Effect Of Partial Replacement Of Berseem Hay By Corn Silage On Performance Of Growing Rabbits

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ABSTRACT: Two experiments were done to study the effect of partial replacement of berseem hay by corn silage on the performance of growing rabbits. In the first one, 8 mature male NZW rabbits with an average body weight of 2.5 kg and 8 months old were used to determine digestibility coefficients and nutritive values of berseem hay (BH) and corn silage (CS). In the second one, 30 NZW growing rabbits of 60 days of age were used in a complete randomized design experiment with three treatments. The first group fed commercial rabbit diet including 40% BH (control diet), while in the other two groups 50 or 100% of BH was replaced by CS throughout the 70 days of experiment. Results of the first experiment indicated that the contents of OM, EE and NFE were higher, but the contents of DM, CP and CF were lower in corn silage (CS) compared with berseem hay (BH). The digestibility coefficients of DM, OM, EE and NFE and the contents of TDN and DE were significantly higher ($P<0.05$), but the CP and CF digestibilities and DCP content was significantly lower ($P<0.05$) for CS than BH. In the second experiment, the contents of OM, EE and NFE increased, but the contents of DM, CP and CF decreased with increasing the level of replacing BH by CS. The digestibilities of DM, OM, EE and NFE and TDN and DE values and TVFA's concentration increased significantly ($P<0.05$), but CP and CF digestibilities and DCP value, pH value and NH_3-N concentration decreased significantly ($P<0.05$) with increasing the level of replacing BH by CS. The final body weight, total and daily weight gain, the total and net revenue and net revenue improvement increased significantly ($P<0.05$), however, average daily and total DM intake, feed cost and feed cost per kg gain decreased significantly ($P<0.05$) with increasing the level of replacing BH by CS. The amount of DM required per kg gain was significantly lower ($P<0.05$) for diets contained 50 and 100% CS compared with commercial rabbit diet. The slaughter weight, carcass weight, dressing percentage, meat weight and percentage and EE percentage increased significantly ($P<0.05$), but the percentages of DM, CP and ash decreased significantly ($P<0.05$) with increasing the level of replacing BH by CS. [Report and Opinion 2010;2(9):68-74]. (ISSN: 1553-9873).

Key words: NZW rabbits, corn silage, digestibility, body weight gain, economic efficiency and carcass traits.

INTRODUCTION

The wild rabbits being a herbivorous, consume a high proportion of plant as an integral part of their diet. Rabbits are true herbivorous and has enlarged cecum and colon with high bacterial population (Abou-Ashour *et al*., 2003). Thus, rabbits have the advantage of utilizing forages and by-products as a major diet component, since forage represents an important part of the rabbit diet (Toson *et al*., 1999). Moreover, rabbits meat production using local sources especially forages can help to overcome the dietary protein gap (Lebas, 1983). In Egypt, there has been a great attempt have been successfully performed on ensiled agricultural by-product and forages in rabbit feeding and their reflexes on their growth performance (Abou-Ashour *et al*., 2003 and Omara *et al*., 2005a).

The effect of nutrition on carcass traits has been studied by several workers (Volek *et al*., 2002 and Omara *et al*., 2005b). But little information is known about the effect of feeding rabbits on different kinds of silage on the carcass traits and meat quality.

The objective of this study was to investigate the effect of substitution of berseem hay by berseem and corn silages on the performance and carcass traits of growing NZW rabbits.

MATERIALS AND METHODS

The current work was carried out at Sakha Animal Production Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture to investigate the

effect of partial replacement of berseem hay by corn silage on the performance of growing rabbits.

Corn silage:

The whole plant corn (*SC 10*) at dough stage of maturity was chopped (1-1.5 cm length) and ensiled in plastic bags (40-50 kg) for two month. Silage quality parameters determined were pH value using Bechman pH meter, NH_3-N concentration (AOAC, 1990), TVFA's concentration (Warner, 1964) and lactic acid concentration (Analytical Chemistry of Foods, 1995).

The first experiment:

The digestibility trial was conducted to determine nutritive values of berseem hay (BH) and corn silage (CS) using 8 mature male NZW rabbits with an average body weight of 2.5 kg and 8 months old. Rabbits were fed twice daily at 8 a.m. and 3 p.m. and refusals were recorded every day and daily feces was weighed. Representative samples of tested feedstuffs and feces were chemical analysis according to AOAC (1990).

The second experiment:

Experimental rabbits and diets:

Thirty NZW growing rabbits of 60 days of age were used in a complete randomized design experiment with three treatments. The first group fed commercial rabbit diet including 40% BH (control diet), while in the other two groups 50 or 100% of BH was replaced by CS throughout the 70 days of experiment. The composition of commercial rabbit diet is shown in Table (1).

