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EFFECT OF DIETARY OILSEED SUPPLEMENT ON NUTRIENT UTILIZATION, MILK YIELD AND COMPOSITION OF LACTATING BUFFALOES

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SUMMARY

Two groups, each of five multiparous lactating buffaloes were arranged into two swing over experiments. Crushed full fat cottonseed or canola seeds was used to replace 25% and 50% of energy of concentrate mixture which contained 55% starch value and 14% crude protein. Fat content of the experimental rations averaged 3.4, 4.5% and 6.3% for control, low and high oilseed levels, respectively. Nutrient requirements were individually calculated based on milk yield and live body weight.

Nutrient digestibilities were significantly decreased except ether extract, which showed significant increase for high fat diets. Milk yield and 4%-fat corrected milk yield (FCM) increased, especially for buffaloes fed high cottonseed diet. Milk fat percentage was not significantly affected by dietary low fat inclusion, however, it was significantly increased in high cottonseed containing diet. Milk protein percentage decreased when high fat diets were fed. Milk total solids, lactose and solids not fat were not significantly affected by oilseed inclusion. Milk casein nitrogen was significantly decreased but milk NPN increased by oilseed inclusion. Ruminal pH, NH_3-N, and VFA's concentrations were not significantly affected by oilseed feeding.

Blood plasma cholesterol, triglycerides, low and high density lipoproteins were significantly increased for buffaloes fed high cottonseed ration but insignificantly decreased for buffaloes fed canola seeds. The lowest feeding cost and the highest revenue has been recorded for buffaloes fed the high cottonseed level. It was concluded that inclusion of 50% crushed cottonseed of concentrate on energy basis is recommended for higher milk yield and profit above feeding cost.

***Keywords:** Buffalo, oilseeds, nutrient utilization and milk*

INTRODUCTION

High levels of grain in dairy rations are not recommended because of the negative effects on rumen metabolism and milk composition. Fats have received increasing interest and full fat seeds are considered to be a useful source of dietary fat for dairy cows (Palmquist, 1984). Use of free fats in diets is usually limited to 3% of dietary DM but more fat (5 to 6% of dietary DM) in the form of Ca salts can be fed without deleterious effects on ruminal digestion (Palmquist, 1988). However, use of whole seeds in the diet increases energy intake, percentage of milk fat, and FCM production and had variable effects on milk protein contents (Harrison, 1991). Whole oilseeds can be fed without marked ruminal inhibition, probably because of a slow release of the oil into rumen (Coppock and Wilks, 1991). Moreover, oil in seeds is encapsulated by seed coat which had beneficial effects as a natural protection (Ekeren *et al.*, 1992) preventing the side effects of chemicals that are used in fat protection (El-Bedawy *et al.*, 1994).

In Egypt, buffaloes are the major milk producing animals and contribute about 73 per cent of the total milk production. The productivity of buffalo is affected by many physiological and environmental factors. Among these, feeding and nutrition are of prime importance. Buffalo milk contains high fat and solids-not-fat, reflecting higher dietary energy requirements than that of cows.

The objective of this study is to evaluate the response of lactating buffaloes to dietary full fat oilseeds in iso-caloric and iso-nitrogenous diets in nutrient utilization, milk yield and composition.

MATERIAL AND METHODS

The experiment was carried out at the Agricultural Experimental Station, Faculty of Agriculture, Cairo University. Two groups, each of five multiparous lactating Egyptian buffaloes were arranged in two swing over design experiments as applied by Abou-Hussein (1958) for 144 day experimental period including four period each of 36 days. Each 36 day-period consisted of 21 days preliminary and 15 days for collection.

Average body weight was 549 kg for the first group and 568 kg for the second one. The average days in milk were 40 and 37 days with initial FCM of 13.56 kg and 11.51 kg. Group 1 received the low level of oilseed diets (Experiment 1) while group 2 received the high level of oilseed diets (Experiment 2). Each experiment started with initial control and ended with final control (no oilseeds) where two controls are required to adjust the normal change in milk yield and composition.

In the first experiment (Low fat diets), 25% of full fat cottonseed and 12.5% full fat canola seeds replaced the concentrate mixture on energy basis. While, 50% of full fat cottonseed and 25% full fat canola seeds replaced the concentrate mixture on energy basis in the second experiment (High fat diets) as shown in Table 1.

