

Effect of Different Oil Seeds on Productive Performance and Unsaturated Fatty Acids Content of Buffalo's Milk*

1- Productive Performance of Lactating Buffaloes.

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Abstract:

Nine Egyptian dairy buffaloes in mid lactation period (from 8th to 26th week of lactation) were randomly assigned to one of three groups (three animals each) in a complete randomized design for 19 weeks, to determine the feeding value of experimental diets and performance of lactating buffaloes. Buffaloes were fed a total mixed ration (TMR) consisted of 40% roughage and 60% concentrate mixture (CM) on dry matter basis either without added fat (control) or with 10% of CM as crushed sunflower seeds (SS group), or 10% of CM as crushed canola seeds (CS group). Apparent digestibility of DM, OM, CP, CF and EE were increased (P<0.05) when sunflower or canola seeds were added, while NFE digestibility was not affected with treatments. Feed intake was the highest in the group fed crushed sunflower seed, followed by control group then that was

fed crushed canola. Body weight of buffaloes decreased by 22, 34 and 40 kg for those fed the control, sunflower and canola seeds diets, respectively. Milk yield and fat corrected milk were increased (P<0.05) when sunflower or canola seeds were added to the basal diet. Sunflower and canola seeds containing diets increased milk fat and total solids concentrations but did not affect milk protein, lactose, ash, and SNF concentrations. Feeding sunflower and canola seeds increased (P<0.05) triglycerides and total lipids in buffaloes blood plasma but had no effect on cholesterol, total protein, albumin and globulin. It could be concluded that, the performance of lactating buffaloes was improved when crushed sunflower or canola seeds was added to the diet at a level of 10% of the concentrate mixture.

Introduction

Oilseeds are a convenient source of both fat and protein to improve the energy balance of dairy cattle.

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The addition of fat supplements to dairy cattle diets generally is required to maintain high levels of milk production. However feeding high levels of supplemental fat to dairy cows (more than 8-9% of the total fat in the diet) can result in a depression in the concentration of fat and/or protein in milk due to its effect on dry matter intake and fiber digestion in the rumen (Jenkins, 1993, and Wu and Huber, 1994).

In fact, whole sunflower seeds are acceptable fat source for mid-lactating cows, as they result in similar milk yields when fed at a rate of 13 to 15% of the DM (Petit, 2003). Whole sunflower seeds can be fed to dairy cows as a fat supplement to the diet. The size of the seeds results in cows chewing and breaking down the product during digestion (Ahrar and Schingoethe, 1978). Feeding sunflower seeds in a mixed ration eliminates any issues of feed preference or palatability. Milk production was increased as much as 15 percent when sunflower seeds replaced barley, corn or oats as an energy source in the diet of early lactating cows (Rafalowski and Park, 1982). However, Boila *et al.*, (1993) did not found any effect due to fat supplementation in the form of whole sunflower seeds in the diets of lactating cows.

Processing (e.g. grinding) permits digestion of canola seeds, but the dietary inclusion level should be limited to avoid adverse effects on ruminal digestion (Kennelly *et al.*, 1987). Alt-

hough numerous authors have reported no effects of rapeseed or canola on milk fat composition (Kennelly, 1996, Kennelly and Glimm, 1998).

The aim of the present experiment was to determine nutrient digestibility, body weight change, feed intake, productive performance and concentration of some blood plasma metabolites for lactating buffaloes after supplementing the control diet with crushed oilseeds (sunflower or canola seeds).

Material and Methods

The present study was carried out at the animal production experimental farm, Department of Animal and poultry production, faculty of Agriculture, Al - Azhar University, from March to August 2007. Two different trials were carried out to determine the effect of different oil seeds addition to basal diet on digestibility of feed nutrients as well as productive performance and some physiological parameters.

Buffaloes and Treatments:

Nine Egyptian lactating buffaloes in mid-lactation were randomly assigned to one of three groups (3 animals each) in a complete randomized design for 19 weeks (from 8th to 26th week of lactation).

