USING ARTICHOKE BY-PRODUCT FOR FEEDING LACTATING COWS

By

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ABSTRACT

Twelve lactating Friesian cows in the 3rd and 4th of lactation, weighting 450-500 kg were used after 8 weeks of calving in a complete switch-back design and divided randomly into three groups (4 in each). Cows in the first group were fed control ration (R1) consisted of 60% concentrate feed mixture (CFM), 25% berseem hay (BH) and 15% rice straw (RS). While, cows in the second group were fed R2 consisted of 60% CFM, 30% dried artichoke by-product (DAB) and 10% RS and those of the third group were fed R3 consisted of 60% CFM and 40% artichoke by-product silage (SAB, on DM basis).

The contents of CP, EE, NFE and ash were higher, while OM and CF were lower in ensiled than DAB. The contents of CP and NFE were higher, but CF and EE were lower in SAB compared with BH. While, the contents of OM and ash were nearly similar for SAB and BH. Ration 3 revealed the higher OM, CP, EE and NFE contents.

Cows fed R3 recorded significantly ($P<0.05$) the highest digestibility coefficients of DM, OM, CP, EE and NFE and subsequently TDN and DCP values followed by those fed R2, while those fed R1 had the lowest values. However, CF digestibility of cows fed R1 and R2 was significantly higher ($P<0.05$) than R3. Cows fed R1 and R2 recorded significantly ($P<0.05$) higher DM intake and lower DCP intake compared with those fed R3. While, TDN intake by cows fed R2 and R3 was significantly higher ($P<0.05$) than those fed R1. Feeding R2 and R3 containing DAB or SAB increased milk yield, fat and lactose content. On the other hand, R3 slightly reduced total milk protein and casein contents. The electrophoretic pattern of casein showed that there was an increase in peak numbers in case of R2 and R3, so

using DAB or SAB had goou economical benefit than control ration and subsequently it is recommended to replace part of cows rations since it improved significantly (P<0.05) feed conversion and economic efficiency.
Key words: Lactating cows, artichoke by-product, milk, feed conversion.

INTRODUCTION

The high cost of the conventional feedstuffs used in ruminant feeding in Egypt have generated interest in exploring alternative and inexpensive feed sources. Therefore, it was necessary to explore the possibilities of introducing cheap and locally available non-conventional ingredients to reduce the cost of production. There are large quantities of agricultural residues that can be used as ruminant feeds (El-Sayaad *et al.*, 1995).

The use of crop residues in animal feeding is a common practice in tropical countries. However, these feed resources have generally been directed to ruminant production, due to the high level of the cell wall fraction (Preston and Leng 1987). As with many other facets of livestock production, research in tropical countries on the nutritive value of crop residues lags behind such activities in temperate countries (Owen and Jayasuriya 1989).

In Egypt, about 13.71 thousand feddans are cultivated with artichoke (*Cynara Scolymus L.*), (Agriculture Economic, 2003) which produce about 8.05 ton /feddan on DM. Flower head of artichoke weights about 200gm, while artichoke bracts weights 70-80 gm (about 37% of the flower head weight). Large amounts of artichoke bracts are produced annually as by-products. However, information on its value and using it for feeding animals is limited or unknown.

The objective of this study was to evaluate the utilization of dried and ensiled artichoke by-product as untraditional roughage in rations of lactating cows as well as investigating milk technological characteristics.

MATERIALS AND METHODS

This study was carried out at El-Karada Animal Production Research Station, Animal Production Research Institute and Agricultural Research Center.

Artichoke by-product silage (SAB) was made between feed toughs, where 30 cm layer of rice straw spread on the ground as bed to absorb seepage and to prevent contamination with earth. EL-Mufeed liquid was added at a level of 3% to fresh artichoke by-product (on fresh matter basis) to increase protein content and the activity of silage fermentation. The materials was compressed by heavy drum filled with sand, then covered with plastic sheet, hard pressed with 30 cm of soil layer and ensiled for eight weeks. While, artichoke by-product were left over a layer of rice straw for air drying with continuing turn over to be dry, then it was collected in plastic bags.