Table 1. The swing over experimental design

Period	1-36 day	37-72	73-108	109-144
Experiment I (Low fat diet)	Initial control	25% full fat cottonseed (LCO)	12.5% full fat canola seeds (LCA)	Final control
Experiment II (High fat diet)	Initial control	50% full fat cottonseed (HCO)	25% full fat canola seeds (HCA)	Final control

Concentrate mixture composed of 37 % yellow corn, 8 % sugar beet bulb, 15 % decorticated cottonseed meal, 20 % wheat bran, 15 % rice bran, 3 % limestone, 1%

sodium chloride and 1% trace mineral premix. The experimental roughages used in this experiment were berseem (*Trifolium alexandrinum*) and rice straw. Oilseeds replaced concentrate mixture on energy basis (starch value) at level of 25% which is equivalent to 17.29 % for cottonseed and 7.28% canola seeds of concentrate mixture dry matter. In experiment 1, these proportions represented 10.49 % and 4.34 % of total ration dry matter. While, the corresponding ratios in experiment 2 were 23.08 % and 8.88 % of the total ration dry matter as shown in Table 2.

Table 2. Composition of the experimental rations (DM basis)

Ingredient (%)	Low fat diets			High fat diets		
	Control	LCO	LCA	Control	HCO	HCA
Berseem	23.18	25.82	28.31	20.55	22.79	26.36
Rice straw	15.17	14.82	14.96	19.30	17.92	18.45
Concentrate mixture	61.65	48.87	52.40	60.15	36.21	46.32
Whole cottonseed	0	10.49	0	0	23.08	0
Whole canola seed	0	0	4.34	0	0	8.88
Roughage%	38.35	40.64	43.27	39.85	40.71	44.81

Nutrient requirements were individually calculated according to body weight, daily milk yield and milk fat test according to Ghoneim (1966). Nutrient allowances and feed intakes were checked and adjusted to body weight and milk production before each period.

Buffaloes were individually housed. Concentrate mixture was offered twice a day at milking time (6:00 a.m. and 6:00 p.m.) and wilted berseem was offered at 10:00 a.m. Rice straw was offered after the evening milking for overnight feeding. Buffaloes were watered twice a day before milking. The 4% fat corrected milk yield was calculated according to Gaines (1927).

Chemical composition of feeds and feces (A.O.A.C., 1990), Milk composition (Ling, 1963), milk nitrogen fractions (Rowland, 1938) were determined. Nutrient digestibilities were determined applying the acid insoluble ash (AIA) technique as described by Van Keulen and Young (1977).

Rumen fluid samples were collected from all animals using stomach tube before feeding, 3, and 6 hours post feeding during the last two days of the collection period. Rumen fluid pH was immediately measured by using pH meter. Ammonia nitrogen (Conway, 1963), total volatile fatty acid's concentrations (Kromann *et al.*, 1967) were also determined.

Blood samples were individually collected at the same times of rumen sampling by puncturing the jugular vein using heparinized evacuated tube. Blood samples were spent at 5000 r.p.m. for 10 minutes. Blood plasma were collected and kept frozen for later analyses. Plasma triglycerides, cholesterol, low density lipoprotein (LDL) and high density lipoprotein (HDL) (Roche Diagnostics GmbH kits, D-68298, Mannheim) were analyzed at sampling times of 0, 3 and 6 hrs post-feeding using Hitachi 90 Automatic analyzer at 505 nm wave length.

Data collected were subjected to the statistical analysis using MSTAT-C (1989). Milk yields, composition, nutrients intake, digestibilities, nutritive values within each experiment were analyzed using one way analysis of variance according to the following model:

$$Y = \mu + x_i + e_{ij}$$

Where : Y = observation.

μ = Overall mean.

x_i = Effect of diets , i =1 - 3.

e_{ij} = experimental error.

Rumen and blood parameters were subjected to two-way analysis of variance according to the following model:

$Y = \mu + X_i + X_j + X_{ij} + e_{ijk}$

Where : Y = observation

μ = Overall mean

X_i = effect of diet

Xj = effect of sampling time for j = 1-3 ; 0 hr, 3 hrs and 6 hrs

X_{ij} = the interaction between diet x sampling time.

e_{ijk} = experimental error.

