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USING PARSLEY AND CARAWAY STRAWS AS SUBSTITUTES FOR ALFALFA HAY IN GROWING RABBIT DIETS

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ABSTRACT

The present study was carried out to investigate the effect of inclusion of different levels of parsley and caraway straws in place of alfalfa hay on growth performance, nutrient digestibility, carcass traits, and certain blood parameters. Five pelleted experimental diets were formulated to contain five levels of parsley and caraway straws mixtures to replace 0 (control), 25, 50, 75 or 100% of alfalfa hay in the basal diet. Eighty growing (New Zealand White × Californian) 6-week-old rabbits divided into five equal experimental groups and fed the experimental diet from 6 to 13 weeks of age. The obtained results during the whole experimental period indicated that neither growth performance(body weight, weight gain, fee intake, feed conversion or economic efficiency of growth), nutrient digestibility [dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE) and crude fiber (CF) and nitrogen free extract (NFE)], carcass traits nor blood plasma constituents (glucose, cholesterol, triglycerides, and activity of AST and ALT) were adversely affected by the experimental treatments. Based on the results of the present study, it can be concluded that parsley and caraway straw can completely replace alfalfa meal in growing rabbit diets without compromising growth performance, nutrient digestibility or carcass traits.

Keywords: Rabbits, parsley, caraway, performance, nutrient digestibility, carcass traits.

INTRODUCTION

In Egypt, rabbit production has become one of the biggest agricultural industries and its improvement is one of the main objectives of both private and public sectors. Feeding cost represents the major part of total cost in the production. Minimizing the feed cost could be achieved through the use of untraditional cheaper feed ingredients or improving utilization of common feeds by using some additives. Attention, therefore, should be drawn towards the use of some locally produced plant by-products.

High-fiber feed ingredients are the main constituent of a rabbit feed and can be included up to 50% of the diet (Gidenne, 2003). Sufficient dietary fiber supply is essential to prevent digestive troubles in growing rabbits. Rabbit diets necessarily contain high levels of fibrous feeds, yet fundamental to the digestive process of this species (Gidenne and Bellier, 2000). Dietary fiber (DF) has an important role in the regulation of the intestinal transit, the gut flora and the intestinal mucosa integrity of rabbits (Fortun-Lamothe and Boullier, 2007). These diets promote intestinal motility and feed intake (De Blas *et al*., 1999). The reduction of the dietary fiber level increases the incidence of digestive disturbances in the growing rabbit (Lebas *et al*., 1998),

namely non-specific enteritis, with diarrhea, poor feed conversion and loss of appetite (Bennegadia *et al*., 2001).

Alfalfa hay is a common source of fiber in rabbit diets in which it is included at high concentrations with no deleterious effects (Pote *et al*., 1980). The total replacement of alfalfa hay by other fiber sources with higher levels fiber than alfalfa hay, such as sugar beet pulp, can influence the retention time of the digesta in some segments of the gut and alter several digestive criteria, at least in diets with low fiber levels (Fraga *et al*., 1991).

Caraway *(Carum carvi)* is a globally distributed spice with a history as a medicinal plant since ancient times (Hartmans *et al*., 1995). Parsley (*Petroselinum crispum*) has different uses in feed formulation, and in pharmaceutical, perfume, and cosmetic industries (Lopez *et al*., 1999). The present study aimed to evaluate the effects of dietary inclusion of parsley and caraway straws as fiber sources instead of alfalfa hay on the performance of growing rabbits from 6 to 13 weeks of age.

MATERIALS AND METHODES

The present study was carried out at the Poultry Research Station, Poultry Production Department, Faculty of Agriculture, Mansoura University. Parsley and caraway straws were used at levels 0, 4, 8, 12 and 16%, instead of alfalfa hay in the diets.

Experimental rabbits:

Eighty growing New Zealand White × Californian rabbits at 6 weeks of age were divided into 5 experimental groups, each of 16 animals. All groups had approximately equal initial live body weights.