Preparation of Canola and Sunflower Seeds:

Canola and sunflower seeds were used after grinding through a 2-mm screen before mixing with other ingredients. The crushed canola and sunflower seeds are processed in a manners

identical to that described by Al-drich *et al.*, (1997).

Feeding Animals:

Buffaloes nutritional requirements were fulfilled through a diet consisted of 40% roughage and 60% concentrate mix (the control group¹). A 10% of the concentrate DM was replaced by either crushed sunflower seeds (SS group) or crushed canola seeds (CS group). Wheat straw (90%), Egyptian clover for the first 3 months then lucern till the

end of the study at a level (10%) were used as roughages during the experimental period.

Samples and Chemical Analyses:

Representative samples of diets were analyzed for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash according to AOAC (1990). Diets composition and chemical analyses are shown in Table (1)

Table (1) Ingredients and chemical composition the experimental diets fed to lactating buffaloes.

| Item/ Ingredients (kg)* | Diets* | | |
|---------------------------------------------------------|---------|-----------|--------|
| | Control | Sunflower | Canola |
| Concentrate Mix ¹ . | 57 | 47 | 47 |
| Wheat straw | 30 | 30 | 30 |
| Egyptian clover/lucern | 10 | 10 | 10 |
| Whole crushed sunflower seed | - | 10 | - |
| Whole crushed canola seed | - | - | 10 |
| Limestone | 2 | 2 | 2 |
| Na cl | 1 | 1 | 1 |
| Total | 100 | 100 | 100 |
| TDN | 63.33 | 70.40 | 76.10 |
| Chemical composition of experimental diets (%)** | | | |
| Dry matter | 88.80 | 89.50 | 89.80 |
| Organic matter | 79.40 | 80.10 | 81.00 |
| Crude protein | 15.10 | 18.75 | 17.92 |
| Ether extract | 5.40 | 6.30 | 10.70 |
| Crude fiber | 18.50 | 21.42 | 20.82 |
| NFE | 40.40 | 33.60 | 31.60 |
| Ash | 9.40 | 9.40 | 08.80 |

¹ Consisted of ground corn , ground cotton seed cake, wheat bran, limestone and molasses.

*Diets were; control = basal diet to satisfy nutrient requirements of the buffaloes with no supplemental fat, sunflower basal diet supplemented with 10% crushed sunflower seeds, and canola basal diet supplemented with 10% crushed canola seeds.

** Nutritional composition was calculated on dry matter basis.

Digestibility Trail:

Digestibility trails were carried out on the same lactating buffaloes by using acid insoluble ash (AIA) technique as an internal marker (Van Keulen and Young, 1977).

Body Weight:

Buffaloes body weight was recorded at the start of the trial, then they were weighed biweekly until the end of the experimental period.

Feed Intake:

The average daily feed intake (FI) was recorded throughout the experimental period. Buffaloes was offered feeding twice daily at 7 (a.m) and 4 (p.m).

Milk yield and milk composition:

Buffaloes were milked twice daily at 6 a.m and 6 p.m. Milk yield was recorded daily along the whole period experiment. Milk samples (10% of milk yield) were obtained weekly from each buffalo for two consecutive milking on Sunday (p.m) and Monday (a.m) of each week. Fat corrected milk (FCM) was calculated according to Headley (1939) where: $FCM=0.4 \times \text{milk yield} + 15 \times \text{fat yield}$. A 100 ml milk sample, from each animal every week was taken for milk composition analyses.

Crude protein (N x 6.38), total solids and ash were determined according to the methods of AOAC, (1990). Fat was determined using Gerber unites (Ling, 1963). The fat percentage

was subtracted from total solids to determine SNF. Lactose was determined according to Barnett and Adel Tawab, (1957).

