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EFFECT OF CUMIN SEED MEAL *(Nigella sativa)* AS FEED INGREDIENT IN GROWING LAMBS.

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SUMMARY

The effect of using cumin seed meal as an ingredient in sheep diets was studied on nutrients digestibility, some rumen parameters and growth performance of sheep. Thirty Ossimi lambs (4 months of age) were divided at random according to their body weight into three groups. The control group (T1) was fed a ration consisting of concentrate mixture and berseem. Cumin seed meal (CSM) was used to replace 20 or 40% of concentrate's protein for groups T2 and T3, respectively. Digestibility trials were conducted for each treatment using four Ossimi lambs. Results of chemical analysis indicated that crude protein (CP) and ether extract (EE) contents were higher in cumin seed meal (CSM) than those of concentrate feed mixture (CFM) and berseem (DM basis). Values of rumen liquor parameters (TVFA's and NH3-N) indicated that rations contained cumin seed meal (T2 and T3) showed the highest ruminal activity. The digestion coefficients of DM and OM were higher ($P<0.01$) for rations T2 and T3 than control group (T1). The same trend was observed with CP digestibility ($P<0.05$). In contrast NFE digestibility was significantly ($P<0.05$) higher for control than cumin seed containing rations. Average total feed intake for Lambs of T2 and T3 were significantly higher ($P<0.01$) than control. Economical efficiency was improved as CSM increased up to 40% of the dietary protein. It could be concluded that cumin seed meal can be used to cover up to 40% of concentrate's protein requirements in rations of growing lambs.

Key words: *Nigella sativa, Lambs, growth, nutrients digestibility, rumen activity.*

INTRODUCTION

Black cumin (*Nigella sativa*) is a spicy plant, and it is a member of the Ranunculaceae family. It's extracted oil (37% of the seed content) is being used in some medical treatments such as asthma, respiratory depression and cough (Karawya *et al.*, 1994). In Egypt, the whole seeds or the products of *Nigella sativa* are traditionally used as a flavoring agent for bakery products and for human consumption in medical treatments. Expanded utilization and cultivation of *Nigella sativa* for oil extraction make the seed meal available in reasonable amounts for animal feeding. Black cumin seed meal is a rich protein feed source containing in average 35.2% crude protein (Khalifah, 1995).

Our primary objective in this work is to evaluate the effect of using cumin seed meal as an ingredient in the feed of sheep on nutrients digestibility, some rumen parameters and growth performance of sheep.

MATERIALS AND METHODS

Animals and feeding:

Thirty Ossimi lambs (4 months old) were divided according to their body weight into three similar groups to study the effect of using cumin seed meal in partial replacement of dietary protein in

lambs' diets on nutrients digestibility, some rumen parameters and growth performance. Animals were housed separately in three semi-open sheds. The control group (T1) was fed on a ration consisting of concentrate feed mixture (CFM) and berseem. Cumin seed meal (CSM) was used to replace concentrate's protein at 20% for group 2 (T2) and 40% for group 3 (T3). Experimental lambs were weighed biweekly and requirements were adjusted accordingly. The concentrate roughage ratio in the diet offered was 60:40. Mineral blocks and fresh water were constantly available. All animals were fed according to NRC (1985) recommendation. Animals were fed twice daily in approximately two equal portions and subjected to routine vaccination program. The study was lasted for four months.

Digestibility trials:

Three digestibility trials in a crossover designed experiment were done at the end of the feeding trials using four Ossimi lambs (35.26 ± 1.37 Kg) to evaluate nutrients digestion coefficients of experimental diets. Each experimental period consisted of 7 days preliminary period and 5 days to determine ad-libitum feed intake and subsequently lambs were fed at 90% of ad-libitum for another 5 days for quantitative collections of feces. Daily samples of 10% of fresh feces were subsampled separately and composite samples over each period were stored at -20°C until chemical analysis.

Rumen liquor:

Rumen liquor samples were collected from three animals of each group using a rubber stomach tube once monthly during the feeding trial. Samples were taken before feeding, three hours and six hours post feeding. Rumen liquor samples were strained through four layers of cheesecloth. The filtrate portion was used immediately for measuring ruminal liquor pH. The rest of the filtrate portion was kept frozen for further analysis. Ammonia nitrogen was determined according to Conway method (1962) and total volatile fatty acids (TVFA's) and its fractionations were assayed using HPLC apparatus.

Chemical analysis:

Feedstuffs and feces samples were dried at 70° C for 24 hrs and then ground to pass through a 1-mm screen. Dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash were determined according to AOAC, (1980). The NFE and organic matter were calculated by difference.

