Egyptian J. Nutrition and Feeds (2006) 9 (2): 221 - 234

EVALUATION OF DRIED AND ENSILED ARTICHOKE *(CYNARA SCOLYMUS L.)* BY-PRODUCT AS A FEED FOR GROWING SHEEP

G. H. A. Ghanem

Animal Production Research Institute, Agricultural Research Center, Dokki, Giza.

(Received 1/3/2006, accepted 28/5/2006)

SUMMARY

Eighteen Barki lambs with average body weight of 20 kg were divided into three similar groups. Lambs in the first group were fed ration consisted of concentrate feed mixture (CFM), berseem hay (BH) as a control ration, while those in the second group were fed CFM and dried artichoke by-product (DAB) and those in the third group were fed CFM and ensiled artichoke by-product (SAB).

Ensiled artichoke by-product contained higher contents of CP, EE and ash and lower OM, NDF, ADF and ADL as compared to DAB. The digestibilities of DM, OM, CP, EE, CF and NFE as well as nutritive values were significantly higher ($P<0.05$) for SAB compared to DAB.

Control ration (R1) had lower OM, CP and NFE, but higher CF and ash contents compared to R2 and R3 containing DAB and SAB, respectively. Ration 3 showed the highest digestbilities of DM, OM, CP, EE and NFE and subsequently nutritive values ($P<0.05$). However, R1 showed the lowest DM, OM and EE digestibilites ($P<0.05$). While, R2 revealed the lowest CP and NFE digestibilities ($P<0.05$).

Ruminal liquor from lambs fed R1 showed the highest pH value and NH_3-N concentration and the lowest TVFA's concentration in rumen fluid ($P<0.05$). While, lambs fed R3 showed the highest ruminal TVFA's concentration and the lowest ruminal pH value ($P<0.05$) and those fed R2 showed the lowest concentration of NH_3-N in rumen liquor.

The DM intake was nearly similar for the different treatments. Lambs fed R3 showed the highest intake of TDN, DE and DCP, followed by those fed R1, while those fed R2 had the lowest intake. Lambs fed R1 and R3 showed significantly higher body weight gain than those fed R2. Lambs fed R2 showed the poorest feed conversion compared to those fed R1 and R3.

Daily feed cost as well as feed cost per kg body weight gain was significantly ($P<0.05$) lower, while economic efficiency was significantly ($P<0.05$) higher for lambs fed R2 and R3 compared to those fed R1.

***Key word:** artichoke by-product, growing lambs, nutritive value, growth performance.*

INTRODUCTION

In Egypt, there is a shortage of available feed for ruminant. According to this problem a growing attention is being focused on the use of crop by-products such as straws like rice straw, sugar beet tops, agriculture

industrialization by-products, fruits and vegetables wastes for ruminant feeding. Using of these resources will decrease the amounts of concentrate feed mixture offered to animals and subsequently reduce the feed cost as well as limitation the environmental pollution. (Abou-Slim and Bendary, 2005).

About 14 thousand feddans are cultivated with artichoke (*Cynara Scolymus L.*) in Egypt (Agriculture Economic, 2003), which produced about 8 tons per feddan (on DM basis). Flower head of artichoke weights about 200 gm, while artichoke bracts weighs 70-80 gm (about 37% of the flower head weight (El-Badry, 1995). Large amounts of artichoke bracts are produced annually as by products. However, information on its value and using for animals feeding is very limited or unknown.

The meat-goat and sheep industry has grown recently (Oman, *et al.* 1999 and Cameron, *et al.* 2001) providing many new opportunities for additional income on diversified farming operations. Meat-goat and sheep producers will need feeds that are economical and easily managed. Grain-based commercial supplements may not be economical for growing and finishing meat goats and sheep, and feeding these traditionally high-starch supplements may lead to reduced ruminal pH and fiber digestibility (Garces-Yepez, *et al.* 1997). Some by-product feeds contain highly digestible fiber, which potentially could provide adequate gain without the management problems associated with high-starch (high-grain) diets. Several studies primarily in developing countries have been performed to evaluate by-products in diets for goats and sheep (Madrid, *et al.* 1997; Maity, *et al.* 1999).

The objective of this study was to evaluate dried and ensiled artichoke by-product and investigate its effect on the performance of growing lambs.

MATERIALS AND METHODS

This study was carried out at Sakha Animal Production Research Station, belonging to Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture.

