400 spectrophotometer.

Statistical Analysis

The results of experimentation were statistically analyzed using GLM (general linear models) procedure of SAS (2000) by one-way ANOVA. Using Duncan's multiple range of test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical evaluation of forages

Table 2: Chemical analysis of pea vines and clover hay on dry matter basis

Items %	DM	OM	CP	CF	EE	NFE	Ash	NDF	ADF	ADL	Ca	P
Clover Hay	92.00	87.17	13.40	26.03	4.03	43.71	12.83	43.20	30.06	5.54	1.50	0.25
Pea Vines	90.01	92.85	13.79	23.76	2.18	53.12	7.15	42.70	34.50	7.70	1.20	0.21

Results in Table 2 indicated that, apart from the variation in OM content, clover hay and pea vines have a similar chemical composition**.** These results are rarely agreement with those obtained in the literature (Zeweil (1992), Gupta *et al*., (1993), Sarhan (2005) and Stanton and LeVally (2007)). Clover hay had lower ADF and ADL content than pea vine, while NDF was similar Concerning to minerals content, Ca and P content were higher in CH. Minerals values of PV are comparable to those values reported by Preston (2002) who found that PV hay contained 1.20% and 0.21% for Ca, P, respectively.

Pea vines contained 1.99% phytate and 1.86% phytic acid. Phytate can form complexes with calcium, copper, cobalt, iron, magnesium, manganese, selenium and zinc, thus reducing the availability of these nutrients (Pallauf and Rimbach, 1997).Pea vines also contains 7.50% oxalate and 1.9% tannins. Oke, (1969) reported that oxalates affect Ca and Mg metabolism and react with proteins to form complexes which have an inhibitory effect on peptic digestion. Pea vines had also a high content of saponin (12.70%).

Growth performance

Results in Table 4 showed that rabbits fed 50% PV diet recorded significantly ($P<0.05$) better live body weight (LBW), average daily gain (ADG), average daily feed intake (ADFI) and feed conversion ratio

(FCR) compared with rabbits fed the other tested diets. This improvement in growth performance could be related to the increase in average daily feed intake because of both higher nutritive value (according to Table 5) and palatability of pea vines. Besides to that, this by-product is comparable to clover hay in chemical composition. However, from 50%PV onwards both the intake and growth decreased, indicating worse utilization of PV at high levels of inclusion (higher than 17.5%). Sarhan (2005) found that daily weight gain of rabbits fed diet contained 30% pea wastes was significantly (P<0.05) higher than that of control(0% pea vines) and 15 % pea vine hay diets. However, Zeweil (1992) found that insignificant differences in weight gain and feed intake among rabbits fed 12.5 and 25% pea processing by-products and the control group (0% pea processing by-products) while FCR was not affected. Grandi and Angelis (1983) did not find differences in FCR when rabbits fed diets contained 5 or 10% pea by-products replaced for dried Lucerne hay.

Table 3: Performance of rabbits fed diets containing pea vines

Items	Substitution level of clover hay by pea vines						
	0% PV	25%PV	50%PV	75%PV	100%PV	±SEM	Probability
No. of rabbits	9	9	9	9	9		
Initial L.B.W. g	724	722	724	725	723	18.51	<0.0001
Final L.B.W. g	1970 ^{d}	1983 ^{cd}	2196 ^{a}	2085 ^{b}	2049 ^{bc}	23.26	<0.0001
Average daily gain (ADG) / g	22.2 ^{d}	22.5 ^{cd}	26.3 ^{a}	24.3 ^{b}	23.7 ^{bc}	0.432	<0.0001
Av. Feed intake (ADFI) g/h/d	81.9 ^{e}	84.2^{d}	94.5^{a}	86.6^{c}	87.3^{b}	0.122	<0.0001
FCR (g feed/g gain)	3.83 ^{ab}	3.86 ^{ab}	3.67 ^{b}	3.76 ^{ab}	3.93 ^{a}	0.076	<0.0001

a,b,c,… Means values with the same letter within the same row did not differ significantly (P>0.05).

Digestibility coefficients and nutritive values of the experimental diets

Results in Table 5 showed that group fed 50% PV recorded significantly (P<0.05) higher digestibility of DM, OM, CP, CF and NFE compared with control group (0%pea vines). The difference in OM, CP, EE and NFE digestibility among 50% PV and 25, 75, 100% PV were significant (P<0.05). Meantime, insignificant differences was observed among 50% PV and 25, 75,100% PV. There were significant increases in DM and CP digestibility with 75% PV substitution compared to the control group. These results agreed with those reported by Sarhan (2005) who noticed that the digestibility of all nutrients was not significantly affected by the inclusion of pea vines hay or pea pod hulls at 15 or 30% in the rabbits diets. Data of nutritive values illustrated that rabbit group fed 50% PV recorded the highest values of DCP, TDN and DE in comparison with other experimental groups. Abdel-Magid et al. (2005) found that the best nutritive value expressed as TDN was recorded by rabbits fed 50% pea straw compared to 75 and 100% substitution levels of clover hay.

Table 4: Effect of inclusion of pea vines on digestion coefficients and nutritive values of rabbit diets

Items	Substitution level of clover hay by pea vines						
	0%PV	25%PV	50%PV	75%PV	100%PV	±SEM	Probability
DM	64.99^{c}	66.10^{bc}	69.25^{a}	67.59^{ab}	66.22^{bc}	0.55	<0.0001
OM	67.09^{c}	68.66^{b}	71.36^{a}	68.74^{b}	68.21^{bc}	0.43	<0.0001
CP	65.08^{c}	68.00^{b}	72.36^{a}	68.56^{b}	67.27^{b}	0.54	<0.0001
CF	44.49^{b}	47.93^{ab}	51.40^{a}	47.50^{ab}	48.46^{ab}	1.28	<0.0001
EE	73.70^{ab}	73.22^{b}	74.94^{a}	72.95^{bc}	71.87^{c}	0.39	<0.0001
NFE	73.28^{b}	73.22^{b}	75.31^{a}	73.14^{b}	72.44^{b}	0.57	<0.0001
DCP	10.48^{c}	11.04^{b}	11.80^{a}	11.22^{b}	11.05^{b}	0.08	<0.0001
TDN	64.57^{b}	66.63^{b}	67.70^{a}	65.35^{b}	64.53^{b}	0.44	<0.0001
DE (kcal/kg)	2859^{b}	2895^{b}	2997^{a}	2894^{b}	2858^{b}	19.55	<0.0001

a,b,c--- Means in the same row with different superscripts are significantly different (P<0.05).

CONCLUSIONS

The reasonable growth performance obtained in this study could encourage us to recommend the use of pea vines up to 100% in replacement of clover hay as a non-conventional cheap feedstuff in growing rabbit's diets without any negative effects on the growth performance.

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