Statistical analysis:

Data of this study were statistically analyzed using the General Linear Model (SAS, 1990). Duncan multiple range test was used to test the significant differences among treatment means (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical analysis:

Chemical analyses of feedstuffs of the experimental rations are shown in Table (1). Data indicated that CP and EE contents were higher in cumin seed meal (CSM) than those of the concentrate feed mixture (CFM) and berseem (DM basis), where CSM contained almost 150% of the protein content of CFM. These results are in agreement with Gabr *et al.*, (1998), who reported that CP of CSM represents about 67.3% of that in Soybean meal (SBM). Moreover ether extract content of CSM was 5.5 times more that of SBM. El-Ayek, (1999), reported that CP and EE contents of CSM were almost double and four-folds values respectively, in comparison with those of the commercial CFM.

Table (1): Chemical analysis of feedstuffs used in experimental rations on DM basis.

Items	Concentrate mixture*	Berseem	Cumin seed meal
Dry matter %	89.90	16.90	91.10
DM composition: %			
Organic matter	91.83	85.99	90.93
Crude protein	14.16	12.11	27.13
Crude fiber	16.98	21.10	11.02
Ether extract	3.82	3.16	19.11
Ash	8.17	14.01	9.07
NFE	56.87	49.62	33.67

*** Concentrate mixture containing: 30% yellow corn, 25% wheat bran, 20% undecorticated cotton seed meal, 15% rice bran, 7%molasses, 2% calcium carbonate and 1% sodium chloride.**

Table (2): Nutrient digestion coefficients and nutritive values of experimental rations.

Item	T1	T2	T3	±SE	Sig.
Digestion coefficients,%					
DM	63.15 b	68.54 a	71.81 a	3.17	**
OM	69.18 b	75.18 a	74.69 a	1.54	**
CP	60.97 b	62.75 b	70.14 a	2.18	*
CF	58.67	59.67	62.32	1.90	NS
EE	75.92	77.14	70.63	2.64	NS
NFE	80.14 a	75.94 b	74.16 b	2.98	*
Nutritive value, %					
TDN	62.30	63.01	65.16	-----	------
DCP	8.63	8.88	9.91	-----	-----

**** = P<0.01**
*** = P<0.05**
NS= Non significant
a,b,c means of different letters in the same row are significantly different.

Digestion coefficients and nutritive values:

The results in Table (2) showed the digestion coefficients and nutritive values of experimental rations. The digestion coefficients of DM and OM were significantly higher ($P<0.01$) for rations 2 and 3 than control ration. It could be noticed that the same trend was observed with CP digestibility ($P<0.05$). In contrast, NFE digestibility was higher ($P<0.05$) for control ration than the other two rations. On the other hand nutritive values expressed as TDN or DCP were higher for rations contained CSM than those of control ration. El-Ayek, (1999) reported that most of the nutrient digestibilities as well as nutritive values of diets contained CSM were higher than those free of CSM. El-Gendy et al., (2001) found that rations containing cumin seed meal had significantly higher DM, OM and CF digestibilities than other rations. They concluded that cumin seed meal could be used successfully in ruminant rations to improve its nutrient digestibility coefficients and nutritive values.

Rumen liquor parameters:

The effect of experimental rations on ruminal pH, ammonia-N, total volatile fatty acids and molar ratio of individual volatile fatty acids of different lamb groups are shown in Table (3). Results indicated that experimental rations had no significant effect on rumen liquor pH values, while sampling time had a significant effect ($P<0.05$ & $P<0.01$) on pH values where minimum pH values were detected at 3 hrs post feeding for all tested rations. This depressive effect could be due to the increase in TVFA's concentration (Table, 3). The values of ruminal pH in this study are within the range reported by Rakha (1988), who reviewed from several studies that the normal value of ruminal pH of sheep is ranging between 4.96 and 7.92. Kaufmann (1972) stated that the regulation mechanism of the ruminant is adjusted and not directed towards maintaining a medium or normal pH concentration.