Preparing of dried and ensiled artichoke by-product:

Artichoke by-product was air dried while spread over a layer of rice straw and left for 5-10 days with continuing turning of the material to enforce drying and then it was collected in plastic bags. Ensiled artichoke by-product was made between feed toughs, where 30 cm layer of rice straw was spread on the ground as bed to absorb the silage seepage and to prevent contamination with earth. Molasses was added at a level of 5% to promote silage fermentation. The ensiled materials were compressed by heavy drum filled with sand, then covered with plastic sheet and were hard pressed with 30 cm of soil layer and ensiled for eight weeks. Color and odder of silage were examined and samples were taken for chemical analysis before starting feeding trials.

Evaluation of dried and ensiled artichoke by-product:

Two digestibility trials were carried out to determine nutrients digestibility coefficients and nutritive values of dried and ensiled artichoke by-product using

adult Ossimi x Finnish crossbred rams (3 in each) with average body weight of about 50 kg and aged 3 years. Each trial consisted of 14 days as a preliminary period and 7 days collection period. Rams were kept and fed individually in metabolic cages. Rams were fed *ad libtium* and the intake was measured during the preliminary period and during the collection period feed was restricted to 90% of the voluntary intake to avoid any feed refusals. Dried and ensiled artichoke by-product were offered for each ram in two equal meals at 8 a.m. and 4 p.m. Water was available at all times in plastic buckets.

Samples of dried and ensiled artichoke by-product were taken at the beginning, middle and end of collection period. Total collection of feces from each ram was weighed daily during collection period and samples (10% by weight) of each daily collection were taken. The samples of dried and ensiled artichoke by-product and feces were dried in air oven at 60 ^{0}C for 48 hours to determine DM content. Then composted and representative samples were analyzed according to AOAC (1990). The obtained feeding values were applied to formulate the experimental rations and to assess the quantities of feed necessary to cover the nutritional requirement of experimental lambs.

Feeding trial:-

Experimental animals and rations:-

Eighteen Barki lambs about 4-5 months old and weighing 20 kg on average were divided into three groups of similar live body weight (6 animals each). Each group was kept in a separate shaded pen and adapted for the tested rations for 15 days. Lambs in the first group were fed ration consisted of concentrate feed mixture (CFM), berseem hay (BH) as a control ration (R1), while those in the second group (R2) were fed CFM and dried artichoke by-product (DAB) and those in the third group (R3) were fed CFM and ensiled artichoke by-product (SAB).

Lambs were fed to cover their requirements according to NRC (1985). Lambs were weighed at the beginning of the experiment and biweekly thereafter till the end of the experiment which lasted for 120 days. The rations were offered in two equal meals twice daily at 9 a.m. and 4 p.m. Water was available for animals all times.

Digestibility trials:

Three digestibility trials were carried out during the feeding trials using 3 animals, chosen randomly from each experimental group to determine nutrients digestibility and nutritive values of experimental rations. Animals were kept in metabolic cages for 3 days before sample collection. Feces were collected daily during the collection period extended for 7 days, weighed and representative samples (10% of weight) were taken. Animals were fed their rations as described above and the residual was collected and weighed daily. Animals were allowed free access to water.

Rumen liquor:

Rumen liquor samples were collected three hours after the morning feeding from 3 lambs of each group during the feeding trial using stomach tube. Samples were filtered through a double layer of cheesecloth. Ruminal pH value was immediately estimated using Orian 680 digital pH-meter. Few drops of a saturated solution of mercuric

chloride were used to stop microbial activity and the samples were stored in polyethylene bottles in a freezer until analysis. Concentration of TVFA's was determined using steam distillation method (Warner, 1964). The concentration of ammonia-N was determined using magnesium oxide (MgO) as described by AOAC (1990).

Feed and economic efficiencies:-

Feed efficiency was calculated as the amounts of DM, TDN, DE and DCP (kg) required per kg live body weight gain. Economic efficiency expressed as the daily feed cost, price of daily weight gain, feed cost per kg gain and the ratio between daily feed cost and price of daily weight gain. The prices in Egyptian pounds (LE/ton) were 985 for CFM, 650 for berseem hay, 60 for rice straw, 65 for ensiled artichoke by-product, 200 for dried artichoke by-product and 15 for one kg live weight gain during year 2004.