Twelve lactating Friesian cows in the 3rd and 4th of lactation, weighing 450-500 kg were used after 8 weeks of calving in a complete switch-back design with 3 treatments with three successive experimental period as described by Lucas (1956). Cows in the first group were fed control ration (R1) consisted of 60% concentrate feed mixture (CFM), 25% berseem hay (BH) and 15% rice straw (RS). While, cows in the second group fed R2 consisted of 60% CFM, 30% dried artichoke by-product (DAB) and 10% RS and those of the third group fed R3 consisted of 60% CFM and 40% artichoke by-product silage (SAB) on DM basis. Cows were individually fed according to NRC (1988) allowances for dairy cattle. Rations were recalculated every week based on the body weight and milk production of the cows. Concentrate mixture was given twice daily at 8 a.m. and 4 p.m., BH, DAB and SAB were offered once daily at 10 a.m, while rice straw was introduced once daily at 5 p.m. Cows were watered three times daily.

Three digestibility trials were carried out during feeding trials (4 cows in each) to determine nutrients digestibility coefficients and nutritive values of experimental rations using acid insoluble ash (AIA) as a natural marker (Van Keulen and Young, 1977). Each digestibility trail consisted of 15 days as a preliminary period followed by 7 days collection period. Feces samples were taken from the rectum of each cow twice daily with 12 hours interval during the collection period. Samples of CFM, BH,DAB, SAB and RS was taken at the beginning, middle and end of collection period. The samples of tested feedstuffs and feces were composted and representative samples were dried in an oven at 65 ^{0}C for 48 hours, ground and analyzed according to AOAC (1990).

Rumen liquor samples were collected at three hours after the morning feeding from the cows using stomach tube and filtered through double layers of cheese cloth. Ruminal pH value was immediately estimated using Orian 680 digital pH meter. The concentration of ammonia-N was determined using saturated solution of magnesium oxide distillation according to the method of AOAC (1990). The concentration of TVFA's was determined in rumen liquor by the steam distillation method according to Warner (1964).

Individual morning and evening milk yields were recorded daily and corrected for 4% fat content (FCM). Milk samples from consecutive evening and morning milking were taken at 4th weeks of each period and mixed in proportion to yield. Fat and total solids (TS) were measured according to Ling (1963). Total nitriogen content (TN) was determined using semi-microKjeldahl as recommended by Rowland (1938). Non-casein nitrogen (NCN) and non-protein nitrogen (NPN) were determined in the collected flitrate after precipitation of casein and protein respectively. Casein nitrogen (CN) and whey protein nitrogen (WPN) were quantified by the difference as reported by Rowland (1938) as follows:

CN =TN – NCN

Casein % = CN x 6.38

Whey protein% = (NCN - NPN) x 6.38

Lactose content was determined according to Barnett and Abdel-Tawab (1957), meanwhile ash content was measured according to AOAC (1990). The method of Kosikowski (1978) was used for determination of total volatile fatty acids (TVFA). Milk samples were skimmed by centrifugation and casein was precipitated at pH 4.6. The SDP-PAGE of casein was carried out as described by Laemmli (1970).

Rennet coagulation time (RCT) was determined according to Berridge (1952. Curd tension was measured at room temperature (25-30^{o}C) according to Chandrasekhar *et al.* (1957), whereas whey syneresis was measured according to Mehanna and Mehanna (1989).

Feed efficiency was calculated as the amounts of DM, TDN, and DCP in kg required to produce 1 kg FCM. Economic efficiency of milk production expressed as the feed cost per 1 kg FCM yield. The prices in Egyptian pounds (LE) / ton FCM (1500 LE), concentrate mixture (985 LE), berseem hay (650 LE), rice straw (60 LE), artichoke by-product silage (65 LE) and dried artichoke by-product (200 LE) during year 2004.

Statistical analysis was carried out according to Lucas (1956). Significance between the means was determined by multiple range test according to Duncan (1955).

RESULTS AND DISCUSSION

Chemical composition:

Chemical composition of tested feedstuffs and calculated composition of experimental rations are shown in Table (1). The composition of DAB and SAB revealed that the contents of CP, EE, NFE and ash were higher, while OM and CF contents were lower in SAB compared with DAB. Moreover, the contents of CP and NFE were higher, but CF and EE were lower in SAB compared with BH. While, the contents of OM and ash were nearly similar.

