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EFFECT OF INCLUDING FILTER CAKE BLOCKS IN LACTATING GOATS RATIONS ON DIGESTIBILITY AND PRODUCTIVE PERFORMANCE.

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SUMMARY

This experiment was carried out to investigate the effect of partial substitution of concentrate feed mixtures (CFM) with filter cake blocks (FCB) (with different level of filter cake (FC) , in rations for lactating does on digestibility, milk yield and milk composition. Thirty Egyptian Baladi lactating does averaged 33.30±1.5-kg live body weight (LBW) and aged 3-4 years were divided randomly into three similar group's. The control ration (RI) consisted of concentrate feed mixture (CFM) 50% , berseem hay (BS) 30% and wheat straw (WS) 20% as (control group), whereas the second and third groups received the same control ration with 50% of CFM protein was substituted by FCB1 (with 40% FC) as group RII or by FCB2 (with 48% FC) as group RIII, respectively. Animals were fed according to NRC,(1989) allowances for goats. Three digestibility trials were conducted with 9 mature bucks to evaluate the nutritive value of tested rations.

Results showed that the digestibility coefficients of CP,CF and nutritive value as TDN, ME and DCP for RII group were significantly ($P<0.05$) improved as compared with the RI group (control). Milk yield and fat corrected milk yield significantly ($P<0.05$) increased with FCB1 substitution. Milk composition was not significantly affected by FCB substitution, whereas, both fat and protein milk yields of goats fed RII ration were significantly higher ($P<0.05$) than those fed control ration (RI). No, significant differences were detected among most tested blood constituents of all groups of lactating goats, except urea-N which was higher on tested groups (RII & RIII) than the control group RI. Moreover, feed cost decreased by 8.82 and 14.71%, leading to an economical efficiency improvement by 41.30 and 12.32%, with RII (with 40% FC) and RIII (with 48% FC), respectively than with RI group (control). In conclusion, partial substitution with FCB1 (with 40% FC) could be recommended for lactating does rations as this will improve stockholders income.

Keywords: *filter cake blocks, lactating does, digestibility, milk yield and milk composition*

INTRODUCTION

Egypt have varying quantities of agro-industrial by-products of good nutritive value which can supply valuable supplementary ingredients to be used in animal rations. Filter cake (FC) is one of the valuable agro-industrial by-products as nutrients rich, which is produced during the milling process as, part of the cane remains after filtering sugar cane juice. Filter cake is produced as a sticky mass containing about 40-50% water (Akhtar *et al.*, 1998). As a result of the high content of water in filter cake, it is difficult to transport (requiring expensive tankers trucks), to store (requiring tanks), to handle and to

distribute to animals. Combining substitution of rice bran with sun dried filter cake in amounts up to 15% in poultry ration, resulted in normal growth rate and mortality, (Ajmal *et al.*, 1997). Mohamed *et al.*,(2001b) observed that the filter cake could successfully and economically replace up to 20% of traditional feed concentrate mixture for growing lambs rations. This study was carried out to investigate the possibility of feeding lactating goat with filter cake blocks. Digestibility, nutritive value and milk yield potential of diets with filter cake inclusion were evaluated.

MATERIAL AND METHODS

The present study was carried out at Sakha Experimental Station, belonging to the Animal Production Research Institute, Agricultural Research Center.

Lactation trials

Thirty Egyptian Baladi lactating does averaged 33.30±1.5 kg live body weight (LBW) and aged 3-4 years at the last two months of gestation were divided randomly into three similar groups (10 does were kept in separate pin). Animals were fed according to NRC, (1989) allowances for goats. Feeding requirements were adjusted biweekly according to weight changes and milk yield. Animal were given concentrate feed mixture 50% (CFM), berseem hay 30% (BH) and wheat straw 20% (WS) as (control group) RI. In the second (RII) and third (RIII), groups, 50% of CFM protein was replaced by filter cake blocks contained 40% FC (FCB1) and 48% FC (FCB2), respectively. The filter cake blocks (FCB) was manufacture by using horizontal mixer to mix ingredients in the following order of introduction, filter cake, molasses, urea, salt, soybean, wheat bran and cement. The mixture is then poured into moulds (frame made of boards (2.5m*0.2m). The composition of filter cake blocks (FCB1 and FCB2) are given in Table 1. The concentrate feed mixture consisted of 25% undecortecated cotton seed cake, 35% wheat bran, 30%corn, 3%rice bran, 4% molasses, 2% limestone and 1% salt.