Blood Samples:

Blood samples were taken from the jugular vein, once every 2 weeks, after feed was offered at 9 a.m. Samples were collected in regular heparin-containing tubes. Blood samples were centrifuged within 30 min at 3000 x g for 15 minute and plasma was decanted into plastic vials and aliquots of plasma were stored at -20°C until analyzed. Total protein, albumin, total lipids, triglycerides, cholesterol, HDL and LDL were determined by kits of (spectrum company). Globulin concentration calculated by subtracting the concentration of albumin from total protein. Concentration of LDL cholesterol was calculated as the difference between total cholesterol – triglycerides / 5-HDL concentrations

Statistical Analysis:

The achieved data were screened for outliers which could cause misleading results. Because data of some tested traits were in percentages, therefore, the percentages values were subjected to arcsine transformation prior to statistical analysis's.

Data were analyzed using General Linear Model (GLM) procedure of SAS (SAS, 1998) according to the following model $Y_{ij} = \mu + T_i + E_{ij}$.

Where:

μ = The overall-mean.

T_i = The effect of treatment.

E_{ij} = The random error.

Duncan's multiple range test was used to detect significant differences among treatments (Steel and Torrie, 1980).

Results and Discussion

Body weight (BW) and Feed intake (FI):

Data of BW and FI are presented in Table (2) and Fig. (1 and 2), Buffaloes average body weight during the experimental period decreased by 22 , 34 and 40 kg for those fed the control, sunflower and canola seeds diets, respectively. Some researchers (Palmquist and Jenkins, 1980) suggested that addition of fat to high fiber diets might limit weight gain in early to mid lactation. However, Markus *et al.* (1996) reported that the performance of cows fed whole sunflower seeds as a source of energy appeared to be similar to that of cows fed traditional high energy diets based on barley. Feed intake was highest for the sunflower seeds diet followed by the control diet and then canola seeds diet. In contrast, Finn *et al.* (1985) noticed that the dry matter intake was lowest ($P < 0.05$) for cows fed sunflower seeds. Processing of sunflower seeds or canola seeds by grinding, rolling, or crushing may reduce acceptability Aldrich *et al.* (1997).

Effect of dietary fat on digestion coefficients:

Data of nutrients digestibilities are shown in Table (2) and Fig. (3). Dry matter (DMD), organic matter digestibility (OMD),

crud protein digestibility (CPD), crud fiber digestibility (CFD), and ether extract digestibility (EED) values were numerically increased in animals fed supplemented fat diets than in those fed control diet. The significant increases ($P > 0.05$) s in digestibility due to treatments were 6.8 & 6.8 ; 6.3 & 6.7; 9.5 & 5.1; 22.6 & 20.9 ; 3.4 & 5.0 percentages for SS & CS treatments compared with the control, respectively.

Dry matter digestibility tends to increase by oil seeds addition. Similar results were obtained by Doreau *et al.* (1993) and Khorasani and Kennelly (1998) in dairy cows. Other authors found no significant effect on dry matter digestibility of added fat to lactating cows diets (Shauff and Clark, 1992).

Apparent increase of total EE digestibility of fat supplemented diets were recorded by El-Bedawy (1989). Similarly, other investigators (Palmquist and Conrad, 1980 and Elliott *et al.* 1995) reported that ether extract digestibility was always higher in all fat supplemented diets and lower in conventional ones. In contrast, Zinn and Plascecia (2002) found that ether extract digestibility decrease due to the increase in fecal ether extract with supplementation of 14% whole sunflower seeds.

Results in Table (2) and Fig (3) indicated that NFE digestibility did not significantly affected by treatments. The differences between types of fat were statis-

tically not significant. This trend was also noticed with fat addition by Sundstøl (1974), as well as with soy oil by Abel and Scholtz (1985). Lower NEF digestibility due to fat supplementation was

recorded by Shahin (1993). However, the NFE digestibility in this experiment was nearly the same (83.3, 82.3 and 82.2) for the three tested treatment respectively (Table 2).