Experimental diets:

Five pelleted experimental diets were formulated and contained five levels of parsley and caraway straws mixtures (1:1) to replace 0, 25, 50, 75, 100% of alfalfa hay in experimental treatments (T_1, T_2, T_3, T_4 and T_5), respectively. The experimental groups of rabbits were fed on their respective experimental diets. The actual composition of parsley and caraway straws (as fed basis; AOAC, 1990) and alfalfa hay (NRC, 1977) are presented in Table 1. Composition and chemical analysis of the experimental diets are presented in Table 2.

Table 1: Nutrient composition of parsley, caraway and Alfalfa hay (as fed basis).

Criteria	Parsley	Caraway	Alfalfa hay
Crude protein, %	9.84	5.51	17.7
Ether extract, %	4.0	4.5	2.4
Crude fiber, %	12.5	35.0	24.9
Ash, %	35.4	13.45	----
DE, (kcal/kg)	2100	2250	2200
Phosphorus, %	0.2	0.16	0.23
Calcium, %	2.18	1.66	1.33

Table 2: Composition and chemical analysis of the experimental diets

Ingredients	Replacement levels				
	Control (T1)	25% (T2)	50% (T3)	75% (T4)	100% (T5)
Yellow corn	----	----	1.0	1.0	1.0
Soybean meal, 44%	8	10.8	13.5	16.3	19.5
Wheat bran	33.8	31.0	27.3	25.5	23.3
Alfalfa hay	32.0	24.0	16.0	8.0	---
Di calcium phosphate	1.2	1.2	1.2	1.2	1.2
Limestone	1.0	1.0	1.0	1.0	1.0
Molasses	1.2	1.2	1.2	1.2	1.2
Salt	0.5	0.5	0.5	0.5	0.5
Premix*	0.3	0.3	0.3	0.3	0.3
Barley	22.0	22.0	22.0	21.0	20.0
Caraway straw	---	4.0	8.0	12.0	16.0
Parsley straw	---	4.0	8.0	12.0	16.0
Total	100	100	100	100	100
Determined analysis (AOAC, 1990)					
DE (kcal/kg)**	2605	2619	2645	2652	2662
CP	17.07	17.08	17.00	17.03	17.18
EE	2.68	2.76	2.82	2.92	3.01
CF	13.27	13.17	13.00	12.94	12.88
Calcium	1.16	1.21	1.27	1.31	1.37
Total phosphorus	0.84	0.82	0.79	0.78	0.77
Lysine, %	0.82	0.81	0.80	0.80	0.80
Methionine, %	0.20	0.20	0.20	0.20	0.20
Meth. + Cys., %	0.49	0.48	0.46	0.45	0.44
Price L.E /kg***	1.64	1.63	1.61	1.59	1.57

*** Premix composition per Kg feed: vit A, 200000IU, vit D150000 IU, vit.E8.33g; vit. $B_1$1.0g, vit B_2 1.09; vit. B_6 0.33mg; vit B_{12} 33mg, chlorine chloride 20g and Mn 5g.**

****According to NRC (1977) except for the test materials which calculated according to its chemical analysis.**

***** The price of one Kg of diet was calculated according to the prevailing market prices of feed ingredients during the experimental period.**

Digestion trials:

During the 13th week of age, five digestion trials were carried out to determine the digestibility coefficients of various nutrients and the feeding value of the experimental diets. Four male rabbits from each treatment were used in each trial. These rabbits were transferred to metabolic cages. Rabbits were weighed at the start and the end of the collection period to make sure that their weights were maintained. A preliminary period of 3 days was followed by 3 days as a collection period of feces. The feed intake was accurately determined and cecotrophy was not prevented.

Quantitative collection of feces started 24 hours after offering the feed. The feces were collected every day in the morning. Shed hair or foreign materials were discarded. The feces were dried primary at 70°C for 8 hours in forced drought oven. At the end of the collection period, all dried feces for each rabbit were mixed, ground and stored until chemical analysis. Diets and

feces were analyzed for dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash according to AOAC (1990).

Slaughter traits:

At 13th week of age, five male rabbits from each treatment were randomly chosen and slaughtered after fasting for 18 hours. Rabbits were immediately weighted before and after slaughtering. Then, they were skinned and emptied. The weights of hot carcass are calculated. All traits were calculated as percentage of the pre-slaughter weight. The total edible parts considered as carcass with head , liver, heart, and kidneys, as well as abdominal fat.