Duncan's Multiple Range Test (Duncan, 1955) was used to separate means at significance level (P<0.05) whenever the main effects were significant.

RESULTS AND DISCUSSION

Chemical composition of the experimental rations (Table 3) was calculated from the chemical composition of feed ingredients and its percentage in the ration dry matter. Ether extract levels were about 3%, 4% and 6% for control, low fat and high fat diets, respectively. All rations contained from 23 to 25% CF. Control rations contained 14% CP while the tested rations contained 16%. These values are recommended for lactating buffaloes (Ranjhan, 1980).

Table 3. Chemical analysis of the experimental rations

Item	Low fat diets			High fat diets		
	Control	LCO	LCA	Control	HCO	HCA
DM	72.83	70.96	69.10	74.94	73.71	70.76
DM composition, %						
OM	87.01	85.75	85.48	86.97	87.14	86.51
CP	14.98	16.50	16.02	14.31	17.21	16.11
CF	23.16	23.63	22.89	23.76	23.13	25.37
EE	3.44	4.22	4.77	3.38	6.48	6.03
NFE	45.43	41.40	41.80	45.52	37.32	39.00
Ash	12.99	14.25	14.52	13.03	12.86	13.49

Average dry matter intake (Kg/h/day) from concentrate mixture, berseem, rice straw, whole cottonseed, and whole canola seed as well as its total is presented in Table 4. Values in Table 4 represented the group average calculated from individual feed intake. Total dry matter intake is also presented as percentage of body weight and Kg/Kg $W^{0.75}$. Intakes were adjusted to body weight and milk production. Therefore, these values does not reflect diet effect.

Table 4. Dry matter intake of the experimental groups

Intake	Low fat diets			High fat diets		
	Control	LCO	LCA	Control	HCO	HCA
Kg/head/day						
Concentrate mixture	7.89	6.09	6.47	7.34	4.11	5.57
Berseem	2.96	3.22	3.50	2.51	2.58	3.17
Rice straw	1.94	1.85	1.85	2.36	2.03	2.22
Whole cottonseed	0	1.31	0	0	2.58	0
Whole canola seed	0	0	0.54	0	0	1.07
Total	12.79	12.47	12.35	12.21	11.34	12.02
Kg/100Kg BW	2.35	2.34	2.33	2.16	2.04	2.18
g/kg $W^{0.75}$	113. 8	112.4	112.0	105.6	99.8	106.6

Feeding oilseed containing rations significantly decreased all nutrient digestibilities except EE which showed significant increase for high fat but not for the low fat diets (Table 5). The effect was much pronounced with feeding canola than cotton seeds. The CF was the most affected nutrient by oil seed inclusion especially with cotton seeds. Moreover, CP digestibility of canola seed diets was less than that of cottonseed diets. It could be related to the difference in protein degradability and ammonia release-absorption relationship which could make the DCP as protein evaluation system is meaningless. The effect of inclusion oilseeds on nutrient digestibilities was intensively studied. Some results indicated negative effect (Mabjeesh *et al.*, 1999 and Bernard *et al.*, 1999), no significant effect (El-Bedawy *et al.*, 1994; Aboul-Fotouh *et al.*, 1999 and Deluca and Jenkins, 2000). or sometimes increase (Karalzos *et al.*, 1992; Horner *et al.*, 1988 and Jenkins, 1998).

The decrease in nutrient digestibilities by oilseed inclusion resulted in lower energetic value of the oilseed containing diets. Jenkins (1998) reported that fat addition does not always improve the nutritive value of the diet, sometimes the improvement, if any, would be less than that expected.