Table (2): Body weight, feed intake and apparent digestion coefficients of or/ used diets.

| Traits \ Group | Control | Control + 10% Sunflower seed | Control + 10% canola seed |
|------------------------------|---------------------------|------------------------------|---------------------------|
| Initial BW (kg)* | 468.0 ± 11.7 ^b | 483.2 ± 9.6 ^a | 443.7 ± 15.2 ^a |
| Final BW (kg)* | 446.4 ± 11.7 ^b | 449.2 ± 9.6 ^b | 403.7 ± 15.2 ^a |
| Average decrease in BW (kg)* | -21.6 | -34.0 | -40.0 |
| FI (kg) | 9.2 ± 0.02 ^b | 9.3 ± 0.02 ^a | 8.5 ± 0.02 ^c |
| DMD (%) | 68.8 ± 0.8 ^b | 75.6 ± 0.8 ^a | 75.6 ± 0.8 ^a |
| OMD (%) | 72.1 ± 0.8 ^b | 78.4 ± 0.8 ^a | 78.8 ± 0.8 ^a |
| CPD (%) | 74.2 ± 0.7 ^c | 83.7 ± 0.7 ^a | 79.3 ± 0.7 ^b |
| CFD (%) | 40.2 ± 2.7 ^b | 62.8 ± 2.7 ^a | 61.1 ± 2.7 ^a |
| EED (%) | 91.6 ± 0.7 ^b | 95.0 ± 0.7 ^a | 96.6 ± 0.7 ^a |
| NFED (%) | 83.3 ± 0.7 | 82.3 ± 0.7 | 82.2 ± 0.7 |

*Through the experimental period.

Means having the same superscripts in the same row are not significantly different at (P<0.05).

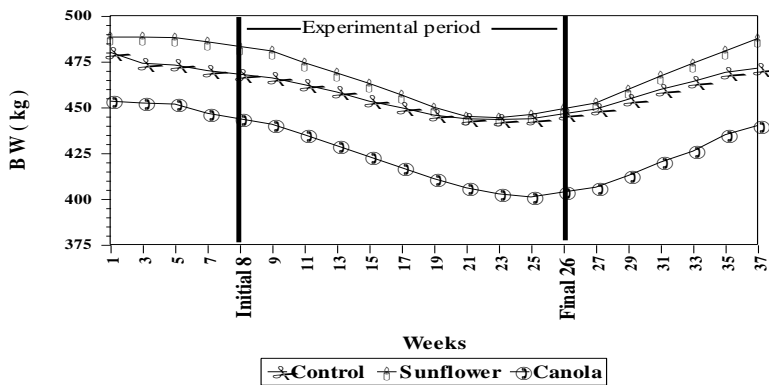


Fig. 1. Change in Body weight during the mid lactation for buffaloes fed diet with different of oil seeds (sunflower seed 10% and canola seed 10%).

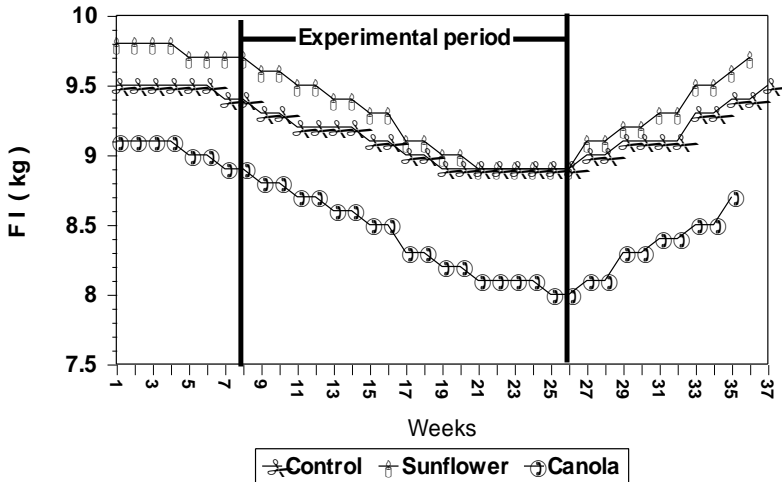


Fig. 2. Feed Intake of buffaloes in mid lactation (8 to 26 weeks) for buffalo's fed diet with different of oil seeds (sunflower seed 10% and canola seed 10%).