Animals were fed twice daily at 8.00 and 16.00 hrs. Fixed quantity of FCB (FCB1 or FCB2) mixed with CFM before offering to animals. Clean drinking water was offered to the animals two times daily. Animals were kept under routine veterinary supervision through the experiment. Milk yield was measured individually, one day biweekly through the 90 days as a trial period. Does were completely hand milked till stripping the udder one mutual meal (morning & evening) daily through two successive days during suckling and milking periods. Kids suckled other dams in days of milk measured. Composite milk samples were collected from morning and evening milking of the same day for chemical analysis. Feed conversion was calculated as the amount of DM, TDN DE and DCP required to produce 1kg FCM. Economic return was calculated as the differences between the prices of milk and feed cost. Economic efficiency was calculated as the ratio between cost of feed consumed to the price of the milk produced, based on market prices

Blood samples were taken in heparnized tubes from jugular vein of tested animals for 3 successive days at 4-hrs post feeding once monthly during the experimental period. Blood samples separated by centrifugation at 4000 rpm for 10 minutes, then frozen at -20^{0}C until analysis.

Digestibility trials

Nine mature bucks average live body weight of 38.10±1.0kg was used to conduct three digestibility trials to determine the digestibility and nutritive

values of the tested rations. Animals were divided into three similar groups (3 animals each). Animals were accustomed to stand in metabolic cages for two weeks as preliminary period followed by one week as collection period. Every group was fed one of the previous tested rations mentioned before. Rations were offered twice daily at 9.00 and 16.00 hrs to the animals and clean drinking water was available. During the collection period, feed intake and leftover were measured, and representative samples were collected. Each 24-hr feces were quantity collected and aliquot samples were kept for chemical analysis.

Chemical analysis:

Chemical analysis of feed stuffs, feces and milk samples were determined according to methods recommended by A.O.A.C. (1990). Milk fat content was determined according to Gerber's methods as described by Ling (1963). Blood serum was analyzed by using kits for Total protein (*Weichselbaum*, 1946), urea (*Patton and Crouch*, 1977), Glucose, glutamic oxalocaetic transminase (GOT) and glutamic pyruvate transminase (GPT) (Siest *et al.*, 1981) Albumin (Doumas *et al* ., 1971) and the methods reported by biochemistry laboratory reagents and products. The serum total globulin (GL) was calculated by the difference (TP - Al). The digestible energy (DE) values of the feeds and milk energy were calculated according to *McDonald et al.*, (1978) equations.

Statistical analysis

The data were statistically analyzed to test the significant using one way analysis of variance according to Snedecor *and Cochran* 1980. *Duncan s* multiple range test (1955) was applied to test significant among means.

RESULTS AND DISCUSSION

The chemical analysis of ingredients and calculated nutrients content for experimental rations are presented in Table (2). Filter cake (FC) had similar CP, lower CF and higher ash content as percentage compared to berseem hay, used in this study, but slightly lower CP compared with concentrate feed mixture (CFM). Filter cake blocks (FCB1& FCB2) had a higher CP, lower CF and higher ash content as percentage compared to berseem hay. The nutrients contents of experimental rations were almost similar, except the ash content that was slightly higher in RIII ration than other ones.

Digestibility coefficients and feeding values:

The results presented in Table (3) showed insignificant differences among tested groups respecting of DM and OM digestibility. The values presented in Table (3) suggest that 50% replacement of CFM with FCB1 and FCB2 had stimulatory effect on total nutrient digestion in tested rations. Feeding FCB1 (for RII group) improved ($P<0.05$) CP digestibility as compared to RI group. Also, substitution 50% of CFM with FCB1and FCB2 (with RII and RIII groups, respectively) caused significantly ($P<0.05$) increase in CF digestibility compared to RI group. This probably due to the shift of rumen microbes to ferment more readily easily fermentable nutrients available through FCB as observed by Singh, (1991); Akhtar *et al.* (1998) and Mohamed *et al* . (2001b).

Improved nutrients digestibility in particular for RII indicated the availability of fermentable N and readily available carbohydrate supplied by FCB1 (group RII) which might have resulted in better utilization of the ration. (Leng, 1984 and Schiere *et al* .,1989).

Table (1): Ingredients of filter cake blocks (on DM basis)

Item	Ingredients components	
	FCB1	FCB2
Filter cake %	40	48
Molasses	12	9
Wheat bran	22	17
Soybean meal	10	12
Salt	5	3
Urea	1	1
Cement	10	10

Table (2): Chemical composition % of the ingredients and calculated composition of experimental rations (on DM basis).