Table 5. Nutrient digestibility and nutritive value of the experimental rations

Item	Low fat diets			SE	High fat diets			SE
	Control	LCO	LCA		Control	HCO	HCA	
Digestibility (%)								
DM	68.45^a	63.91^b	59.87^c	2.48	67.47^a	62.52b	59.68^b	2.28
OM	73.67^a	66.40^b	62.98^b	3.15	73.47^a	65.18b	62.54^b	3.29
CP	71.64^a	66.90^b	51.72^b	6.01	70.53^a	62.14b	56.26^c	4.14
EE	74.88	82.66	73.60	2.83	68.60^b	89.69a	59.12^b	9.03
CF	59.92^a	44.84^b	48.37^b	4.56	58.07	50.71	54.16	2.12
NFE	79.73^a	67.58^c	70.63^b	3.65	78.35^a	64.77c	70.34^b	3.94
Nutritive value (%)								
TDN	66.85^a	55.71^b	57.37^b	3.47	65.00^a	60.76^b	59.22^b	1.73
SV	57.56^a	46.36^b	48.24^b	3.46	55.13^a	50.28^b	49.00^b	1.87
DCP	10.73	10.10	9.97	0.23	10.10^b	10.79^a	9.80^b	0.29

[a,b,c] Means with different superscripts within each parameter and each experiment differ significantly (P<0.05).

Nutrient intakes as TDN or SV of oilseed containing rations were ($P<0.05$) lower than control values (Table 6). This might be due to the decreasing effect of oil seed inclusion on nutrient diegestibilities and nutritive value of these diets (Table 5). However, DCP intake of buffaloes fed cottonseed containing rations was almost similar to that of buffaloes fed control or canola seed rations.

Table 6. Nutrient intake of lactating buffaloes fed the experimental rations

Intake	Low fat diets				High fat diets			
	Control	LCO	LCA	SE	Control	HCO	HCA	SE
Av. BW, Kg	544	534	531	4.00	566	557	551	5.00
Starch value								
Kg/h/day	7.362[a]	5.760[b]	5.964[b]	0.19	6.724[a]	5.652[b]	5.850[b]	0.22
Kg/100KgBW	1.342[a]	1.072[b]	1.128[b]	0.03	1.196[a]	1.022[b]	1.088[ab]	0.04
g/kg $W^{0.75}$	65.20[a]	52.00[b]	54.00[b]	2.00	58.40[a]	50.00[b]	52.20[ab]	2.00
TDN								
Kg/h/day	8.544[a]	7.230[b]	7.114[b]	0.18	7.930[a]	6.952[b]	7.000[b]	0.24
Kg/100KgBW	1.572[a]	1.360[b]	1.344[b]	0.03	1.412	1.270	1.294	0.04
g/kg $W^{0.75}$	76.20[a]	65.20[b]	64.40[b]	2.00	68.40[a]	61.20[b]	62.40[ab]	2.0
DCP								
g/h/day	1372[a]	1255[ab]	1235[b]	40.00	1231	1215	1167	38
g/100 Kg BW	252.6	236.4	232.6	8.00	221	222.4	217.4	7.0
g/kg $W^{0.75}$	12.18	11.34	11.14	0.40	10.70	10.74	10.44	0.30

[a,b] Means with different superscripts within each parameter and each experiment differ significantly ($P<0.05$).

Ruminal pH, ammonia nitrogen and total VFA's concentrations as affected by dietary treatments and sampling times are presented in Table 7. Incorporation of full-fat oilseeds either at low level or high level had no significant ($P<0.05$) effect on ruminal pH. However, values tended to be lower with oilseed containing rations. The reducing effect of fat containing diets on ruminal pH was well documented (Huard, *et al.*, 1998; Jenkins, *et al.*, 2000 and Mabjeesh, *et al.*, 2000). Ruminal pH decreased 3 hours post feeding, then increased at 6 hrs after feeding Sampling time affects ruminal pH more than the diet did.

Feeding oilseed containing rations ($P<0.05$) decreased post-feeding ruminal ammonia nitrogen concentrations either at low or high level of fat. No significant differences among the experimental groups were found before feeding. Pena *et al.* (1986), and Mabjeesh *et al.*(2000) found a decrease in ruminal ammonia when fat containing diets were fed. Effect of sampling time on ruminal ammonia was not consistent. This might be due to that rumen fluid samples were collected by using stomach tube and such sample could be contaminated with saliva. Nevertheless, the lower values for the oilseed diets could suggest a lower degradability and NH_3 absorption that explain the lower apparent protein digestibility (Table 5) but that does not mean a lower availability of amino acids for intestine absorption..