Blood constituents:

At the end of study (13 weeks of age), blood samples were collected during slaughter into heparinzed tubes. Then blood samples were isolated by centrifugation at 3000 rpm for 15 minutes. Blood plasma concentration of total protein (mg/dL), Glucose (mg/dL), cholesterol (mg/dL), triglycerides (mg/dL), and activity of aspartate aminotransferase (AST, U/L) and alanine aminotransferase (ALT, U/L) were determined using commercial kits.

Statistical analysis:

For data processing, analysis of variance was done using SAS program (SAS, 2003). Significant differences among means of treatments were estimated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Live body weight (LBW):

Table 3 revealed for the initial body weights of 6-week-old rabbits were nearly equal in all treatments, ranging from 903 to 911 g. With the exception of the slight reduction in live body weight in treatments 3, 4 and 5 during the 12th week of age, there were no significant differences in weekly live body weight among the all experimental treatments of rabbits. These results are in agreement with those obtained by Bahnas *et al.* (2009) found that no significant difference among dietary treatments in live body weight and live body weight gain during the period from 10 to 38 days of age.

Table 3: Live body weight (g) of rabbits at different ages as affected by experimental treatments.

Treatments	Age (weeks)							
	6	7	8	9	10	11	12	13
T1	903	968	1196	1375	1551	1693	1915[a]	2157
T2	906	960	1156	1323	1509	1641	1864[ab]	2107
T3	911	963	1158	1328	1504	1653	1831[bc]	2075
T4	904	975	1167	1324	1497	1638	1834[bc]	2031
T5	909	941	1166	1315	1480	1600	1795[c]	2041
SEM	9	13	19	19	21	22	18	40
Significance	NS	NS	NS	NS	NS	NS	*	NS

NS = Non-significant,* Significant at 0.05 probability level

a-c: Means in the same column having different superscripts are significantly different (P≤0.05).

However, El-Shenawi, (1992) indicated that the medicinal and aromatic plants has a useful or beneficial microbial activities in the digestive system which led to more LBW and LBWG when compared with the control group. Similar conclusion reported by Osman, *et al.* (2004) who observed that LBW and LBWG values were significantly increased by feeding some medicinal and aromatic plants.

Body weight gain:

Results presented in Table 4 showed no significant difference among dietary treatments in weight gain values during the period from 6 to 13 weeks of age. In agreement with the present results, Safwat, (2010) found that body weight and body weight gain did not significantly differ by feeding the experimental diets containing corn cubs and field bean. However, EL-Nattat and El-Kady (2007) found that daily body weight gains of rabbits were significantly increased by 19.3, 19.4 and 14.2% for radish, rocket and their mixture and reduced by 20.0% for rabbits fed black cumin-diets, respectively compared to the control diet. Osman *et al.* (2004) also reported that economic efficiency improved by increasing inclusion level of radish or parsley till 15% by about 33.5% and 22.2%, respectively as well as rocket up to 10% by about 15.9% as compared to the control group. A little information is available about possibility of using herbal and aromatic by-products in poultry diets. In this respect, Ibrahim (2005) reported that using medicinal and aromatic plants in broiler and rabbits diets improved body weight, body weight gain and performance index.

Table 4: Weekly body weight gain (g) of rabbits at different ages as affected by experimental treatments.

Treatments	Age (weeks)							
	6-7	**7-8**	**8-9**	**9-10**	**10-11**	**11-12**	**12-13**	**6-13**
T1	64	228	178	177	143	221	242	1254
T2	53	197	167	186	132	223	243	1201
T3	52	195	170	176	149	178	245	1164
T4	71	192	158	172	142	196	198	1127
T5	52	255	149	165	120	195	246	1182
SEM	11	13	9	15	10	12	44	37
Significance	NS	NS	NS	NS	NS	NS	NS	NS

NS = Non-significant.