Statistical analysis:-

The data were subjected to statistical analysis using general linear models procedure adapted by SPSS for windows (1999) with one-way ANOVA. Duncan test within program SPSS was done to determine the degree of significance between the means.

RESULTS AND DISCUSSION

Evaluation of dried and ensiled artichoke by-product:

Chemical analysis of dried and ensiled artichoke by-product as shown in (Table 1) indicated that even though the ensilaged and dried artichoke by-products were taken from the same field, ensiled artichoke by-product (SAB) contained higher CP, EE and ash contents and lower OM, CF, NFE, NDF, ADF, ADL, cellulose and hemicellulose contents as compared to dried artichoke by-product (DAB),. These results were nearly similar to the values obtained by Nour *et al.* (1980) and Sadek (1999). These differences in chemical composition of ensiled or dried artichoke by-product may be attributed to the loss occurs during drying or ensiling and handling. These losses were greatly reduced when the artichoke is made into silage. The present results are confirmed by those obtained by Chauhan et al., (1980) who found that drying of forage crops caused a decrease in different nutrients, because of the losses of nutrients during hay making. The present data are in agreement with those obtained by El-Deek *et al.* (1988) and El-Sayaad *et al.* (1995) as they found that artichoke by-product contained reasonable amounts of CP, NFE and ash, while the content of CF was quite high.

Silage made from artichoke by-product was green in color, free from mold, must smell caramelized and tobacco odorous. Also, silage quality characteristics revealed that pH value was 4.15 and the concentrations of total organic acids, lactic acid, TVFA's and ammonia-N were 8.11, 5.54, 2.57% of DM and 5.30% of total-N, respectively. These results indicated good quality silage as stated by McDonald *et al.* (1995).

Digestion coefficients and nutritive values of SAB and DAB are presented in Table (2). Results indicated that digestibility of DM, OM, CP, EE, CF and NFE as well as nutritive values (TDN, DE and DCP) were significantly higher ($P<0.05$) for SAB compared to

Table (1): Chemical analysis of dried and ensiled artichoke by-product.

Item	DAB	SAB
Chemical composition		
DM %	90.93	23.30
Composition of DM %		
OM	92.52	89.43
CP	11.43	13.58
EE	1.70	2.66
CF	23.95	20.10
NFE	55.44	53.09
Ash	7.48	10.57
NDF	52.49	43.81
ADF	41.27	37.31
ADL	6.89	6.58
Cellulose	34.38	30.79
Hemicellulose	11.22	6.50

DAB= dried artichoke by-product SAB= ensiled artichoke by-product

Table (2): Dry matter intake, digestibility coefficients and nutritive values of dried and ensiled artichoke by-product.

Item	DAB	SAB	SEM
DM intake, kg	1.05	0.81	0.06
Digestibility coefficients %			
DM	55.07^{b}	58.41^{a}	0.85
OM	56.31^{b}	58.97^{a}	0.75
CP	45.68^{b}	48.56^{a}	1.80
EE	34.25^{b}	50.06^{a}	4.57
CF	51.26^{b}	53.41^{a}	1.45
NFE	61.36^{b}	64.18^{a}	0.78
Nutritive values			
TDN %	52.83^{b}	54.40^{a}	0.58
DE Mcal/kg DM*	2.33^{b}	2.40^{a}	0.03
DCP %	5.22^{b}	6.59^{a}	0.37

DAB= dried artichoke by-product SAB= ensiled artichoke by-product

* DE= TDN % x 0.04409. (NRC 1988)

DAB. The average nutritive values of SAB and DAB were 54.40 and 52.83% for TDN, 2.40 and 2.33 Mcal DE/Kg DM and 6.59 and 5.22% for DCP, respectively. The lower nutritive values of DAB compared to SAB may be due to the higher DM intake (Table 2) as well as the high CF and low CP and EE content in DAB (Table 1). The high CF and low CP content of DAB reduced apparent digestibility (Table 2), which agreed with Abd El-Baki *et al.* (1989). Ghanem *et al.* (2000) found that the digestibility coefficients and nutritive values of broad bean vine silage were higher than that of dried broad bean vine.