Feeding oilseed containing rations decreased total VFA's concentrations specially in case of canola seeds. The differences were ($P<0.05$) significant at low fat level

(Table 7). Khorasani *et al.* (1992) and Khorasani and Kennelly (1998) found linear decrease in total volatile fatty acids concentrations with increasing canola seeds in dairy cows diet. The decrease in total volatile fatty acids in the rumen by addition of dietary fat might be due to that fat partially replaces the non-structural carbohydrate in the diet, and as a result, there is less fermentable carbohydrate available for VFA production (Khorasani and Kennelly, 1998). The decrease in ruminal volatile fatty acid by fat feeding was reported by El-Bedawy *et al.* (1994), Jenkins *et al.* (2000) and Mabjeesh *et al.* (2000).

Table 7. Effect of feeding full-fat cotton and canola seeds on ruminal pH, NH3-N and TVFA's concentrations of lactating buffaloes

Item	Low Fat diets				High Fat diets			
	Control	LCO	LCA	SE	Control	HCO	HCA	SE
Ruminal pH								
Before feeding	6.89[a]	6.89[a]	6.80[ab]	0.03	7.07[a]	6.76[b]	6.83[b]	0.09
3 hr after feeding	6.68[bc]	6.67[bc]	6.57[c]	0.04	6.83[b]	6.68[bc]	6.56[c]	0.08
6 hr after feeding	6.61[bc]	6.89[a]	6.77[ab]	0.08	6.73[bc]	6.81[b]	6.86[b]	0.04
NH3-N, mg (%)								
Before feeding	11.31[b]	11.09[b]	10.81[b]	0.15	10.64[b]	9.30[bc]	6.67[c]	0.86
3 hr after feeding	13.89[a]	9.41[bcd]	8.12[cd]	1.75	13.61[a]	9.35[bc]	9.07[bc]	1.47
6 hr after feeding	15.51[a]	7.67[d]	10.36[bc]	2.30	14.56[a]	10.81[b]	8.74[bc]	1.70
TVFA's, mEq (%)								
Before feeding	18.10[ab]	13.20[bc]	20.00[a]	2.03	17.30	12.10	12.40	1.69
3 hr after feeding	21.20[a]	10.70[c]	16.50[abc]	3.04	19.30	17.70	18.00	0.49
6 hr after feeding	23.20[a]	12.60[bc]	21.10[a]	3.24	19.30	11.50	17.10	2.32

[a,b,c] Means with different superscripts within each parameter and each experiment differ significantly (P<0.05).

Blood plasma total cholesterol, triglycerides, low and high lipoproteins (LDL and HDL) of lactating buffaloes fed full-fat oilseeds containing rations are presented in Table 8.

Plasma cholesterol concentration (P<0.05) increased for buffaloes fed oilseed containing rations specially those fed HCO rations. The increase in cholesterol by feeding oilseed containing vegetable fat (cholesterol free) like cottonseed or canola could be explained that the increase in dietary fat stimulates intestinal cholesterol synthesis to meet the increased demand for absorption and transport of fat because of the lack of cholesterol in the ruminants diet and dependence on *de novo* synthesis (Nestel *et al.*, 1978).

Plasma triglycerides were significantly ($P<0.05$) higher for buffaloes fed LCO rations, but lower for those fed LCA ones.Feeding the high levels of cottonseed or canola seeds insignificantly affected plasma triglyceride concentrations

High and low density lipoproteins (HDL and LDL) were ($P<0.05$) higher for buffaloes fed HCO rations. On the other hand, feeding LCA or HCA rations significantly decreased blood plasma LDL concentrations.

Concerning the effect of sampling time on blood plasma lipids, no significant differences were detected. The result of blood plasma lipids as affected by oilseed incorporation in the rations are in agreement with the findings of Khorasani and Kennlley (1998) and Deluca and Jenkins (2000).

Milk yield of buffaloes fed oilseed containing rations was , in general, higher than that of controls. Feeding whole cotton or canola seeds had no significant effect on milk yield of buffaloes fed low fat diets. Milk yield was found to be 9.98, 10.06 and 10.18 Kg/h/day being 13.35, 14.17 and 14.51 Kg 4-FCM /h/day. Buffaloes fed 50% cotton seed produced ($P<0.05$) more milk than those fed 25% canola or the control by about 20%. This could indicate that the effect of fat level on milk yield is dependant on the dietary fat source (Chouinard *et al.*, 1997, and Khorasani and Kennelly, 1998).