Item	Chemical composition % (on DM basis)						
	DM	OM	CP	CF	EE	NFE	Ash
CFM	90.82	90.08	17.48	10.72	3.45	58.43	9.92
Berseem hay	89.26	88.93	13.52	27.86	2.18	45.37	11.07
Filter cake	60.32	78.67	13.55	18.88	2.62	43.62	21.33
Wheat straw	90.38	86.37	4.38	38.84	1.26	41.89	13.63
FCB1	89.78	83.17	15.28	11.78	1.82	54.29	16.83
FCB2	88.63	81.62	14.17	13.82	1.45	52.18	18.38
Tested Rations							
Ration1 RI	90.32	89.14	13.20	22.70	2.12	51.12	0.86
Ration2 RII	89.88	88.77	13.04	22.88	2.14	50.71	11.23
Ration3 RIII	89.52	88.17	12.86	22.36	2.23	50.72	11.83

Table (3) Digestion coefficients and feeding values of experimental rations.

Item	Exprimental Rations			
	RI	RII	RIII	SE
Digestion coefficients %				
DM	56.48	58.27	57.18	0.66
OM	59.67	62.68	61.36	0.72
CP	69.82^{b}	75.28^{a}	72.23^{ab}	0.64
CF	57.68^{c}	63.58^{a}	60.72^{b}	0.82
EE	79.28	78.56	78.74	0.72
NFE	69.38	72.54	70.43	0.65
Feeding values %				
TDN	60.66^{b}	65.04^{a}	62.55^{ab}	0.54
DE (Kcal/ 100 g DM)	267.43^{b}	286.67^{a}	275.67^{ab}	3.58
DCP	9.22^{b}	9.94^{a}	9.30^{b}	0.40

A,b,c Means in the same row having different superscript significantly differ (P<0.05)

Similar, trends of nutrient digestibility in cattle (*Gary and Gupta*, 1992 and *Mohamed et al.*, 2001a), and buffaloes (Dias, 1991 and Hosamani *et al.*, 1998) was reported.

Consequently, feeding values in terms of TDN, DE and DCP% was significantly ($P<0.05$) higher for RII group as compared to control group. Insignificant differences were noticed between control and RIII groups. As a result to that, TDN intake was low in group RI, which tended to increase in group RII & RIII as shown in Table (4).

There were no significant differences found between RI and RIII groups in respect of nutrients intake due to FCB substitution .The maximum DMI, TDN and DCP and intake were observed for animals fed RII ration (28.40, *18.47 and 3.47* g / kg BW, respectively). These results are comparable to those reported by *Dias* (1991), *Akhtar et al.* (1998) and *Mohamed et al .,* (2001b) who reported higher TDN and DCP values when FC was added to sheep rations.

Milk yield and composition:

As for daily milk yield, fat corrected milk FCM and its composition, the results in Table 5, show that daily milk yield and FCM of does fed RII diet was significantly higher ($P<0.05$) than those fed RI diet by 52.22 and 20.22%, respectively, but they did not significantly differ from those fed RIII diet. However, despite the differences were not significant between does fed RI diet and those fed RIII, and the daily milk yield and FCM produced by the latter group was higher by about 22.22 and 7.87%, respectively than the former one. This could be associated with higher DM intake accordingly TDN intake by does fed RII and RIII diets than those fed RI diet.

Milk fat, protein (Statistical analysis revealed insignificant differences for milk composition percentage among tested groups). The average of milk fat and milk protein (Table 5) of does fed RII diet was significantly higher ($P<0.05$) than those fed RI diet. However, the average of milk fat and milk protein yield of does fed RIII diet was not significantly different from the other tested diets. Such differences in milk fat and milk protein yield could be attributed to the differences in average of milk yield and milk composition, since it was practically similar. The obtained values for milk yield and milk composition are in agreement with those reported by *Gary and Gupta,* (1992) and *Mohamed et al .,* (2001a).

Blood plasma parameters

Values of some blood metabolites are presented in Table (6). There were no significant difference detected among the tested blood parameters of lactating does except for urea, which was slightly ($P<0.05$) higher in RII and RIII than RI group (control). The obtained values of blood parameters are within the normal range given by *Kameko* (1989) and Gabr *et al.* (2001) for healthy lactating does.

Feed conversion and economic efficiency for experimental rations:

Does fed on FCB1 have a better-feed conversion compared to goat fed control ration expressed as DM, TDN, DE and DCP/kg FCM. Substitution, 50% of CFM with FCB1 (with 40% filter cake) resulted in better feed conversion rate by 13.85; 7.60 and 6.81% for DMI, TDN, and DCP, respectively for producing 1kg FCM compared to control group. The DMI for the lactation does seems to be higher than values obtained with digestibility trials. On the mean time, the feed cost decreased by 8.82 and 14.71% with RII and RIII groups, respectively as compared to does fed control ration. The estimated economic

Table (4): Dry matter intake and nutrients intake of experimental rations fed to bucks.