Feeding trial:

Chemical composition of ingredients and experimental rations:

Chemical analysis of tested feedstuffs and calculated composition of the experimental rations are shown in Table (3). Control ration (R1) had lower OM (89.01%), CP (13.55%) and NFE (53.44%), but higher CF (19.47%) and ash (10.99%) contents compared to R2 and R3 contained DAB and SAB. Such results were mainly a reflection of the chemical composition of CFM, BH and artichoke by-product (dried or silage) as shown in Table (3).

Nutrients digestibility and nutritive values of the experimental rations:

Digestion coefficients and nutritive values of experimental rations are presented in (Table 4). Results indicated that R3 containing artichoke silage showed (the highest digestbilities of DM, OM, CP, EE and NFE and subsequently nutritive values expressed as TDN, DE and DCP ($P<0.05$). Diet R1 containing berseem hay showed the lowest DM, OM and EE digestibilites ($P<0.05$). Diet R2 containing dried artichoke by-product revealed the least CP and NFE digestibilities ($P<0.05$). This decrease might be due to the lower CP and higher CF content in R1 and R2 compared with R3 as shown in Table (3).

The main reasons which might be responsible for the superiority of the artichoke by-product silage containing ration (R3) could be due to some beneficial effects of silage like being succulent and containing suitable amount of digestible nutrients. These factors resulted in some changes in digestive function, which increased the availability and utilization of nutrients in the rumen and could have a significant impact on intake as stated by Williams and Newbold (1990).

Rumen fermentation:

Results in Table (5) revealed that, ruminal pH value of lambs fed control ration (R1) was significantly higher ($P<0.05$) than those fed rations contained dried and ensiled artichoke by-product (R2 and R3). The pH values obtained herein were within the range of 6 to 7 given by Mertens (1977) for optimum cellulytic bacteria activity. Also, variations in pH values obtained in the present study could be explained according to Phillipson (1970) who stated that rumen pH values varied according to the nature of the diet, post feeding time and quantities of organic acids in the digesta. Lambs fed R1 showed significantly ($P<0.05$) highest NH_3-N concentration as well as the least TVFA's concentration. While, lambs fed ration contained SAB recorded the highest ruminal TVFA's concentration and the lowest ruminal pH value ($P<0.05$). However, lambs fed ration

Table (3): Chemical analysis of feed ingredients and calculated chemical composition of the experimental rations.

Item	DM %	Chemical composition of DM %					
		OM	CP	EE	CF	NFE	Ash
Feed ingredients							
CFM*	90.70	90.55	16.18	3.12	10.30	60.95	9.45
BH	92.50	88.27	11.10	2.01	28.62	46.54	11.73
DAB	90.93	92.52	11.43	1.70	23.95	55.44	7.48
SAB	23.30	89.43	13.58	2.66	20.10	53.09	10.57
Experimental rations							
R1. Control	91.60	89.01	13.55	2.55	19.47	53.44	10.99
R2. CFM + DAB	90.82	91.35	13.78	2.40	17.10	58.07	8.65
R3. CFM + SAB	36.78	89.92	14.86	2.88	15.26	56.92	10.02

* CFM (concentrate feed mixture): 42% cottonseed meal, 27% yellow corn, 23% wheat bran, 5% molasses, 2% limestone and 1% sodium chloride.

BH: berseem hay, DAB= dried artichoke by-product, SAB= ensiled artichoke by-product

Table (4): Digestion coefficient and nutritive values of experimental rations.

Item	Experimental rations			SEM
	R1	R2	R3	
Digestion coefficient %:				
DM	63.12^{c}	64.91^{b}	66.40^{a}	0.50
OM	64.08^{c}	66.16^{b}	68.47^{a}	0.65
CP	61.00^{b}	57.64^{c}	62.58^{a}	0.76
EE	71.34^{b}	75.14^{a}	75.47^{a}	0.68
CF	43.12	42.79	43.28	0.22
NFE	75.24^{a}	72.15^{b}	76.16^{a}	0.66
Nutritive values:				
TDN	60.98^{b}	60.27^{b}	64.13^{a}	0.53
DE Mcal/kg DM*	2.69^{b}	2.66^{b}	2.83^{a}	0.02
DCP	8.27^{b}	7.94^{c}	9.30^{a}	0.21

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

*DE= TDN % x 0.04409 (NRC 1988).