The end products of rumen fermentation (TVF'A and NH3-N) indicated that rations contained cumin seed meal (T2 and T3) showed the highest ruminal activity which was reflected on higher digestibility coefficients of tested rations (Table, 2). Ruminal NH3-N (mg/100ml) and TVFA (meq/100ml) in the present study were observed at 3 hrs post feeding in all groups. These results are in agreement to those obtained by Abdel-Kareem (1990); Abdel-Aziz *et al.*, (1993) and El-Ashry *et al.*, (1997), who reported that NH3-N and total TVFA concentrations in the rumen liquor were minimum before feeding and increased to it's maximum level at 3 hrs post feeding. Hungate *et al.*, (1966) reported that the main part of CP in the diet was degraded to NH3-N in the rumen by the microorganisms and it depends to large extent on the physical and chemical nature of each protein. The molar proportion of VFA's (acetic, propionic, butyric and acetic: propionic ratio) are shown in Table 3., the values of acetic and propionic acids were increased while the values of butyric acid were decrease as the time after feeding was increased. The values of NH3-N and TVFA,s are within the range obtained by Rakha, (1988). These results are in agreement with those reported by Van Vuuren and Nel, (1983); Ushida *et al.*, (1985) and El-Mohands *et al.*, (1999).

Sheep performance and economical efficiency:

Body weight (kg), daily weight gain, feed efficiency, and economical efficiency of growing lanbs fed rations containing different levels of cumin seed meal (CSM) are shown in Table (4). Average total feed

Table (3): Effect of experimental rations on pH, ammonia-N, total volatile fatty acids concentrations and molar ratio of individual volatile fatty acids in lambs rumen liquor.

Items	Time of morning feeding hrs	T1	T2	T3	±SE	Sig. Among treatments
pH	0	6.76 ^{A}	6.98 ^{A}	7.01 ^{A}	055	NS
	3	5.94 ^{B}	6.02 ^{B}	6.98 ^{A}	0.62	NS
	6	6.02 ^{B}	5.99 ^{B}	6.18 ^{B}	0.49	NS
±SE	---	0.19	0.12	0.13	---	---
Sig. Among times		*	*	*	---	---
Ammonia-N (mg/100ml)	0	19.24 ^{C}	21.54 ^{B}	22.74 ^{B}	0.22	NS
	3	23.54 ^{Ab}	24.71 ^{Aa}	25.98 ^{Aa}	0.96	*
	6	20.17 ^{Ba}	19.32 ^{Bb}	18.24 ^{Cb}	0.82	*
±SE	---	1.15	1.05	1.06	---	--
Sig. Among times		**	*	*	---	---
TVFA (meq/100ml)	0	7.84 B	6.32 B	8.01	0.90	NS
	3	10.12 ^{Ab}	9.41 ^{Ab}	11.62 ^{a}	0.23	*
	6	8.61 ^{Bb}	8.16 ^{A}b	10.24 ^{a}	0.34	**
±SE	---	0.64	0.59	0.55	---	---
Sig. Among times		*	*	NS	--	--
Molar proportion of acetic acid	0	50.87^{C}	49.31^{C}	52.11	3.20	NS
	3	57.63^{A}	56.87^{A}	53.64	2.19	NS
	6	54.34^{Bb}	52.57^{Bb}	55.48^{a}	2.24	*
±SE	---	1.69	1.67	1.70	---	----
Sig. Among times		**	*	NS	---	---
Molar proportion of propionic acid	0	20.18	21.47	19.64C	3.30	NS
	3	24.14^{a}	22.69^{c}	25.74^{Ab}	2.24	*
	6	22.94a	24.58b	23.75^{Bb}	2.18	*
±SE	---	1.32	1.26	1.24	--	---
Sig. Among times		NS	NS	**	---	---
Molar proportion of butyric acid	0	23.67^{A}	22.86^{B}	21.34^{A}	2.67	NS
	3	16.34^{B}	18.64^{B}	17.35^{C}	2.48	NS
	6	20.89^{Bb}	22.49^{A}a	20.95^{B}b	1.85	*
±SE	---	2.98	3.01	2.64	---	---
Sig. Among times		*	**	*	--	---
Acetic : Propionic ratio	0	1.94	2.30	3.06	--	--
	3	2.19	2.51	2.08	---	---
	6	2.05	2.18	2.48	---	---

Within row, times having similar small letters are not differing significantly, whiles within column, treatments having similar capital letters are not differing significantly.

**** = P<0.01**

*** = P<0.05**

NS = non significant difference

Table (4): Body weights (kg), daily weight gains, feed efficiency and economical efficiency of lambs fed rations containing cumin seed meal.