Housing and management:

Rabbits were housed in galvanized wire cages and fresh water was automatically available at all time. All rabbits were kept under the same managerial, hygienic and environmental conditions. Live body weight and feed consumption were recorded at weekly interval throughout the experimental period. Daily weight gain, feed conversion and economic efficiency were calculated.

Digestibility trials:

Digestibility trial was undertaken at the end of the experimental period (16 wk of age) on four animals from each group. Rabbits were housed individually in metabolism cages. The experimental diets were offered daily and fresh water was provided all the time. Feed intake was accurately determined. Feces were collected for 5 days as a collection period, then the feces was dried at 60^{o}C for 12 h. All collected feces for each animal were mixed, then feces were ground for chemical analysis and urine was kept (4-5 ^{o}C) for analysis. Chemical analysis of different foodstuffs and feces was determined according to AOAC (1990).

Carcass traits:

At the end of experiment, 3 rabbits were taken randomly from each group fasted for 18 hours before slaughtering, weighed and slaughtered. Carcass weight (the main body, head, kidneys, liver, heart and other total edible parts) were determined according to Blasco *et al*. (1993). Chemical analysis of meat was done according to AOAC (1990).

Cecum parameters:

Cecum contents of slaughtered rabbits were taken for the determination of pH using Bechman pH meter, NH_3-N concentration according to the method of **AOAC (1990)** and TVFA's concentration according to Warner (1964).

Statistical analysis:

The data was statistically analyzed using general linear models procedure adapted by SPSS (2008) for user's guide with one-way ANOVA. Duncan test within program SPSS was done to determine the degree of significance between the means.

RESULTS AND DISCUSSION

The first experiment:

Composition of tested feedstuffs:

The contents of OM, EE and NFE were higher, but the contents of DM, CP and CF were lower in corn silage (CS) compared with berseem hay (BH) as presented in Table (2). These results agreed with those obtained by **Abd El-**Lateif (2002) and Omara *et al*. (2005c).

Digestibility coefficients and nutritive values of tested feedstuffs:

Results in Table (2) showed that the digestibility coefficients of DM, OM, EE and NFE and the contents of TDN and DE were significantly higher ($P<0.05$), but the CP and CF digestibilities and DCP content was significantly lower ($P<0.05$) for CS than BH. The obtained results are within the values obtained by Abd El-Lateif (2002) and Omara *et al*. (2005c) for commercial rabbit diet, corn silage using NZW rabbits.

The second experiment:

Composition of experimental diets:

The calculated composition of experimental diets showed that the contents of OM, EE and NFE increased, but the contents of DM, CP and CF decreased with increasing the level of replacing BH by CS (Table 3). These results agreed with those obtained by Abd El-Lateif (2002) and Omara *et al.* (2005c).

Digestibility coefficients and nutritive values of experimental diets:

The digestibilities of DM, OM EE and NFE and TDN and DE values increased significantly (P<0.05), but CP and CF digestibilities and DCP value decreased significantly (P<0.05) with increasing the level of replacing BH by CS as shown in Table (3). The differences in nutrients digestibility and nutritive values among the different diets might be attributed to the differences in chemical composition of different diets. The results obtained here were higher than those obtained by Abd El-Lateif (2002) and Omara *et al*. (2005a), which may be attributed to the high quality of corn silage used here.

Cecum parameters:

Results in Table (4) revealed that pH value and NH_3-N concentration decreased significantly (P<0.05), however, TVFA's concentration increased significantly (P<0.05) with increasing the level of replacing BH by CS. The cecum fermentation parameters are affected by several factors such as: composition of the diet, feeding type, feeding level, roughage: concentrate ratio and post feeding period of sample. These results are in accordance with those obtained by Abd El-Lateif (2002) who found that the depression of cecum pH values with maize silage is associated with the increase of VFA's production, which the fluctuations in pH value reflect the changes of organic acids quantities accumulated in the ingesta. The concentration of NH_3-N in cecum reflects the protein content in the diets.

Body weight gain:

The final body weight, total and daily weight gain increased significantly (P<0.05) with increasing the level of replacing BH by CS (Table 5). The daily weight gain of rabbits fed diets contained 50 AND 100% CS increased by 9.28 and 16.31% compared with those fed commercial diet, respectively. These results could be attributed to the higher DE content (Table 3) and TVFA's concentration (Table 4). Such variations were mainly a reflection of the quality of experimental diets. Average daily weight gain reported herein was higher than those obtained by Abd El-Lateif (2002) ranged from 17.70 to 24.00 g/day and Omara *et al*. (2005a) ranged from 14.87 to 22.90 g/day for NZW fed diets containing corn silage, but were within the values obtained by Eweedah *et al*. (2007) being 26.74-30.34 g/day for NZW rabbits fed diets contained peanut vines.