R1= Control, R2= CFM + DAB, R3= CFM + SAB

containing DAB recorded the lowest concentration of NH_3-N in rumen liquor ($P<0.05$). Concentration of ammonia-N in all feeding groups were in the normal range of the rumen liquor as described by Church (1976), who stated that the normal range of the rumen ammonia-N ranged between 10 and 45 mg/100 ml depending on the composition of the ration, time of sampling and method of analysis used.

Average daily feed intake:

Average daily intake of different feed ingredients is shown in Table (6). The highest daily TDN, DE and DCP consumption were recorded by lambs fed R3 contained artichoke by-product silage, being 0.59 kg, 2.60 Mcal and 85.56 g, respectively. The corresponding lowest values of feed consumption were found for R2 contained dried artichoke by-product being 0.55 kg, 2.42 Mcal and 72.25 g, respectively. While lambs fed control rations recorded intermediate values of feed consumption being 0.56 kg, 2.47 Mcal and 76.08 g as TDN, DE and DCP, respectively. These results are within the values obtained by Mostafa *et al.* (2000) who reported that DM and TDN intake by lambs fed maize stover silage ranged from 0.89 to 0.99 and from 0.56 to 0.68 kg, respectively. Gabr and Ahmed (2003) found that daily intake by lambs fed agriculture by-product silages ranged from 0.53 to 0.76 kg TDN.

Body weight gain:

Data presented in (Table 6) showed that during feeding trial (120 day), the average total body weight gain was 18.00, 15.94 and 18.51 Kg for lambs fed R1, R2, R3, respectively. The corresponding values of daily body weight gain were 150.00, 132.83 and 154.25 g, respectively. The data indicated that lambs fed R1 and R3 achieved significantly ($P<0.05$) higher daily body weight gain (154.25 and 150.09 g, respectively) compared to those fed R2 (132.83 g). Also, results revealed that the average daily gains of the different treatments appeared to be more affected by TDN, DE and DCP intake. It was noticeable that R3, which had the highest intake of TDN (0.59 kg) DE (2.60 Mcal) and DCP (85.56 g) produced the highest daily gain 154.25 g. It was clear that, feeding artichoke by-product silage or berseem hay along with concentrate feed mixture increased body weight gain, which may be attributed to the comparatively higher digestible nutrients intake. These results are within the values obtained by El-Saadany *et al.* (2003) who found that average daily gain of growing lambs ranged from 113.30 to 160.10 g. Mostafa *et al.* (2000) fed lambs on ration contained maize or maize stover silage and reported that lambs consumed more TDN and DCP gained more weight.

Feed conversion:

Results of feed conversion as the amount of DM, TDN, and DE required to producing one kg body weight gain are shown in Table (7). Data indicated that lambs fed R2 containing dried artichoke recorded the least feed conversion compared to those fed R1 and R3. The best feed conversion was attained by lambs fed R3 compared to R1 and R2. This is an indication of higher metabolizable energy in the DM of R3 which would be more efficiency utilized for growth (Blaxter 1967). Mostafa *et al.* (2000) fed lambs on ration contained maize or maize stover

Table (5): pH, total volatile fatty acids (TVFA's) and ammonia (NH_3-N) concentrations in the rumen of lambs fed experimental rations.

Item	Experimental rations			SEM
	R1	R2	R3	
pH	6.22[a]	6.12[b]	6.02[b]	0.04
TVFA's meq/ 100 ml	12.35[c]	13.70[b]	14.85[a]	0.38
NH3-N mg/ 100 ml	17.18[a]	12.49[c]	15.30[b]	0.54

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

R1= Control, R2= CFM + DAB, R3= CFM + SAB

Table (6): Average daily feed intake and body weight gain of growing lambs fed experimental rations.

Item	Experimental Ration			SEM
	R1	R2	R3	
Average daily feed intake:				
NO. of animals	6	6	6	
Duration (day)	120	120	120	
Concentrate feed mixture (kg)	0.50	0.50	0.50	
Berseem hay (kg)	0.50	-	-	
Dried artichoke by-product (kg)	-	0.50	-	
Silage artichoke by product (kg)	-	-	2.00	0.001
DM (kg)	0.92	0.91	0.92	0.004
TDN (kg)	0.56[b]	0.55[b]	0.59[a]	0.02
DE Mcal	2.47[b]	2.42[b]	2.60[a]	1.98
DCP (g)	76.08[b]	71.25[c]	85.56[a]	
Body weight gain (kg):				
Initial body weight (kg)	22.5	22.70	24.00	0.54
Final body weight (kg)	40.5	38.64	42.51	0.87
Total body weight gain (kg)	18.00	15.94	18.51	0.58
Daily body weight gain (g)	150.00[a]	132.83[b]	154.25[a]	4.83

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

Table (7): Feed conversion and economic efficiency of growing lambs fed experimental rations.