Table 1: Chemical composition of tested feedstuffs and calculated composition of experimental rations

Items	DM %	Composition of DM %					
		OM	CP	CF	EE	NFE	Ash
Tested feedstuffs							
CFM*	88.23	90.97	16.23	9.61	3.11	62.02	9.03
BH	90.36	89.43	12.96	29.64	3.04	43.79	10.57
DAB	89.66	91.71	11.74	32.63	1.92	45.42	8.29
SAB	21.49	89.58	14.78	23.91	2.82	48.07	10.42
RS	89.85	81.65	3.28	30.15	1.21	47.01	18.35
Experimental rations							
R1 (control)	89.01	89.17	13.44	17.80	2.80	55.12	10.83
R2	88.82	90.25	13.56	18.66	2.56	55.47	9.75
R3	40.56	90.44	15.68	15.02	3.00	56.74	9.56

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

Calculated composition showed that R3 had the highest OM, CP, EE and NFE contents. These results are similar to those obtained by El-Deek *et a.* (1988) and El-Sayaad *et al.* (1995), they found that artichoke by-product contained reasonable amounts of CP, NFE, ash meanwhile its fiber content was quite high. Gupta *et al.* (1985) reported that vegetable wastes generally were fairly rich in protein and fiber but had low content of soluble carbohydrates.

Nutrients digestibility and nutritive values:

Results in Table (2) show that cows fed R3 (contained SAB) recorded significantly (P<0.05) the highest digestibility coefficients of DM, OM, CP, EE and NFE and subsequently TDN and DCP values followed by those fed R2 (contained DAB), while those fed R1 (contained BH) had the lowest values. However, CF digestibility of cows fed R1 and R2 was significantly higher (P<0.05) than those fed R3. These results agree with those obtained by Koushki *et al.* (1994) who found that the digestibility of nutrients was higher in non-conventional forage diets than the control diet. El-Sayaad *et al.* (1995) reported that the digestibilities of all nutrients by rabbit fed diets containing artichoke bracts were higher than those of control diet contained alfalfa hay.

Table 2: Nutrients digestibility and nutritive values of experimental rations

Items	Experimental rations			
	R1 (control)	R2	R3	SEM
Nutrients digestibility coefficients %				
DM	60.11^{b}	61.82^{ab}	63.24^{a}	0.47
OM	61.03^{b}	63.01^{ab}	65.21^{a}	0.62
CP	57.68^{b}	56.51^{b}	61.35^{a}	0.76
CF	41.86^{a}	41.54^{a}	37.01^{b}	1.31
EE	70.63^{b}	74.40^{a}	74.72^{a}	1.64
NFE	67.54^{b}	71.30^{a}	73.23^{a}	0.92
Nutritive values %				
TDN	56.89^{c}	59.25^{b}	61.78^{a}	0.68
DCP	7.75^{b}	7.66^{b}	9.62^{a}	0.28

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

Feed intake:

Feed intake by cows fed the different rations is presented in Table (3). Cows fed R1 and R2 recorded significantly ($P<0.05$) the highst DM intake and the lowst DCP intake compared with those fed R3. While, TDN intake by cows fed R2 and R3 was significantly higher ($P<0.05$) than those fed R1. These results confirmed with DM content of experimental rations (Table 1) and the nutritive values of experimental rations (Table 2). These data are in accordance with those obtained by Zeweil (1992) and El-Sayaad *et al.* (1995), they found that feed consumption by rabbit fed diets containing artichoke bracts was lower than those fed diet contained BH. Shitta and Gaafar (2003) reported that DM intake by lactating cows was significantly lower with feeding vegetable marketing waste silage compared with feeding berseem hay containing ration.

Table 3: Feed intake and rumen liquor parameters of lactating Friesian cows fed the experimental rations

Items	Experimental rations			
	R1	R2	R3	SEM
Feedstuffs intake as fed (kg/day)				
CFM	12	12	12	
BH	5	0	0	
DAB	0	6	0	
SAB	0	0	30	
RS	3	2	0	
DM intake	17.80^a	17.76^a	17.03^b	0.11
TDN intake	10.13^b	10.52^a	10.52^a	0.08
DCP intake	1.38^b	1.36^b	1.64^a	0.04
Rumen liquor parameters				
pH	6.86^a	6.31^b	6.14^b	0.05
TVFA's (meq / 100 ml)	15.20^b	17.67^a	18.80^a	0.35
NH_3-N (mg / 100 ml)	18.90^a	16.80^b	15.40^b	0.42

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

Rumen parameters:

Results in Table (3) reveal that, ruminal pH value of cows fed control ration (R1) was significantly higher ($P<0.05$) than those fed rations DAB and SAB (R2 and R3). Also, cows fed R1 recorded significantly (P<0.05) the highest NH_3-N concentration as well as the lowest TVFA's concentration. While, cows fed ration contained SAB (R3) recorded significantly (P<0.05) the highest ruminal TVFA's concentration and the lowest ruminal pH value and NH_3-N concentration. These results agree with those obtained by Van Soest (1982) who stated that the optimum pH value for growth of cellulolytic microorganisms was 6.7 ± 0.5. Russell and Dombrowski (1980) found that ruminal VFA production was closely related to ruminal pH, which can be considered an important regulator of microbial yield. Hungate (1966) demonstrated that rumen microorganisms utilize more NH_3-N when more energy sources are fermented.

Milk yield and composition:

Data in Table (4) reveal that replacing BH (control, R1) by DAB or SAB (R2 or R3) insignificantly increased average daily milk yield. This was not surprising since the animals on all treatments received their recommended nutrients allowances (NRC, 1988). Rations containing DAB and SAB (R2 and R3) increased fat and TS in milk more than the control (R1). Milk composition it seems to be affected by the quality of roughage used in this experiment. In addition, fiber, crude protein content and physical form of the diet can also influence milk composition (Davis and Brown, 1970). Khattab *et al.* (2000) found insiginificantly increases in milk yield and fat, lactose and total solids contents when they fed lactating goats some agro-industrial by-products. Bendary *et al.* (2000) reported that replacing BH by dried or ensiled sugar beet tops did not affect milk yield and composition.

Feeding R3 caused a slight reduction in total protein and casein content, while R2 had no effect on these parameters as compared with control treatment. On the other hand, whey protein had nearly same values. Statistical analysis showed that the differences in the main protein fractions among treatments were insignificant (Table 4). Lactose content slightly increased in R2 and R3, and was slightly higher in case of R3. These increases in lactose content of milk produced subsequently increases milk osmotic pressure which may partially causes the increases in milk yield particularly of R3 (Table 4). Total solids content followed fat and lactose trend, so it's slightly increased as a result of applied R2 and R3 feeding systems. A pronounced reduction in TVFA was observed in R2 and R3. The results showed significant differences between R1 and both of R2 and R3 (Table 4). Treatment R3 caused a significant reduction in milk ash content while R2 had no effect (Table 4).

Table 4: Average daily milk yield and its components of lactating Friesian cows fed experimental rations

Items	Experimental rations			
	R1	R2	R3	SEM
Milk yield (kg/ day)	17.37	17.69	18.19	0.37
4% FCM (kg/ day)	15.33	16.71	17.30	0.45
Milk composition (%)				
Fat	3.21	3.65	3.66	0.10
Protein	2.68	2.68	2.47	0.06
Casien	2.27	2.24	2.11	0.01
Whey protein	0.43	0.42	0.45	0.004
Lactose	4.04	4.15	4.22	0.06
Total solids	10.65	11.20	11.03	0.12
Solids not fat	7.44	7.55	7.37	0.07
Ash	0.72^a	0.72^a	0.68^b	0.01
TVFA*	2.25^a	1.75^b	1.66^b	0.02

a and b: Values in the same row with different superscripts differ significantly ($P<0.05$).
*ml 0.1 N NaOH/ 10 g. sample.

Casein electrophoretic assay:

Fig. (1) shows the electrophoretic pattern of casein (k-casein, β-casein and αs-casein) of R1, R2 and R3. It could be noticed from this figure that there is clear increases in peaks number in R2 and R3 as compared with R1 (12 and 8 vs. 6, respectively). The degradution was more pronounce in k-casein and αs-casein than β-casein. These increases may be due to proteolysis occurred inside the cow's udder or immediately after milking. The artichoke plant has some proteolytic enzymes, which may be secreted into the milk itself, or some substances, which may stimulate natural milk enzymes. These results agree with those obtained by Cordiro et al. (1992), Abdel-Kader (2003) and Abou El-Einin (2005).