Item	Experimental Rations			
	RI	RII	RIII	SE
Av. body weight kg	38.50	37.50	38.20	
Dry matter intake				
DMI g/ head /day	985	1065	1015	2.5
" " " kg BW	25.58^{b}	28.40^{a}	26.57^{ab}	0.55
Nutrients intake				
TDN g/ head /day	597.50^{b}	693.68^{a}	634.88^{ab}	38
" " " kg BW	15.52^{b}	18.47^{a}	16.62^{ab}	1.57
DE K cal / head /day	91.61^{b}	104.05^{a}	97.03^{ab}	0.94
" " kg BW	2.38^{b}	2.78^{a}	2.54^{ab}	1.85
DCP g/ head /day	90.82^{b}	130.00^{a}	117.76^{ab}	2.75
" " " kg BW	2.36^{b}	3.47^{a}	2.47^{ab}	0.88

a,b,c Means in the same row having different superscript significantly differ (P<0.05)

Table (5): Average daily milk yield , milk composition for lactating doas fed experimental rations

Item	Experimental Rations			
	RI	RII	RIII	SE
Av. daily milk yield kg/h	0.90^{c}	1.37^{a}	1.10^{b}	0.21
Av. daily Fat corrected milk	0.89^{b}	1.07^{a}	0.96^{ab}	0.13
Milk composition, %				
Fat	3.52	3.46	3.48	0.23
Protein	3.61	3.62	3.57	0.18
Total Solids (TS)	12.18	12.26	12.07	0.11
Solids not fat (SNF)	8.66	8.80	8.59	0.28
Lactose	4.12	4.24	4.18	0.30
Ash	0.83	0.82	0.84	0.13
Av. Fat yield g / h /d	33.10^{b}	45.67^{a}	38.28^{ab}	0.36
Av. Protein yield g / h /d	33.93^{b}	47.78^{a}	39.27^{ab}	0.32

a,b,c Means in the same row having different superscript significantly differ (P<0.05)

Table (6): Effect of feeding the experimental rations on some blood plasma Parameters of does.

Item	Experimental Rations			
	RI	RII	RIII	SE
Total protein gm/100 ml	7.24	7.32	7.29	0.12
Albumin gm/100 ml	3.68	3.69	3.74	0.08
Globulin gm/100 ml	3.56	3.63	3.55	0.11
AL / GL ratio	1.03	1.02	1.05	0.07
Glucose gm/100 ml	61.38	63.30	64.50	0.23
Gpt	8.72	8.38	8.63	0.12
Got	61.32	62.72	62.83	0..11
Urea mg/100 ml	41.28^{b}	45.63^{a}	46.83^{a}	0.31

a,b,c Means in the same row having different superscript significantly differ (P<0.05)

efficiency are given in (Table 7) illustrate that FCB substitution in RII & RIII reflected superiority over the control ration.. Moreover, economical efficiency improved by 41.30 and 12.32% with RII and RIII, respectively as compared to control group.

From this study it can be concluded that blocks based on filter cake (with 40% filter cake) fed successfully and economically as a partial substitute for cereal based concentrate rations for lactating does without any adverse effects on animal performance which reflect on feeding cost and economical efficiency.

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Table (7): Feed conversion and economic efficiency of lactating does fed experimental rations.

Item	Experimental Rations		
	RI	RII	RIII
***Feed conversion**			
Kg DM / kg FCM	1.30	1.12	1.23
Kg TDN / kg FCM	0.79	0.73	0.77
DE Mcal / kg FCM	3.48	3.21	3.39
g DCP/ kg FCM	119.65	111.50	114.31
***Economic Efficiency**			
Total feed cost LE/doe	61.20	55.80	52.20
Price of milk LE/h	84.60	108.90	81.00
Return LE	23.40	53.10	28.80
Economic Efficiency	1.38	1.95	1.55
The Economic Efficiency improvement %		41.30	12.32

***Market price for CFM, BH, WS FCB1, FCB2 milk (on fresh basis) LE/ton, 700,400, 200, 500,400 and 1000.**

تأثير استخدام قوالب مخلفات مرشحات السكر في علائق الماعز الحلاب على معاملات الهضم وأدائها الانتاجي.