The increase in milk production in response to feeding oilseed diets could not be attributed to higher energy intake since the TDN intake of buffaloes fed oil seed diets was not higher than their controls (Table 6). This increase might be due to the improved effect of supplementary fat on efficiency of energy utilization by reducing methane production and heat increment (Andrew *et al.*, 1991; Wu *et al.*, 1994; Chan *et al.*, 1997 and Jenkins, 1998) and/or unsuitability of starch value to express net energy for lactation. Although the recent ME and NE systems are more accurate and are of more scientific basis, yet the TDN system is still more acceptable and applied in many publications. The DCP system, however, is deeply criticized and metabolizable protein system should be followed.

Buffaloes fed high fat diets produced milk with higher fat percentage but there was no difference between buffaloes fed low fat diets (Table 9). Inclusion of cotton seeds in high fat diet increased fat percentage by about 20%. Supplementation of dairy cow diets with fat sometimes (Schingoethe and Casper, 1991), but not always (Romo *et al.*, 1996), depressed milk fat percentages. The effect of dietary fat on milk fat percentage depends on composition and the degree of saturation of the fatty acid in dietary fat. High proportion of long chain and saturated fatty acids in dietary fat was reported to decrease milk fat percentage (Dhiman *et al.*, 1999 and Deluca and Jenkins, 2000). Cotton and canola seeds contains high level of unsaturated fatty acid (18:1) which could be the reason for the higher milk fat percentage of buffaloes fed HCO containing diets.

Milk protein decreased ($P<0.05$) by oilseed feeding at high fat level. Feeding HCO and HCA diets decreased milk protein by about 5 and 10%, respectively. Although the higher CP of the tested ration (16%) than the control (14%). DePeters and Cant (1992) found a decrease of 0.1 to 0.3 units when fat containing diet was fed to dairy cows.

Table 8. Effect of full-fat cotton and canola oilseeds on plasma lipid metabolites concentrations (mg, %) in lactating buffaloes

Item	Low Fat diets				High Fat diets			
	Control	LCO	LCA	SE	Control	HCO	HCA	SE
Total cholesterol								
Before feeding	87.80	103.60	95.20	4.564	77.80^{c}	104.2^{a}	88.80^{bc}	7.656
3 hr after feeding	89.80	96.60	95.00	2.053	80.80^{c}	95.20^{ab}	76.80^{c}	5.587
6 hr after feeding	93.00	99.00	96.20	1.733	77.00^{c}	102.80^{a}	81.80^{c}	7.922
Triglycerides								
Before feeding	16.00^{ab}	17.20^{a}	10.00^{cd}	7.227	15.26^{c}	10.26^{bc}	9.00^{bc}	1.912
3 hr after feeding	11.00^{bcd}	12.80^{abc}	10.40^{bcd}	0.721	9.50^{bc}	8.00^{c}	9.76^{bc}	0.548
6 hr after feeding	15.20^{abc}	10.80^{bcd}	6.80^{d}	2.426	11.50^{b}	10.50^{bc}	11.00^{bc}	0.289
High density lipoprotein (HDL)								
Before feeding	83.60	90.60	97.20	3.93	77.0^{bcde}	85.00^{ab}	80.60^{bc}	2.31
3 hr after feeding	87.60	81.00	80.20	2.35	70.0^{def}	78.0^{bcd}	60.80^{f}	4.97
6 hr after feeding	89.00	97.80	81.80	3.93	74.60^{cde}	92.20^{c}	67.20^{ef}	7.41
Low density lipoprotein(LDL)								
Before feeding	9.32	13.12	13.48	1.34	9.88^{b}	16.12^{a}	14.22^{ab}	1.85
3 hr after feeding	10.10	10.76	12.98	0.87	12.38^{ab}	16.22^{a}	11.82^{ab}	1.38
6 hr after feeding	10.58	11.52	13.48	0.85	11.88^{ab}	15.66^{a}	12.58^{ab}	1.16

^{a,b,c,d,e} Means with different superscripts within each parameter and each experiment differ (P<0.05).