Items	Experimental diets				Sig.
	T1	T2	T3	±SE	
Number of lambs / treatment	10	10	10	---	---
Initial body weight. (4 mo. of age)	17.61	18.11	17.94	1.10	NS
Wt. At 8 months of age	34.14c	36.10a	37.02a	1.21	**
Average daily weight gain (gm/day)	137.67c	149.32 b	158.58a	1.96	**
Feed intake (kg DM/ animal/d)	0.953a	0.889b	0.907b	0.07	*
Concentrate (kg DM/ animal/d)	0.514a	0.431b	0.442b	0.12	*
Roughage (kg DM/ animal/d)	0.439	0.458	0.465	0.19	NS
Feed conversion (g DM/g gain)	6.95c	5.96b	5.74a	0.08	*
Feed cost/day (LE)[1]	0.491	0.479	0.465	---	---
Total cost/day (LE)[2]	0.701	0.670	0.663	---	---
Return/day (LE/ animal)[3]	0.469	0.599	0.642	---	---
Economical efficiency[4]	0.67	0.89	0.96	---	---

**** = P<0.01**

*** = P<0.05**

NS = Not significant

a,b,c means of different letters in the raw are significantly different.

(1) Based on market prices at the beginning of the experiment, the prices (LE/kg) were CFM, 0.60; berseem 0.06; cumin seed meal, 0.20 and kg live body weight, 8.5.

(2) The total cost was calculated from the feeding cost that represents 70% of the total cost.

(3) Return/day = Price of daily weight gain – total cost.

(4) Economical efficiency = return/total cost.

intake of T2 and T3 containing CSM are significantly higher ($P<0.01$) than that of control group. Such results might be attributed to the enhancement effect of the rate / or the extent of CSM components in the rumen. Feed conversion (g DMI / g. gain) was significantly higher ($P<0.05$) for T1 than other treatments. This may be a reflection of the lower daily weight gain for T1 than other feeding treatments. These results were in agreement with Awadalla, (1997), Gabr *et al.*, (1998); El-Khnawy *et al.*, (1999) and El-Ayek *et al.*, (1999).

Economical efficiency was the best for T3 followed by T2 then T1. The values of return/day (LE/ animal) were 0.469, 0.599 and 0.642. It can be concluded that cumin seed meal can replace up to 40% from protein of concentrate mixture for feeding growing lambs. This is in full agreement with El-Ayek (1999) who reports that cumin seed meal could be used as a relatively good source of energy and protein supplement in the diets of ruminants since its protein characterized by low degradation rate in the rumen.

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تأثير استخدام كسب حبة البركة فى علائق الحملان

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لدراسة تأثير استخدام حبة البركة كأحد مصادر الاعلاف البروتينيه فى الأغنام على معاملات الهضم ونشاط الكرش وكفاءة التحويل الغذائى استخدم فى الدراسة ثلاثون حملا خليط أعمارهم حوالى ٤ شهور من هجين الكيوس والاوسيمى قسموا الى ثلاثة مجموعات طبقا لوزن الجسم.

المجموعة الأولى غذيت على عليقه من العلف المركز والبرسيم أما المجموعة الثانية فقد تم احلال كسب حبة البركة بنسبة ٢٠% من بروتين العليقة المركزة بينما بلغت نسبة الاحلال من بروتين العلف المركز ٤٠% فى المجموعة الثالثة. كما أجريت تجارب الهضم لجميع المعاملات الغذائية.

اوضحت النتائج ان البروتين الخام والدهن الخام فى كسب حبة البركة اعلى عن مخلوط العلف المركز حيث احتوى كسب حبة البركة على نسبة من البروتين الخام تعادل ضعف محتوى البروتين الخام فى العليقة المركزة تقريبا.كما اوضحت النتائج ايضا ان الناتج النهائى لتخمرات الكرش (الاحماض الدهنية الطيارة وامونيا الكرش) للعلائق التى تحتوى على حبة البركة (المعاملات الثانية والثالثة) كانتا اعلى عن باقى العلائق وقد انعكس ذلك على تحسن معاملات الهضم لهذه العلائق .

اوضحت النتائج ايضا ان معاملات هضم المادة الجافة والمادة العضوية ارتفعتا معنويا (١%) للعليقة الثانية والثالثة والمحتوية على كسب حبة البركة عن المعاملة الاولى (الكنترول). كما لوحظ ان معاملات هضم البروتين الخام تأخذ نفس الاتجاه وعلى العكس فقد كانت معاملات هضم المستخلص الخالى من ألا زوت (NFE) عالية معنويا فى العليقة الكنترول عن المعاملات الاخرى.

اوضحت النتائج ايضا ان الماكول من الغذاء للمعاملات الثانية والثالثة كات اقل معنويا عن المعاملة الاولى (الكنترول) كما كانت الكفاءة الاقتصادية افضل فى المعاملة الثالثة ثم تليها المعاملة الثانية ثم المعاملة الاولى (الكنترول).

ويستخلص من هذه الدراسة الى انه يمكن استخدام كسب حبة البركة حتى ٤٠% من احتياجات الاغنام من بروتين العليقة المركزة.