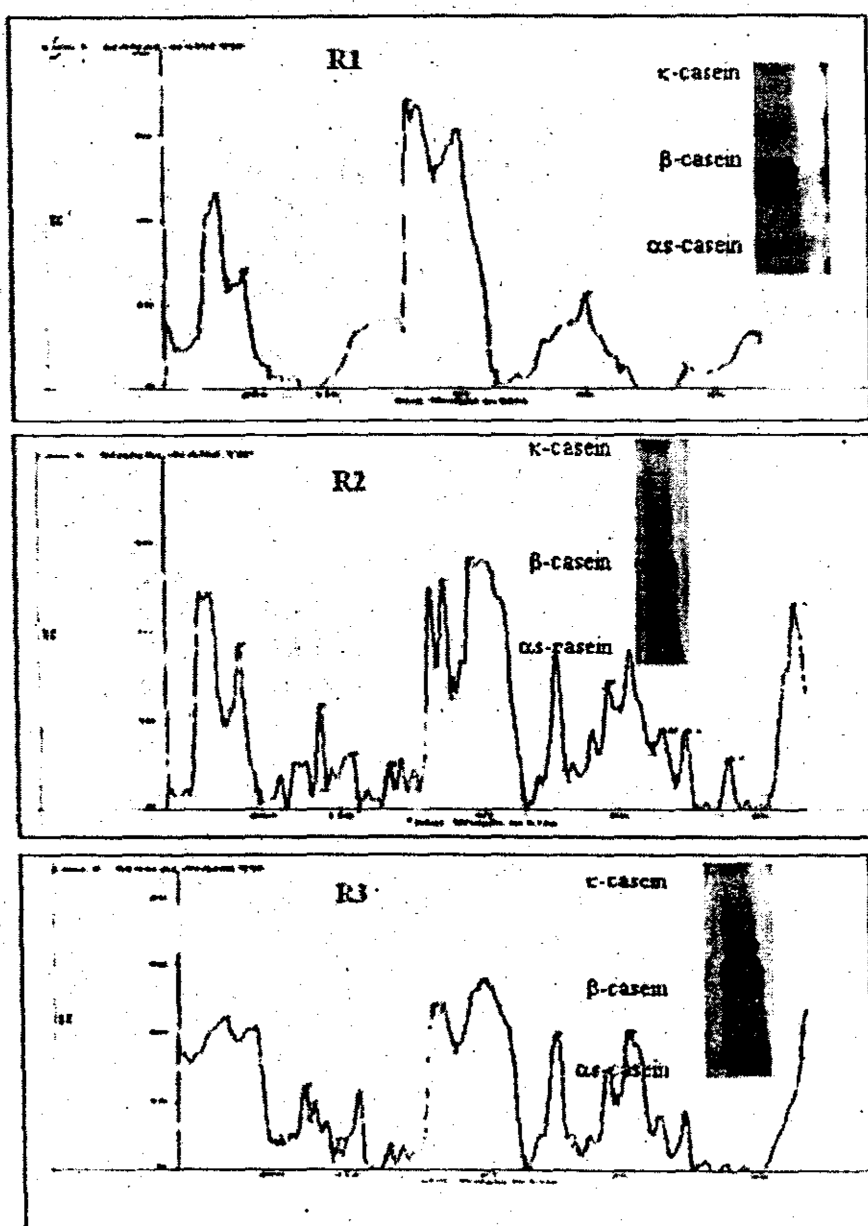

Fig. (1): Discontinuous PAGE densitrograms of acid casein as affected by feeding systems of R1, R2 and R3.

Characteristics of milk coagulum:

Results obtained in Table (5) show that R3 milk samples had lower clotting time than R1 and R2, and higher curd tension, which reflects more suitability of milk, produced by cows fed R3. The curd syneresis of all treatments tended to increase gradually and the increase more pronounced with R1 followed by R3.

Table 5: Clotting time, curd tension and curd syneresis in milk of cows fed experimental rations

Ration	Item	Clotting time (min)	Curd tension (gm)	Curd syneresis (after)			
				10 min	30 min	60 min	120 min
R1	Min.	11.50	15	5.48	7.33	8.70	9.12
	Max.	12.23	17	6.50	8.29	9.25	9.65
	Aver.	11.78[a]	16.25[a]	5.83[a]	7.73[a]	8.90[a]	9.36[a]
	SEM	0.13	0.48	0.23	0.21	0.13	0.12
R2	Min.	11.03	15	4.12	5.98	7.24	7.79
	Max.	12.00	20	6.40	8.36	9.22	9.82
	Aver.	11.40[a]	17.50[a]	5.23[a]	7.04[a]	8.13[a]	8.63[a]
	SEM	0.16	1.04	0.58	0.61	0.52	0.46
R3	Min.	8.18	17	5.19	7.09	8.18	8.69
	Max.	11.0	25	6.02	7.62	8.85	9.22
	Aver.	9.35[b]	19.75[a]	5.50[a]	7.32[a]	8.55[a]	9.00[a]
	SEM	0.50	1.32	0.18	0.11	0.15	0.11