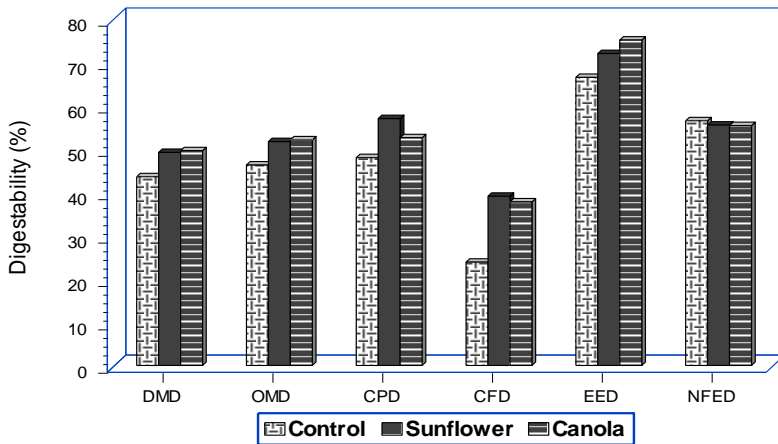


Fig. 3. Apparent digestibility coefficients for diets supplemented with crushed sunflower and canola seeds.

Milk yield and milk composition:

Milk yield tended to be higher for buffaloes fed diet with crushed canola seeds than for those fed either the control diet

or crushed sunflower seeds. Fat corrected milk (FCM) of buffaloes fed crushed sunflower and canola seeds diets were higher by 2.4, 2.5 kg /day/animal. The difference was significant ($p < 0.05$)

when compared with those fed control diet. Petit (2002) suggested that greater fat mobilization may contribute to the increased milk yield of buffaloes fed whole sunflower and canola seeds.

The data of Protein and fat concentrations in milk are presented in Table (3) and Fig. (4). The whole crushed sunflower and canola seeds diets gave similar results in milk protein but milk fat concentration was significantly ($p < 0.05$) lower in canola seeds diet. Our results on milk protein percentage are consistent with data from the literature indicating that fat supplemented diets tend to maintain percentage of milk protein (Ruegsegger and Schultz, 1985) and to reduce the percentage of milk fat (Aldrich et al., 1997 and Christensen et al., 1994). However Garcia- Bojalil et al. (1998) reported that Milk protein concentrations was significantly reduced by feeding 10% canola seeds compared with the control diet.

On average, milk protein percentage were high for all treatments, perhaps because buffaloes carrying the β genetic variant for α -casein. Other research (Palmquist and Jenkins, 1980) suggested that reduced insulin secretion or action, limiting uptake of amino acids by the memory gland. The effect of feeding a fat – supplemented diet on milk protein percentage has been attributed to changes in the casein fraction (Dunkley et al. 1977).

Davis and Brown (1970) indicated that decreased milk fat production may be related to lower ratio of rumen acetate/propionate or feeding of polyunsaturated oil. Unsaturated fatty acids contained about 66 and 90% in SS and CS (Schingoethe et al., 1996). Therefore, fat depressing effects of dietary oil may have been compensated partially by the relatively high fiber content in these high sunflower seeds diets.

Some researches have reported that cows fed fat supplemented diets have decreased milk protein percentages (DePeters and Cant, 1992, Christensen et al., 1994). While others reported that milk fat and milk protein percentages were unaffected when cows were fed either unground or ground canola at levels of 8.3 or 15.6 % of the diet DM (Murphy et al., 1990).