Item	Experimental Ration			SEM
	R1	R2	R3	
Feed conversion:				
DM kg/kg gain	6.13	6.85	5.96	0.22
TDN kg/kg gain	3.73	4.14	3.82	0.14
DE Mcal/kg gain	16.47	18.22	16.86	0.61
DCP g/kg gain	507.20	543.93	545.08	18.5
Economic efficiency:				
Daily feed cost (LE)	0.82[a]	0.59[b]	0.62[b]	0.03
Feed cost (LE)/Kg gain	5.47[a]	4.44[b]	4.02[b]	0.21
Price of daily gain (LE)	2.25	1.99	2.31	0.07
Economic efficiency*	2.74[b]	3.37[a]	3.73[a]	0.14

* Economic efficiency = money output / money input

silage and stated that lambs gained more weight had the best feed conversion.

Economic efficiency:

The data in Table (7) indicated that daily feed cost as well as feed cost per kg body weight gain were significantly ($P<0.05$) lower, while economic efficiency was significantly ($P<0.05$) higher for lambs fed rations contained artichoke by-product as silage or dried (R3 and R2) compared to those fed ration contained berseem hay along with concentrate feed mixture (R1). Feed cost per kg of body weight gain of lambs fed R1, R2, and R3 were 5.47, 4.44 and 4.02 LE, respectively. These results indicated that feeding lambs on artichoke by-product as dried (R2) or silage (R3) along with concentrate feed mixture reduced the feed cost per kg gain by 18.83 and 26.51%, respectively. However, lambs fed R3 contained artichoke by-product silage had the least feed cost per kg body weight gain and subsequently the highest economic efficiency (3.73), while those fed R1 contained berssem hay achieved the lowest economic efficiency (2.74). These results attributed to the high price of berseem hay (650 LE) compared with dried (200 LE) or ensiled (65 LE) artichoke by-product. These results agreed with those obtained by El- Tahan *et al.* (2003) who found that lambs fed rations containing mushroom by-product improved economic efficiency more than the control ration which contained berseem hay.

In general from nutritional and economical results of the present work, it could be concluded that substitution berseem hay with artichoke by-products (dried or silage) for feeding growing lambs resulted in appreciable reduction in feed cost without any adverse effect on animal performance.

REFERENCES

Abd El-Baki, S.M.; M.S. Nowar; E.M. Hassona; L. Soliman; H.M. Ghanem and S.A. Gad Alla (1989). Evaluation and utilization of corn stalks fodder and its silage by sheep. Third Egyptian British conference on Animal, Fish and Poultry Production. 7-10 October, PP. 169, Alexandria, Egypt.

Abou-Slim, I. A. and M. M. Bendary (2005). Feedstuff resources in Egypt. Sources and maximization of its utilization. Animal Production Research Institute, Second Conference & Regional Symposium on Buffalo Production, 27-29 September, 2005, Sakha, Kafr El-Sheikh, Egypt.

Agricultural Economics (2003). Central Administration, Agricultural Ecnomics. Summer and Nili Crops. Economic Affairs Sector, Ministry of Agric., ARE.

AOAC (1990). Association of Official Analytical Chemists. Official Methods of Analysis, 15th Ed., Washington, DC.

Blaxter, K. L. (1967). The energy metabolism of ruminants, 2nd Ed. Hutchinson and Co ited. London.

Cameron, M. R.; J. Luo; T. Sahlu; S. P. Hart; S. W. Coleman and A. L. Goetsch (2001). Growth and slaughter traits of Boer x Spanish, Boer x Angora, and Spanish goats consuming a concentrate-based diet. J. Anim. Sci. 79:1423.

Chauhan , T.R ;R.S. Gill and J.S. Lchhponani (1980). Nutritive value of berseem and cluster been forages. Indian J. Anim. Sci. 50: 1052.

Church, D.C. (1976). Digestive Physiology and Nutrition Ruminants. Vol.1. Digestive Physiology, 145. 2nd Ed. 8 Book, Corvallis Oregan.