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

Feed conversion:

Cows fed rations contained DAB and SAB (R2 and R3) showed significantly ($P<0.05$) the highest feed conversion (Table6) compared with those fed control ration (R1). Cows fed R3 recorded significantly ($P<0.05$) the lowest amounts of DM and TDN per kg of 4% FCM followed by those fed R2, while cows fed R1 had the highest values. However, cows fed R3 had significantly ($P<0.05$) the highest amount of DCP per kg of 4% FCM followed by those fed R1, while cows fed R2 had the lowest value. These results are in accordance with those obtained by Shitta and Gaafar (2003) who found that replacing BH by vegetable marketing waste improved feed efficiency of lactating Friesian cows. El-Nahas *et al.* (2004)

reported that lactating cows fed ration containing orange waste silage showed significantly higher feed utilization.

Table 6: Average feed conversion and economic efficiency of lactating Friesian cows fed the experimental rations

Items	Experimental rations			
	R1	R2	R3	SEM
Feed conversion				
DM kg/ kg FCM	1.16[a]	1.06[ab]	0.98[b]	0.04
TDN kg/ kg FCM	0.66[a]	0.63[b]	0.61[b]	0.02
DCP g/ kg FCM	90.02[a]	81.39[b]	94.80[a]	3.42
Economic efficiency				
Daily feed cost (LE)	15.25[a]	13.14[b]	13.77[b]	0.38
Feed cost (LE)/ kg FCM	0.99[a]	0.79[b]	0.80[b]	0.05
4% FCM income (LE)	23.00[b]	25.07[a]	25.95[a]	0.85
Economic efficiency	1.51[b]	1.91[a]	1.88[a]	0.10

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

Economic efficiency:

Using DAB and SAB in ration led to significant (P<0.05) reduction in feed cost. Cows fed control ration (R1) recorded significantly (P<0.05) the highest average daily feed cost and feed cost per kg 4% FCM and the lowest income of 4% FCM and economic efficiency compared with those fed R2 and R3 as shown in Table (6). Average daily feed cost for cows fed R2 and R3 decreased by 13.84 and 9.70% compared with those fed ration contained BH (R1). These results might be attributed to the high price of BH compared with DAB and SAB. Also, the lower yield of 4% FCM for cows fed R1 compared with those fed R2 and R3 (Table 4). These results agree with those obtained by Al-Shanti (2003) who found that lactating cows fed ration containing orange waste silage showed significantly better economically than the control group. Shitta and Gaafar (2003) reported that introducing vegetable marketing waste silage in ration of lactating cows resulted in a significant decrease in feed cost and improved economic efficiency.

In conclusion, berseem hay could be replaced in ration of lactating cows by artichoke by-product as dried or silage without any adverse effects on lactational performance as well as reducing the costs of feed.

REFERENCES

Abdel Kader, Y. I. (2003). Changes in the nitrogen fractions of Domiati cheese made with microbial and recombinant rennets during ripening. Egyptian. J. Dairy Sci., 31: 111.

Abou El-Einin, E. H. (2005). Attempts on extraction and using of coagulating enzyme from plant (Globe artichoke). Ph. D. Thesis, Fac. Agric. kafr El-Sheikh, Tanta Univ.

Agriculture Economic (2003). Summer and Nili crops. Economic affairs sector, Agricultural Economics Central Administration. Volume 2, Ministry of Agriculture and Land Reclamation, Arab Republic of Egypt.

Al-Shanti, H. A. (2003). Ensiled orange wastes for lactating cows and its effects on cows milk and cheese quantity and quality in Palestine. Egyptian J. Nutrition and Feeds, 6(Special Issue): 563.

AOAC (1990). Official Methods of Analysis, 14th ed. Association of Official Analytical Chemists. Washington DC.