Feed intake:

Results in Table (5) showed that average daily and total DM intake decreased significantly (P<0.05) with increasing the level of replacing BH by CS. Decreasing DM intake with increasing the level of CS might be due to the bulk of silage. Feed consumption of rabbits depends basically on nutrient contents in accordance with the actual energy need of the animal (Dehalle, 1981) or/and protein and fiber level of its ration (Fekete and Bokori, 1985). These results agreed with those obtained by Abd El-Lateif (2002) and Omara *et al*. (2005a) for NZW fed rations containing maize silage.

Feed conversion:

As shown in Table (5), It is obviously that inclusion of CS in the diets of growing rabbits improved feed conversion, which the amount of DM required per kg gain was significantly lower (P<0.05) for diets contained 50 and 100% CS compared with commercial rabbit diet. The lower feed conversion for diet contained BH (0% CS) may be attributed to that increasing DM intake led the faster passage rate from the digestive tract. Similar result was observed with NZW growing rabbits fed diets containing different kinds of silage (Abou Ashour *et al*., 2003 and Omara *et al*., 2005a).

Economic efficiency:

The total and net revenue and net revenue improvement increased significantly (P<0.05), but feed cost and feed cost per kg gain decreased significantly (P<0.05) with increasing the level of replacing BH by CS. Net revenue for diets contained 50 and 100% CS increased by 24.71 and 46.13% compared with commercial diet, respectively. These results may be due to the lower prices of corn silages compared with berseem hay. It is well known that grassland conserved products such as silages are normally cheaper per unit of energy than concentrate. The same author reported that if more increasing amounts of such feeds could replace expensive feedstuffs in the diet of rabbits without adverse effect on their performance, the cost of feeding would be reduced. Similar results obtained by Abd El-Lateif (2002) and Omara *et al*. (2005a) they found that economical efficiency values for diets containing corn silage were better than control diet.

Carcass traits:

Data in Table (6) showed that the slaughter weight, carcass weight, dressing percentage, meat weight and percentage increased significantly (P<0.05) with increasing the level of replacing BH by CS. The differences in carcass traits may be attributed to the differences in slaughter weight. It was obviously that dressing percentage increased with increasing body weight, which was in accordance with those obtained by Szendro *et al*. (1998). The results are in agreement with those

obtained by Abd El-Lateif (2002) and Omara *et al*. (2005b).

Meat composition:

The composition of rabbits meat for the different groups is shown in Table (6). The percentages of DM, CP and ash decreased significantly (P<0.05), but EE percentage increased significantly (P<0.05) with increasing the level of replacing BH by CS. The chemical composition of meat reflects the protein and energy intake. These results agreed with those obtained by Abd El-Lateif (2002) and Omara *et al*. (2005b).

Table 1: Composition of commercial rabbit diets.

Ingredient	%	Ingredient	%
Berseem hay	40	molasses	2
Wheat bran	8	limestone	1
Soybean meal	18	Common salt	0.5
Yellow corn	15	Premix*	0.5
Barley grain	15	Total	100

* Each one kg of premix (minerals and vitamins mixture) contains vit. A, 20000 IU; vit. D3, 1500 IU; vit. E, 8.33 g; vit. K, 0.33 g; vit. B1, 0.33; vit. B2, 1.0 g; vit. B6, 0.33 g; vit. B5, 8.33 g; vit. B12, 1.7 mg; pantothenic acid, 3.33 g; biotine, 33 mg; folic acid, 0.83 g; choline chloride, 200 g; Zn, 11.7 g; Fe, 12.5 g; Cu, 0.58 g; I, 33.33 g; Se, 16.6 mg and Mg, 66.7 mg.

Table (2): Chemical composition of feedstuffs and experimental diets used in rabbit feeding

Item	BH	CS*	±MSE	P-value
Chemical composition:				
DM %	89.45	29.50		
Composition of DM %:				
OM	89.70	92.70		
CP	14.35	8.50		
CF	27.64	21.40		
EE	2.45	2.90		
NFE	45.15	59.90		
Ash	10.30	7.30		
Digestibility coefficients %:				
DM	66.20	71.02	0.93	0.001
OM	67.70	72.80	1.08	0.007
CP	67.60	65.60	0.45	0.013
CF	63.50	61.15	0.58	0.032
EE	70.42	72.90	0.51	0.004
NFE	66.40	73.10	1.27	0.001
Nutritive values:				
TDN %	61.11	67.21	1.08	0.001
DCP %	9.70	5.58	0.69	0.001
DE (kcal/kg)	2694	2963	47.74	0.001

** Silage quality was pH 3.98, lactic acid 5.35% of DM, TVFA's 1.95% of DM and NH_3-N 4.20% of total-N.*

Table 3: Chemical composition, digestibility coefficients and nutritive values of experimental diets by growing rabbits.