El-Badry, M. A. (1995). Effect of some agricultural treatments on yield productivity of artichoke.M.Sc. Thesis, Faculty of Agriculture, Moshtohor, Zagazig University.

El-Deek ,A.A.; M.K. Shebl and H.S. Zweil (1988). The Possibility of using artichoke (*Cynara scolymus*) by-product in duck feeding.

El-Saadany, S. A.; T. I. El-Monayer; A. M. M. Zeid and M. A. Boraei (2003). Effect of feeding different rations with or without bentonite on the performance of growing lambs. Egyptian J. Nutr. and Feeds, 6 (Special Issue): 1181.

El-Sayaad, G. A. E.; M. R. El-Mahdy and A. S. Soliman (1995). Artichoke bracts as a food processing waste product in growing rabbit diets. Egyptian J. Rabbit Sci., 5: 125.

El-Tahan, A. A.; G. A. Abd El-Rahman; M. A. Sarhan and F. F. Abou Ammo (2003). Utilization of mushroom by-product for feeding ruminants. 2- Utilization of mushroom by-product for feeding sheep. Egyptian J. Nutr. and Feeds, 6 (Special Issue): 879.

Gabr, A. A. and M. E. Ahmed (2003). Utilization of low quality agriculture by-products for making silage from 1-cut of berseem (*Trifilium Alexandrinum L.*) in comparative study by sheep and goats. Egyptian J. Nutr. and Feeds, 6 (Special Issue): 949.

Garces-Yepez, P.; W. E. Kunkle; D. B. Bates; J. E. Moore; W. W. Thatcher and L. E. Sollenberger (1997). Effects of supplemental energy source and amount on forage intake and performance by steers and intake and diet digestibility by sheep. J. Anim. Sci. 75: 1918.

Ghanem, G.H.A.; Bahira K. Mohamed; M.M. Bendary and I.A. Gomaa. (2000). Evaluation of dried or ensiled broad bean vine for feeding lactating cows. J. Agric. Sci. Mansoura Univ., 25: 2545.

Madrid, J., F. Hernndez; M.A. Pulgar, and J.M. Cid (1997). Urea and citrus by-product supplementation of straw-based diets for goats: Effect on barley straw digestibility. Small Ruminant Research, 24: 149-155.

Maity, S. B.; A. K. Mishra and V. S. Upadhyay (1999). Effect of wheat bran supplementation on the utilization of mixed straws in goats. Indian J. Anim. Nutr. 16: 86.

McDonald, P.; R.A. Edwards; J.F. Edwards; J.F.D. Greenhalgh and C.A. Morgan (1995). Animal nutrition. 5th Ed., Text Book Copyright Licensing. LTD., London.

Mertens, D.R. (1977). Effect of buffers upon fiber digestion. Invited paper at "Regulation of Acid-Base Balance" Symposium, Tucson, Arizona.

Mostafa, M. R. M.; M. F. El-Sayes; K. I. Etman and M. K. Hathout (2000). Evaluation of maize stover silage in comparison with whole maize silage in sheep rations. Conference of animal production in the twenty first century challenges and prospects 18-

20 April, Sakha, Kafr El-Sheikh, Egypt, P. 229.

Nour, A. M.: K. El-Shazly; A. R. Abou-Akkada; B. E. Borhami and M. A. Abaza (1980). Evaluation of silage of some by-products from food processing industry. Alex. J. Agric. Res., 28: 17.

NRC (1985). Nutrient Requirement of sheep. Sixth revised Ed. National Research Council. National Academy Press. Washington, D.C.

NRC (1988). Nutrient Requirement of Dairy Cattle. 6th Ed., National Academy Press, Washington, D.C.

Oman, J. S.; D. F. Waldron; D. B. Griffin and J. W. Savell (1999). Effect of breed-type and feeding regimen on goat carcass traits. J. Anim. Sci. 77: 3215.

Phillipson, A.H. (1970). "Physiology of Digestion Metabolism in the Ruminants". Oriel Press, Newcastle Upon Tpon, England.

Sadek, M. F. M. (1999). The use of food industry by-product in ruminant nutrition. Ph. D. Thesis, Fac. Agric., Ain Shams Univ., Cairo, Egypt

SPSS (1999). "Statistical Package for the Social Sciences", Release 10, SPSS INC, Chicago, USA.