Table 9 . Effect of full fat cotton and canola seeds on milk yield and composition of buffaloes

Item	Low Fat diets				High Fat diets			
	Control	LCO	LCA	SE	Control	HCO	HCA	SE
Milk yield, Kg/h/day								
Adjusted	9.98	10.06	10.18	0.06	8.15^{b}	8.73^{a}	8.46^{ab}	0.17
4% FCM	13.35	14.17	14.51	0.34	11.47^{b}	13.52^{a}	11.95^{b}	0.46
Milk composition (%)								
Fat	6.26	6.61	6.67	0.13	6.75^{b}	7.84^{a}	6.93^{b}	0.34
Protein	4.36	4.12	4.02	0.10	4.40^{a}	4.17^{b}	4.02^{b}	0.11
Lactose	4.82	3.63	3.67	0.39	4.11	3.10	3.85	0.30
Ash	0.95	0.91	0.96	0.02	0.98	0.99	1.02	0.01
SNF	10.13	8.66	8.65	0.49	9.50^{a}	8.26^{b}	8.89^{ab}	0.36
TS	16.39	15.27	15.32	0.37	16.25	16.10	15.82	0.13

^{a,b} Means with different superscripts within each parameter and each experiment differ (P<0.05) .

Many hypotheses were proposed to explain this effect, Casper and Schingoethe (1989) showed that added fat had a negative effect on somatotropin which reduce the mammy uptake of amino acids. Chilliard and Ottou (1995) proposed that dietary fat decreases insulin secretion that stimulates the utilization of amino acids for gluconeogesis and consequently reduces the amino acids available for milk protein synthesis

Milk lactose percentage showed also a decrease by oilseed inclusion but this decrease was not significant which is supported by the findings of Bernard and Calhoun 1997. Inclusion of oilseeds ($P<0.05$) decreased milk casein nitrogen but ($P<0.05$) increased milk NPN. No consistent difference was observed for whey nitrogen. When milk nitrogen was calculated as a percentage of milk total nitrogen, feeding cotton seed ($P<0.05$) decreased casein proportion but ($P<0.05$) increased whey nitrogen. Milk NPN as a percentage of total nitrogen ($P<0.05$) decreased by feeding oilseed containing rations (Table 10). It is evident that the reduction in milk protein by oilseed inclusion is mainly due to the decrease in milk casein (Harrison, 1991; DePeters and Ferguson, 1992 and Cant *et al.*, 1993)

Table 10. Effect of full-fat cotton and canola seeds on nitrogen distribution in buffalo milk

Item	Low fat diets				High fat diets			
	Control	LCO	LCA	SE	Control	HCO	HCA	SE
Milk nitrogen (%)								
Casein N	0.540^{a}	0.442^{c}	0.491^{b}	0.028	0.560^{a}	0.442^{b}	0.477^{b}	0.035
Whey N	0.112^{b}	0.160^{a}	0.097^{c}	0.006	0.099^{b}	0.170^{a}	0.106^{b}	0.023
NPN N	0.032	0.044	0.042	0.004	0.031^{b}	0.040^{ab}	0.046^{a}	0.004
Total N	0.684^{a}	0.646^{b}	0.630^{c}	0.016	0.690^{a}	0.652^{b}	0.629^{c}	0.017
Percentage of total N								
Casein N	78.96^{a}	68.38^{b}	77.98^{a}	3.38	81.11^{a}	67.70^{b}	75.73^{a}	3.90
Whey N	16.36^{b}	24.84^{a}	15.48^{b}	2.99	14.34^{b}	26.02^{a}	16.93^{b}	3.54
NPN N	4.65^{b}	6.78^{a}	6.64^{a}	0.69	4.55^{b}	6.35^{a}	7.37^{a}	0.82

^{a,b,c} Means with different superscripts within each parameter and each experiment are significantly differ ($P<0.05$).

It could be concluded that cottonseed inclusion in lactating buffaloes diet improved milk yield, fat percentage. In addition, rumen fermentation in the rumen had not been affected drastically by oilseed feeding. The relative low response to oilseed incorporation in dairy rations for buffaloes could be due to the low milk productivity. Higher response could be expected for high yielders or at early lactation than low producers or at the middle or late lactation.