Feed consumption of rabbits:

As presented in Table 5 there were no significant differences among the different experimental treatments in feed consumption of rabbits with the exception of a slight decrease in feed intake for treatment 5 during the period from 11–12 weeks of age as compared to the control group. In this respect, Ibrahim, *et al.* (2004) reported that rabbits received either dill or parsley at levels of 0.50 and 1.0 % of the diet showed no significant differences in feed consumption.

Table 5: Feed consumption (g) of rabbits at different ages as affected by different experimental treatments.

Treatments	Age (weeks)							
	6-7	7-8	8-9	9-10	10-11	11-12	12-13	6-13
T_1	304	377	593	646	684	824[a]	1070	4498
T_2	306	381	587	637	649	829[a]	1056	4444
T_3	306	386	587	675	664	820[ab]	1053	4491
T_4	300	379	588	643	678	806[ab]	1056	4449
T_5	311	382	593	679	672	786[c]	1047	4469
SEM	6	4	5	17	11	5	34	47
Significance	NS	NS	NS	NS	NS	**	NS	NS

NS = Non-significant, ** Significant at 0.01 probability level.

a-c: Means in the same column having different superscripts are significantly different (P≤0.05).

Feed conversion:

As presented in Table 6 there were no significant differences among the different experimental treatments in feed conversion of rabbits during different studied periods as compared to the control group. From Table 6 there were no significant differences in economic efficiency of growth for the rabbits during the whole experimental period. This results agreed with Bahnas *et al*. (2009) who found that rabbits fed parsley-containing diets had significantly better feed conversion value during the period from 10 to 38 days of age. Rajendra *et al*. (2000) reported that mustard cake could be used up to 30% of the rabbit diet without an adverse effect on growing rabbit performance.

Table 6: Feed conversion (g feed/ g gain) of rabbits at different ages as affected by experimental treatments as well as economic efficiency of growth (EEG %).

Treatments	Age (weeks)								EEG %
	6-7	7-8	8-9	9-10	10-11	11-12	12-13	6-13	
T1	5.7	1.7	3.4	3.7	4.8	3.7	4.5	3.75	240
T2	6.5	1.9	3.5	3.5	4.9	4.0	5.1	3.88	231
T3	6.4	2.0	3.5	3.9	4.5	4.9	4.6	4.03	222
T4	4.3	2.0	3.8	3.8	4.9	4.2	7.3	4.13	219
T5	6.0	1.7	4.0	4.2	5.7	4.1	4.4	3.84	223
SEM	1.3	0.13	0.17	0.30	0.32	0.50	1.27	0.11	9.1
Significance	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS = Non-significant, * Significant at 0.05 probability level.

Digestibility coefficients:

There were no significant differences in digestibility coefficient of dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fiber (CF) and NFE due to feeding the experimental diets. As reported by Ibrahim (2005) crude fiber digestibility of rabbits receiving 1% of rocket seed as a supplement was significantly increased compared to the control rabbits.

Table 7: Nutrient digestibility for the experimental diets.

Treatments	Nutrient digestibility %					
	DM	OM	CP	EE	CF	NFE
T1	64.2	64.0	69.1	75.1	52.6	64.8
T2	66.5	66.0	71.1	74.9	57.0	66.2
T3	64.2	63.9	73.7	75.9	53.6	62.3
T4	63.4	61.9	68.2	74.9	46.1	63.4
T5	65.2	65.7	69.5	71.1	53.3	67.4
SEM	1.3	1.4	2.3	3.04	4.2	2.6
Significance	NS	NS	NS	NS	NS	NS

NS = Non-significant.

Carcass traits:

Results presented in Table 8 revealed no significant differences among dietary treatments in the relative weights (carcass with head, liver, kidney, heart, abdominal fat and the total edible parts). The total edible parts represent between 56.56 (T5) to 59.01 (T4) without significant differences among them. These results agree with the findings of Ghazalah and Ibrahim (1996) who reported that addition of medicinal and aromatic plants had no negative impacts on carcass parameters. However, Azouz (2001) and Abd El-Latif, *et al.* (2002) found that addition of medicinal and aromatic plants had significantly improved dressing percentage of carcasses in Japanese quail and broilers than those fed the control diets.