Warner, A.C.I. (1964). Production of volatile fatty acids in the rumen: Methods of measurements, Nutr Abstr and Rev., 34 : 339.

Williams, P. E. and C. J. Newbold (1990). The effect of novel microorganisms on rumen fermentation and ruminal productivity. In: Recent advances in animal nutrition, 1990 (Ed. Cole, D. J. A. and W. Haresign). Butter Worths, London., UK

تقييم مخلفات الخرشوف الجافة و المسيلجه كغذاء للأغنام النامية

جمال حسنى عبدالله غانم

معهد بحوث الانتاج الحيوانى، مركز البحوث الزراعية، الدقى، الجيزة.

استخدم في هذه التجربة ١٨ حمل برقى متوسط وزنها ٢٠ كجم قسمت إلى ٣ مجموعات متماثلة. غذيت حملان المجموعة الأولى على ألعلف المركز مع دريس البرسيم والمجموعة الثانية على العلف المركز مع مخلفات الخرشوف الجافة والمجموعة الثالثة على العلف المركز مع سيلاج مخلفات الخرشوف.

توضح تجربة تقيم مخلفات الخرشوف الجاف والمسيلج ارتفاع البروتين الخام والمستخلص الأثيري والرماد وانخفاض المادة العضوية والألياف الخام والمستخلص الخالي من الازوت ومكونات الألياف في سيلاج مخلفات الخرشوف عن مخلفات الخرشوف الجافة. زيادة معاملات هضم كل من المادة الجافة والعضوية والبروتين الخام والمستخلص الاثيرى والألياف الخام والمستخلص الخالي من الازوت وكذلك القيم الغذائية معنويا في السيلاج عن الجاف.

أظهر إدخال مخلفات الخرشوف الجافة والمسيلجة في علائق الأغنام النامية الآتى:-

انخفاض محتوى كل من المادة العضوية والبروتين الخام والمستخلص الخالي من الازوت وارتفاع محتوى كل من الألياف الخام والرماد في عليقه الكنترول بالمقارنة بالعليقة الثانية والثالثة المحتوية على مخلفات الخرشوف الجافة والمسيلجة.

ارتفاع معاملات هضم كل من المادة الجافة والمادة العضوية والبروتين الخام والمستخلص الاثيرى والمستخلص الخالي من الازوت والقيم الغذائية معنويا فى العليقه الثالثة وانخفاض معاملات هضم المادة الجافة والعضوية والمستخلص الاثيرى في ألعليقه الأولى ومعاملات هضم البروتين الخام والمتخلص الخالي من الازوت وبالتالي القيم الغذائية فى العليقة الثانية.

سجلت الحملان المغذاة على العليقه الأولى معنويا أعلى قيم لدرجه الحموضة وتركيز الامونيا وأقل تركيز للأحماض الدهنية الطيارة في سائل الكرش بينما الحملان المغذاة على ألعليقه الثالثة أظهرت أقل درجه الحموضة وأعلى تركيز للأحماض الدهنيه الطيارة أما العليقه الثانية أظهرت اقل تركيز للأمونيا.

أظهرت النتائج أن المأكول من المادة الجافة متماثل تقريبا في الثلاث مجموعات. سجلت الحملان المغذاة على العليقة الثالثة أعلى مأكول من المركبات الغذائية المهضومة والطاقة المهضومة والبروتين المهضوم يليها المجموعة الأولى بينما حققت المجموعة الثانية أقل كميات مأكولة، كما أظهرت الحملان المغذاة على ألعليقه الأولى و ألعليقه الثالثة أعلى معدلات نمو على الحملان في المجموعة الثانية.

حققت الحملان المغذاة على العليقة الثانية اقل معدل للتحويل الغذائي بالمقارنة بالحملان المغذاة على العليقتين الأولى والثالثة.

انخفاض تكلفه التغذية لكل كيلو جرام نمو وارتفاع الكفاءة الاقتصادية للحملان المغذاة على العليقتين الثانية والثالثة المحتويتين على مخلفات الخرشوف الجافة والمسيلجة مقارنة بتلك المغذاة على العليقة الأولي المحتوية على دريس البرسيم.

نستنتج من هذه الدراسة انه يمكن استبدال دريس البرسيم في علائق الحملان النامية بمخلفات الخرشوف الجافة أو المسيلجه مما يؤدى إلي زيادة العائد الاقتصادي.