Total solids content of milk was low ($P < 0.01$) for buffaloes fed rolled canola seeds.. Similar results were observed by Rafalowski and Park (1982). They noted depression of total solids in milk from cows receiving 20 and 30% sunflower seeds concentrates and attributed the decrease concentration of TS to depression in lactose synthesis. Decreased milk lactose also was observed by Macleod et al. (1977), possibly from a shortage of glucose precursors in high fat containing diets.

Concentration of lactose in milk was similar among treatments as previously reported by

Petit (2003) for mid lactating flower seeds and whole crushed buffaloes fed whole crushed sun- canola seed.

Table (3): Milk yield and composition of buffaloes fed diets containing different oil seeds through mid lactation periods.

| Group | Control | Control + 10% Sunflower seed | Control + 10% canola seed |
|------------------|--------------------------|------------------------------|---------------------------|
| Milk yield (kg) | 4.5 ± 0.15 ^b | 7.0 ± 0.15 ^a | 7.2 ± 0.15 ^a |
| FCM (kg)* | 6.8 ± 0.11 ^b | 9.2 ± 0.16 ^a | 9.3 ± 0.08 ^a |
| Fat (%) | 6.4 ± 0.11 ^a | 6.2 ± 0.11 ^a | 5.9 ± 0.11 ^b |
| Protein (%) | 5.4 ± 0.07 | 5.4 ± 0.07 | 5.3 ± 0.07 |
| Lactose (%) | 4.1 ± 0.12 | 4.2 ± 0.12 | 4.1 ± 0.12 |
| Total solids (%) | 15.5 ± 0.17 ^a | 15.2 ± 0.17 ^{ab} | 14.9 ± 0.17 ^b |
| Ash (%) | 0.7 ± 0.16 | 0.7 ± 0.16 | 0.7 ± 0.16 |
| SNF (%) | 9.1 ± 0.14 | 9.0 ± 0.14 | 9.0 ± 0.14 |

* FCM=0.4 x milk yield + 15 x fat yield

Means having the same superscripts in the same row are not significantly different at (P<0.05).

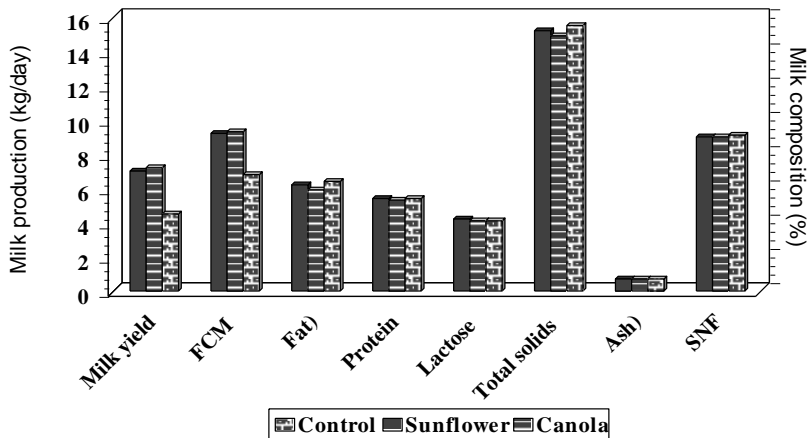


Fig. 4. Milk yield and milk composition of buffaloes fed with (sunflower seed 10% and canola 10% seed) through in mid lactation (8 to 26 weeks).

**Blood plasma constituents:
Total protein, Albumin and
Globulin:**

Data concerning plasma total protein concentration of the different experimental groups are presented in Table (4) and Fig. (5). Animals received sunflower seeds and canola seeds diets had higher ($P>0.05$) plasma total protein and globulin concentrations than those fed control diet. However, albumin concentration was not ($P>0.05$) affected by treatments.

The present results disagree with those found by Rafalowski and Park (1982) who reported that the total serum protein decreased for animals fed sunflower seed diets, but it agree with Puppione (1978) results, who reported that cows in early lactation maintained elevated concentration of alpha lipoproteins that comprise 30 to 55% of protein moiety.