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تأثير إضافة البذور الزيتية فى الغذاء على الاستفادة من الغذاء وإنتاج اللبن وتركيبه فى الجاموس الحلاب

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قســمت عشــرة جاموسات حلابة إلى مجموعتين متشابهتين، و أجريت على كل مجموعة منهما تجربة اســتمرت لمدة ١٤٤ يوما بطريقة عود إلى بدء بهدف دراسة تأثير احلال بذرة القطن والكانولا الكاملة محل ٢٥% أو ٥٠% من طاقة العليقة المركزة على إنتاج اللبن وتركيبه و تخمرات الكرش ونواتج تمثيل الدهون فــى بلازمــا الــدم. كانت العلائق التجريبية متساوية الطاقة والبروتين ولكنها مختلفة فى نسبة الدهن، حيث احتوت عليقة المقارنة على ٣,٤ % مستخلص أثير بينما احتوت العليقة الثانية على ٥ر٤ % مستخلص أثير فــى المتوســط (عليقة منخفضة الدهن) واحتوت العليقة الثالثة على ٣ر٦ % مستخلص أثير (عليقة عالية الدهن). وقد قورنت العليقتين المنخفضتين فى نسبة الدهن بعليقة المقارنة فى تجربة ، بينما قورنت العليقتين العاليتيــن فــى نسبة الدهن بعليقة المقارنة فى تجربة أخرى. حسبت الاحتياجات الغذائية لكل جاموسة فرديا علــى أســاس إنتاج اللبن المعدل ٤ % دهن و وزن الجسم، وتم مراجعة هذه الاحتياجات فى بداية كل فترة تجريبــية. أخــذت عينات اللبن والكرش والروث والدم خلال فترة الجمع و التى استمرت لمدة أسبوعين فى نهاية كل فتره تجريبية مدتها ٣٦ يوما.

انخفضــت معــاملات هضم جميع المركبات الغذائية معنويا فيما عدا مستخلص الأثير عند التغذية على علائــق تحتوى على بذور زيتية. كما زاد إنتاج اللبن الفعلى و المعدل ٤ % دهن خاصة عند التغذية على النســبة المــرتفعة مــن بذرة القطن. وبينما لم تتأثر نسبة دهن اللبن معنويا بالمستويات المنخفضة من دهن العلــيقة، فأنها زادت معنويا بحوالي ١٦ % فى الجاموس الذي غذى على علائق بها نسبة مرتفعة من بذرة القطن. و انخفضت نسبة بروتين اللبن انخفاضا خطيا بزيادة دهن العليقة، كما حدث انخفاض غير معنوي في كل من نسبة سكر اللاكتوز والجوامد اللادهنية دون تغير معنوى فى نسبة الجوامد الكلية.وقد لوحظ انخفاض نسبة نتروجين كازين اللبن معنويا بزيادة مستوى دهن العليقة، بينما زادت نسبة البروتين غير الحقيقى.

وبالنســبة لتخمرات الكرش، إتجهت درجة الحموضة بالكرش الى الانخفاض غير المعنوي بزيادة دهن العلــيقة، فــى حين لم تتأثر نسبة الأمونيا وتركيز الأحماض الكلية الطياره. انخفض التركيز النسبى لحمض الخلــيك والبــيوتريك و زاد التركــيز النسبى لحمض البروبيونيك زيادة غير معنوية فى كلا التجربتين. انخفضــت نسبة حمض الخليك /حمض البروبيونيك انخفاضا معنويا خاصة فى الحيوانات التى غذيت على دهن منخفض.

لوحظت زيادة فى تركيز الجلسريدات الثلاثية والكوليستيرول والليبوبروتينات منخفضة ومرتفعة الكثافة معــنوياً فى بلازما دم الحيوانات التى غذيت على نسبة مرتفعة من بذرة القطن، بينما انخفضت عند التغذية على بذور الكانولا بمستوييها.

يمكن استنتاج أن تغذية الجاموس الحلاب على بذرة القطن كاملة الدهن كاستبدال من العليقة على أساس الطاقة تحسن انتاج اللّبن و النّسبة المئويّة للدهن. مع عدم التأثير على وظائف الكرش. والسبب فى الإستجابة المنخفضة نسبيا فى انتاج اللبن قد ترجع الى الإنتاجيّة المنخفضة للجاموس. ويمكن توقع استجابة أعلى عند كإضافة الى العليقة وليس استبدال وفى الحيوانات عالية الإدرار أو فى فترة الحليب الأولى.