Table 8: Carcass traits of 13-week-old rabbits as affected by experimental treatments.

Treatment	Live body weight (g)	Carcass empty (%)	Kidney (%)	Liver (%)	Heart (%)	Abdominal fat (%)	The total edible parts (%)
T1	2019	51.9	0.98	4.0	0.28	0.22	57.36
T2	2158	52.6	0.94	4.0	0.28	0.25	58.12
T3	2045	52.0	0.97	3.9	0.21	0.28	57.34
T4	2091	53.2	1.14	4.1	0.27	0.31	59.01
T5	2107	51.5	1.05	3.4	0.31	0.26	56.56
SEM	39	0.7	0.07	0.3	0.03	0.05	0.67
Significance	NS	NS	NS	NS	NS	NS	NS

NS = non-significant.

Blood plasma constituents:

Data of plasma constituents are summarized in Table 9. The results of plasma constituents indicated that there were no significant differences in blood plasma concentrations of glucose, cholesterol, triglycerides or total protein, or the activity of ALT in blood plasma while activity of AST was significantly increased in treatment 5 (in which parsley and caraway straws completely replaced alfalfa hay). In disagreement with the present results, Behnas *et al.* (2009) found that quails fed diets- containing parsley and its by-products had significantly higher serum calcium, cholesterol and triglycerides.

Table 9: Blood plasma constituents of 13-week-old rabbits as affected by experimental treatments.

Treatment	Glucose (mg/dL)	Cholesterol (mg/dL)	Triglycerides (mg/dL)	ALT (U/L)	AST (U/L)	Total protein (mg/dL)
T_1	145	52	79	13	26^b	6.84
T_2	142	60	106	17	28^b	7.04
T_3	146	63	76	20	31^b	6.96
T_4	138	65	73	20	35^b	7.12
T_5	132	55	63	18	55^a	7.04
SEM	5	7	11	3	6	0.17
Significant levels	NS	NS	NS	NS	*	NS

NS: non-significant

a-b: Means in the same column having different superscripts are significantly different (P≤0.05).

Conclusion

Based on the results of the present study, it can be concluded that parsley and caraway straw can completely replace alfalfa meal in growing rabbit diets without compromising growth performance, nutrient digestibility or carcass traits.

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إستخدام تبن البقدونس والكراوية كبدائل لدريس البرسيم الحجازي في علائق الأرانب النامية

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أجريت هذه الدراسة لتقييم تأثير تغذية الأرانب النامية علي مستويات مختلفة من تبن البقدونس وتبن الكراوية بدلا من دريس البرسيم الحجازي علي الأداء الإنتاجي ومعاملات هضم العناصر الغذائية وصفات الذبيحة وبعض مقاييس الدم. تم تكوين خمسة علائق تجريبية (في صورة محببة) تحتوي علي خمسة مستويات مختلفة من مخلوط تبن البقدونس وتبن الكراوية (1:1) لتحل محل صفر، 25، 50، 75 أو 100% من دريس البرسيم الحجازي في عليقة الكنترول. تم توزيع عدد 80 أرنب نامي من خليط النيوزيلاندي الأبيض مع الكاليفورنيا في خمسة مجموعات تجريبية متساوية وغذيت كل مجموعة علي العليقة الخاصة بها من عمر 6 حتى عمر 13 أسبوعا. أوضحت النتائج أن المعاملات الغذائية المستخدمة لم تؤدي إلى تأثيرات سلبية علي المظاهر الإنتاجية للأرانب، معاملات هضم العناصر الغذائية، صفات الذبيحة أو معايير الدم التي تم قياسها في هذه الدراسة. وبناء علي النتائج المتحصل عليها يمكن استنتاج أنه يمكن استخدام مخلوط تبن البقدونس والكراوية بدلا من دريس البرسيم الحجازي كليةً في علائق الأرانب النامية بدون أي تأثيرات ضارة علي المظاهر الإنتاجية للأرانب أو معاملات هضم العناصر الغذائية أو خصائص الذبيحة.

قام بتحكيم البحث

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