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١- قسم بحوث استخام المخلفات ، ٢-قسم بحوث الأغنام والماعز ، معهد بحوث الإنتاج الحيواني ، مركز البحوث الزراعية. جيزة. مصر

تم دراسة تأثير استبدال مخلوط العلف المركز بواسطة قوالب مخلفات مرشحات السكر (ق م م س) في علائق الماعز الحلاب على كفاءة الحيوان لانتاج اللبن وتركيب اللبن . استخدمت في هذه الدراسة ٣٠ ماعز بلدي حلاب متوسط وزن الجسم ٣٠٣٣ ± ١٠٥ كجم ويتراوح عمرها ٣-٤سنوات في موسم الحليب الثاني و الثالث وبدأت التغذية على العلائق المختبرة خلال الشهرين الأخيرين من الحمل واستمرت لمدة ٣شهور . وقد تم تقسيم الحيوانات إلى ثلاث مجامع متماثلة لدراسة تأثير استبدال (ق م م س) على إنتاجيه الماعز. كانت العلائق المختبرة تتكون من علف مركز ودريس برسيم وتبن قمح (عليقه مقارنة)ع١ ،أو استخدام عليقه المقارنة مع استبدال ٥٠% من بروتين العلف المركز بقوالب (ق م م س١) ع٢ ، أو استخدام العليقة المقارنة مع استبدال ٥٠% من العلف المركز لعليقه المقارنة بقوالب(ق م م س٢) ع٣ . وقد استخدمت عدد ٩ من ذكور الماعز متوسط وزنها ١و٣٨ ±٠و١كجم لإجراء تجارب الهضم.

وقد دلت النتائج على إن القيمة الهضمية لكل من المادة الجافة والمادة العضوية للعلائق المختبرة مع استبدال العلف المركز ب (ق م م س) كانت متشابه تقريبا . بينما كانت القيمة الهضمية لكل من البروتين الخام والألياف الخام والقيمة الغذائية محسوبة كمركبات غذائية مهضومة ومكافئ النشا والطاقة الممثلة والبروتين الخام المهضوم قد تحسنت تحسنا معنويا (احتمال ٠،٠٥) بالنسبة للمجموعة ع٢ مقارنة بمجموعة ع١ . بينما لم توجد فروق معنوية بالنسبة لقيمة كل من البروتين الخام المهضوم والألياف الخام المهضومة والقيمة الغذائية محسوبة كمركبات غذائية مهضومة والطاقة المهضومة والبروتين الخام المهضوم عند مقارنة ع٣ و ع١.

بالنسبة لمعدل إدرار اللبن فقد زاد معدل الإدرار للمجموعة ع٢ زيادة معنوية (احتمال ٠،٠٥) عند مقارنته المجموعة ع١. بينما لم توجد فروق معنوية بين المجاميع المختبرة بالنسبة لكل من نسبة الدهن والبروتين الخام والجوامد الصلبة الكلية والجوامد اللادهنيه واللاكتوز . بالنسبة لانتاج اللبن معدل الدهن فقد كانت هناك فروق معنوية (احتمال ٠،٠٥) عند مقارنة ع٢ ومجموعة المقارنة ع١ . بينما لم توجد فروق معنوية بين مجموعة ع٣ ، ع١ بالنسبة للبن معدل الدهن. وقد ازداد محصول الدهن والبروتين للمجموعة ع٢ زيادة معنوية (احتمال ٠،٠٥)

مقارنة بالمجموعة ع١. بالنسبة لبعض مقاييس الدم لم تتأثر معنويا بإحلال (ق م م س) محل ٥٠% من العلف المركز . كذلك تحسنت الكفاءة التحويلية للحيوانات محسوبة في صورة طاقة مهضومة وبروتين مهضوم نتيجة هذا الاستبدال ، كما انخفضت تكاليف التغذية بمقدار ١٤،٧١ ، ٢٨،٨٢% لكل من مجموعتي ع٢، ع٣ على التوالي عن مجموعة المقارنة. وقد أدى ذلك إلى تحسن الكفاءة الاقتصادية لانتاج كجم لبن للحيوانات بمقدار ٤١،٣ ، ١٢،٣٢%لكل من مجموعتي ع٢، ع٣ على التوالي عن مجموعة المقارنة.

وتخلص الدراسة إلى انه من الممكن استبدال ٥٠% من العلف المركز بواسطة قوالب مخلفات مرشحات السكر (ق م م س١ المحتوية على ٤٠% من مخلفات مرشحات السكر) بدون أن يتأثر أداء الحيوان مع انخفاض تكاليف التغذية وزيادة الكفاءة الاقتصادية.