Barnett, A. J. And G. Abdel-Tawab, (1957). A rapid method for determination of lactose in milk and cheese.J. Sci Food Agric. 8:437

Bendary, M. M.; S. A. El-Ayouty; F. H. H. Farrage; A. M. A. Mohi El-Din and F. F. M. Khalil (2000). Productive performance of lactating cows fed rations containing different forms of sugar beet tops and berseem silage. Proc. Conf. Anim. Prod. In the 21th Century, Sakha, 18-20 April, P. 255.

Berridge, N. J. (1952). Some ovservation of activity of rennet. Analyst, 77: 57.

Chandrasekhara, M. R. ; R. K. Bhagawan ; M. Swaminathan and C. Subrahmanyan (1957). The use of mammalian milk and processed milk foods in the feeding of infants. Indian J. Child Health, 6: 701.

Cordiro, M. ; E. Jakob ; Z. Puhon ; M. S. Pais and P. F. Brodelius (1992). Milk clotting and proteolytic activities of purified cynarases from cynara cardunculus a comparison to chymosin. Milchwissenschaft 47: 683.

Davis, G.L. and R.E. Brown (1970). Metabolic disorders of the ruminant, low fat milk syndrome. In Physiology of Digestion and Metabolism in the Ruminant, P.545.Ed.by A.T. Phillipson, Oriel Press limited, England.

Duncan, D. B. (1955). Multiple range and multiple F-test. Biometrics, 11: 1.

El-Deek, A. A.; M. K. Shebl and H. S. Zweil (1988). The possibility of using artichoke (*Cynara Scolymus*) by-product in duck feeding. J. Agric. Sci. Mansoura Univ., 13: 1047.

El-Nahas, H. M.; G. H. A. Ghanem; H. M. A. Gaafar and E. E. Ragheb (2004). Effect of feeding berseem and orange waste silage on productive performance of lactating Friesian cows. J. Agric. Sci. Mansoura Univ., 29: 6137.

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.

Gupta, B. S.; R. Gupta; P. K. Maheshwari and A. P. Sinha (1985). Nutritive potential of some vegetable waste products. Indian J. Anim. Health, 24: 25.

Hungate, R. E. (1966). The Rumen and Its Microbes. Academic Press. New York and London.

Khattab, H. M.; S. A. H. Abo El-Nor; H. M. El-Sayed; M. Y. Saada and O. H. Abd El-Shaffy (2000). Utilization of some agro industrial by-product combination in rations of lactating goats. Egyptian J. Dairy Sci., 28: 85.

Kosikowski,F.V. (1978). Cheese and Fermented Milk Food. 2nd ed., Published by the author, Cornell Univ. Ithaca, New York, USA.

Laemmli, U. K. (1970). Cleavage of structureal proteins during assembly of the head of backeriophage. Nature, 227: 680.

Ling,E.R. (1963). A Text Book of Dairy Chimstry. 3rd ed.,Vol.2. Chapman and Hall, London, UK..

Lucas, H. L. (1956). Switchback trials for more than two treatments. J. Dairy Sci., 39: 146.

Mehanna, N. M. and A. S. M. Mehanna (1989). On the use of stabilizers for improving some properies of cow's milk yoghurt. Egyptian J. Dairy Sci., 17: 289.

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

Owen, E. and M. C. N. Jayasuriya (1989). Use of crop residues as animal feeds in developing countries. In: Research and Development in Agriculture. Longman 6:129

Preston, T. R. and R. A. Leng (1987). Matching ruminant production systems with available resources in the tropics and subtropics. Technical Center for Agricultural and Rural Cooperation. Pernambul Books, Armidale p 245

Rowland, S. (1938). The determination of nitrogen distribution in milk. J. Dairy Res., 9:4.

Russell, J. B. and D. B. Dombrowski (1980). Effect of pH on the efficiency of growth by pure culture of ruminal bacteria in continuous culture. Apple. Environs. Microbial., 39: 604.

Shitta, A. A. and H. M. A. Gaafar (2003). Effect of replacing berseem hay by vegetable marketing waste silage in the rations on some productive and physiological traits of lactating cows. J. Agric. Sci. Mansoura Univ., 28: 5957.

Van Keulen, J. and B. A. Young (1977). Evaluation of acid insoluble ash as a digestibility studies. J. Anim. Sci., 44: 282.

Van Soest, P.J (1982) Nutritional Ecology of the Ruminant. O.&B. Books Inc., Corvallis, Oregon, USA.

Warner, A. C. I. (1964). Production of volatile fatty acids in the rumen, method of measurements. Nut. Abest. and Rev., 34:339.