Plasma Total Lipids and Triglycerides:

Results in Table (4) and Fig. (6). indicated that all supplemented fat groups had higher ($P<0.05$) values of plasma total lipids and triglycerides than that of the control. It is shown also that total lipids values were higher for canola seeds diet than for the sunflower seeds diet but the difference was not significant. Our results are in agreement with that of Jenkins (1990) and Lough *et al.* (1991), who indicated that fat supplementation significantly elevate the plasma lipid and triglycerides levels of ruminants. The same results were found by Palmquist and Conrad (1978). Also, Park and Ra-

falowski (1983) stated that serum triglycerides concentrations of blood serum were higher for heifers fed sunflower seed diets than control. They suggested that the linear increase in serum triglycerides with fat supplementation may represent a greater transfer of dietary lipid into blood..

The increase in total lipids of plasma which contain high triglycerides due to feeding sunflower seed and canola seeds diets in the present study may be attributed to the greater quantity of fatty acids intake and absorbed from fat supplemented diets than from control diet. Garton (1965) reported that feeding fat is associated with depression in lipogenic enzyme activities by liver and adipose tissues (Steele, 1980).

Plasma cholesterol, HDL and LDL:

Effect of dietary fat on plasma cholesterol are presented in Table (4) and Fig (6). Results generally indicated that all fat supplemented diets showed higher ($P>0.05$) values of plasma cholesterol than that of control. Finn *et al.*, (1985) found that total serum cholesterol was increased by feeding sunflower seeds diets. The higher plasma cholesterol for feeding sunflower seeds and canola seeds diets may be due to that feeding dietary poly-unsaturated long chain fatty acids increased cholesterol synthesis in comparison with feeding saturated long chain fatty acid (Dinius *et al.*,1974). Unsaturated

fatty acids contained about 66 and 90% in SS and CS (Schingoethe *et al.*, 1996). This agree with earlier reports on the hypercholesterolemia effects of feeding large amounts of polyunsaturated fat in ruminant diets (Wrenn *et al.*, 1976).

Effect of dietary fat on plasma cholesterol-HDL and cholesterol-LDL are presented in Table (4) and Fig. (6). Results indicate that sunflower seeds and canola

seeds diets supplemented treatments showed a high values of plasma cholesterol-HDL and cholesterol-LDL than that of control. Differences among treatments were not significant ($P>0.05$). The present results are in agreement with those found by Garcia- Bojalil *et al.* (1998) who reported that the type of dietary fatty acids alter its effect on plasma HDL and LDL cholesterol concentrations..

Table (4): Effect of sunflower and canola seeds supplementation on concentration of certain plasma constituents.

| Traits \ Groups | Control | Sunflower | Canola |
|---------------------------------|---------------------------|----------------------------|---------------------------|
| Total protein (g/dl) | 7.1 ± 0.13 ^b | 7.6 ± 0.13 ^a | 7.5 ± 0.13 ^a |
| Albumin (g/dl) | 3.5 ± 0.1 | 3.4 ± 0.1 | 3.5 ± 0.1 |
| Globulin (g/dl) | 3.6 ± 0.2 ^b | 4.2 ± 0.2 ^a | 4.0 ± 0.2 ^{ab} |
| Total Lipids (mg/dl) | 362.1 ± 26.1 ^b | 403.9 ± 26.1 ^{ab} | 459.8 ± 26.1 ^a |
| Triglyceride (mg/dl) | 34.2 ± 3.3 ^b | 44.4 ± 3.3 ^a | 44.9 ± 3.3 ^a |
| Cholesterol (mg/dl) | 111.7 ± 6.2 | 126.1 ± 6.2 | 128.8 ± 6.2 |
| HDL- cholesterol (mg/dl) | 32.9 ± 2.8 | 37.3 ± 2.8 | 39.3 ± 2.8 |
| LDL- cholesterol (mg/dl) | 71.9 ± 5.1 | 80.0 ± 5.1 | 80.5 ± 5.1 |

Means having the same superscripts in the same row are not significantly different at ($P<0.05$).