Item	Replacing level %			±MSE	P-value
	0	50	100		
Chemical composition:					
DM %	91.23	64.49	49.88		
Composition of DM %					
OM	90.27	90.87	91.47		
CP	16.78	15.61	14.44		
CF	17.81	16.56	15.31		
EE	2.69	2.78	2.87		
NFE	52.99	55.92	58.85		
Ash	9.73	9.13	8.53		
Digestibility coefficients %:					
DM	69.47^{b}	74.85^{a}	75.37^{a}	0.94	0.006
OM	70.84^{b}	76.00^{a}	76.84^{a}	0.89	0.002
CP	71.35^{a}	69.26^{ab}	67.29^{b}	0.58	0.006
CF	64.63^{a}	63.23^{b}	62.01^{b}	0.37	0.005
EE	76.91^{b}	81.14^{a}	81.31^{a}	0.66	0.001
NFE	71.18^{b}	74.81^{a}	75.23^{a}	0.62	0.003
Nutritive values:					
TDN %	65.86^{b}	68.19^{a}	68.73^{a}	0.50	0.032
DCP %	11.97^{a}	10.81^{ab}	9.72^{b}	0.34	0.013
DE (kcal/kg DM)	2904^{b}	3006^{a}	3030^{a}	22.20	0.032

a, b: Values in the same row with different superscripts differ significantly (P<0.05).

Table 4: Cecum activity of growing rabbits fed experimental diets.

Item	Replacing level %			±MSE	P-value
	0	50	100		
pH value	6.12^{a}	5.82^{b}	5.75^{b}	0.06	0.007
TVFA's (mmol/dl)	8.74^{b}	10.15^{a}	10.75^{a}	0.30	0.006
NH_3-N (mg/dl)	21.87^{a}	20.35^{b}	19.50^{b}	0.35	0.008

a, b: Values in the same row with different superscripts differ significantly (P<0.05).

Table 5: Feed intake, body weight gain, feed conversion and economic efficiency of growing rabbits fed experimental diets.

Item	Replacing level %			±MSE	P-value
	0	50	100		
Initial weight (g)	772	776	774	3.80	0.924
Final weight (g)	2613^{c}	2787^{b}	2917^{a}	38.28	0.002
Total weight gain (g)	1841^{c}	2012^{b}	2143^{a}	40.01	0.001
Average daily gain (g/day)	26.30^{c}	28.74^{b}	30.61^{a}	0.57	0.001
Feed intake (g DM/head/day)	105.35^{a}	102.62^{ab}	98.45^{b}	1.24	0.061
Feed consumption (kg DM)	7.37^{a}	7.18^{ab}	6.89^{b}	0.09	0.061
Feed conversion (kg DM/kg gain)	4.01^{a}	3.57^{b}	3.22^{b}	0.11	0.07
Total revenue (L.E.)	29.46^{b}	32.19^{a}	34.29^{a}	0.65	0.002
Feed cost (L.E./head)	14.60^{a}	13.67^{a}	12.58^{b}	0.29	0.006
Feed cost (L.E.)/kg gain	7.93^{a}	6.79^{b}	5.87^{c}	0.27	0.001
Net revenue (L.E./head)	14.86^{c}	18.52^{b}	21.71^{a}	0.81	0.001
Net revenue improvement %	100.00^{c}	124.71^{b}	146.13^{a}	5.38	0.001

a, b, c: Values in the same row with different superscripts differ significantly (P<0.05).

The price of commercial rabbit diet 1800 L.E./ ton, berseem hay 800 L.E./ ton, berseem silage 150 L.E./ ton, body weight gain 16 L.E./ kg (2009).

Table 6: Carcass traits and chemical composition of meat of growing rabbits fed experimental diets.

Item	Replacing level %			±MSE	P-value
	0	50	100		
Carcass traits:					
Slaughter weight (g)	2508[c]	2676[b]	2801[a]	37.24	0.001
Carcass weight (g)	1512[c]	1681[b]	1809[a]	37.60	0.001
Dressing %	60.29[b]	62.81[a]	64.98[a]	0.66	0.004
Meat weight (g)	1058[b]	1177[a]	1266[a]	29.59	0.005
Meat %	42.2[b]	43.98[a]	45.20[a]	0.45	0.009
Chemical composition of meat %:					
DM	29.06[a]	28.34[ab]	27.59[b]	0.28	0.085
CP	77.17[a]	76.87[ab]	75.83[b]	0.24	0.048
EE	10.33[b]	12.74[a]	13.93[a]	0.53	0.006
Ash	8.95[a]	7.75[b]	7.46[b]	0.23	0.007

a, b, c: Values in the same row with different superscripts differ significantly (P<0.05).

CONCLUSION

In conclusion, feeding growing rabbits diet contained 40% corn silage showed the beast results concerning body weight gain, feed conversion and economic efficiency.

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