Zeweil, H. S. (1992). Artichoke (*Cynara Scolymus*) canning by-products as rabbit feed. Egyptian J. Poultry Sci., 12: 1.

استخدام مخلفات الخرشوف في تغذية الأبقار الحلابة

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أجريت هذه الدراسة على ١٢ بقرة حلابة فى موسمى الحليب الثالث والرابع متوسط وزنها ٤٥٠-٥٠٠ كجم بعد ٨ أسابيع من الولادة باستخدام التصميم الكامل لثلاث معاملات وثلاث فترات تجريبية. غذيت أبقار المجموعة الأولى على عليقة المقارنة (ع١) والتى تتكون من ٦٠% مخلوط علف مركز، ٢٥% دريس برسيم، ١٥% قش أرز. أما أبقار المجموعة الثانية غذيت على العليقة الثانية (ع٢) والتى تتكون من ٦٠% مخلوط علف مركز، ٣٠% مخلفات الخرشوف الجافة، ١٠ % قش أرز. بينما غذيت أبقار المجموعة الثالثة على العليقة الثالثة (ع٣) والتى تتكون من ٦٠% مخلوط علف مركز، ٤٠% سيلاج مخلفات الخرشوف.

اوضحت النتائج ارتفاع محتوى البروتين والمستخلص الاثيرى والمستخلص الخالى من الأزوت والرماد بينما انخفض محتوى المادة العضوية و الألياف فى سيلاج مخلفات الخرشوف عن المخلفات الجافة.

كذلك ارتفع محتوى البروتين والمستخلص الخالى من الأزوت بينما قل محتوى الألياف والمستخلص الاثيرى فى سيلاج مخلفات الخرشوف بالمقارنة بدريس البرسيم. بينما كان محتوى المادة العضوية والرماد متماثلا تقريبا في سيلاج مخلفات الخرشوف ودريس البرسيم. أظهرت العليقة الثالثة أقل محتوى للمادة الجافة وأعلى محتوى للمادة العضوية والبروتين والمستخلص الاثيرى والمستخلص الخالى من الأزوت، العليقة الثانية أعلى محتوى للألياف الخام بينما أظهرت العليقة الأولى أعلى محتوى للمادة الجافة والرماد.

حققت الأبقار المغذاة على العليقة الثالثة أعلى معاملات هضم لكل من المادة الجافة والمادة العضوية والبروتين والمستخلص الاثيرى والمستخلص الخالى من الأزوت وبالتالى المركبات الغذائية المهضومة والبروتين المهضوم تلتها المجموعة الثانية بينما أظهرت المجموعة الأولى أقل قيم. بينما ارتفع معامل هضم الألياف فى المجموعتين الأولى والثانية معنويا عن المجموعة الثالثة، ارتفعت كمية المادة الجافة المأكوله بينما انخفضت كمية البروتين المهضوم معنويا للأبقار المغذاة على العليقتين الأولى والثانية عن تلك المغذاة على العليقة الثالثة. بينما ارتفعت كمية المأكول من المركبات الغذائية المهضومة للأبقار المغذاة على العليقتين الثانية والثالثة عن تلك المغذاة على العليقة الأولى.

أظهرت النتائج أن المعاملتين الثانية والثالثة أدت إلى زيادة في إدرار اللبن والمحتوى من الدهن، اللاكتوز ومن ناحية أخرى أدت المعاملة الثالثة إلى انخفاض طفيف في المحتوى من البروتين الكلى والكازين كما أظهرت تحليل الهجرة في مجال كهربي للكازين زيادة واضحة في عدد القمم لكل من αs-, K-casein في المعاملة الثانية والثالثة.أدى استخدام مخلفات الخرشوف كسيلاج او جاف فى علائق الأبقار الحلابة إلى تحسن معنوى فى معدل التحويل الغذائى والكفاءة الاقتصادية.

نستخلص من هذه الدراسة أنه يمكن استبدال دريس البرسيم فى علائق الأبقار الحلابة بمخلفات الخرشوف كسيلاج أو جافة دون أى تأثير سلبى على إنتاج اللبن مع تقليل تكلفة التغذية بالإضافة إلى تحسن واضح في التركيب الكيماوي وبعض الصفات التكنولوجية للبن الناتج عند التغذية على هذا المخلف بصوره المختلفة مقارنة بالعليقة التقليدية الصيفية.