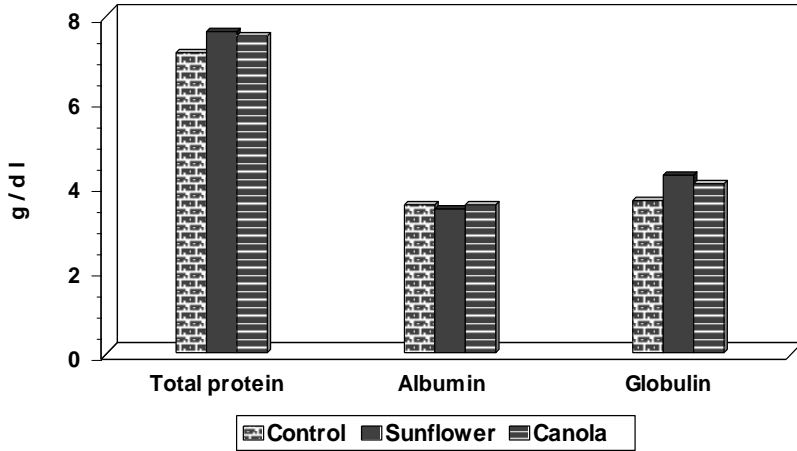


Fig. 5. Change in plasma Total protein, albumin, and globulin of buffaloes fed diet with different of oil seeds (sunflower seed 10% and canola seed 10%).

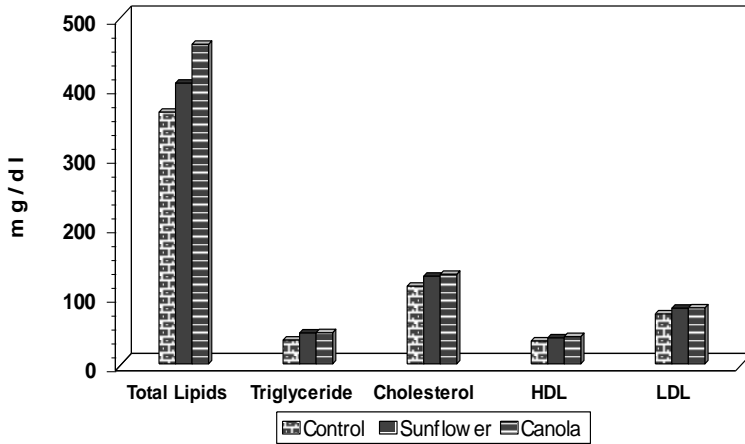


Fig. 6. Change in plasma Total lipids, triglysrde, choledterol, HDL, and LDL of buffaloes fed diet with different of oil seeds (sunflower seed 10% and canola seed 10%).

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تأثير البذور الزيتية المختلفة على الأداء الانتاجي ومحتوى دهن اللبن الجاموسى من الأحماض الدهنية غير المشبعة 1- الأداء الانتاجي للجاموس الحلاب

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أجريت هذه الدراسة على عدد 9 من الجاموس المصرى الحلاب فى وسط موسم الحليب من (8-26 أسبوع) تم توزيعها على ثلاث مجموعات (3 حيوانات بكل مجموعة) فى نظام تام العشوائية ولمدة 19 أسبوع لتحديد القيمة الغذائية للعلائق التجريبية والأداء الانتاجي للحيوانات. تمت تغذية الجاموس على عليقة مكونة من 40% مادة خشنة و 60% مادة مركزة على أساس المادة الجافة بدون إضافة أى زيوت للمجموعة الكنترول. وفى المجموعة الثانية تم إضافة 10% من مجروش بذرة عباد الشمس الكاملة أما المجموعة الثالثة فتم استخدام 10% من مجروش بذرة الكانولا الكاملة.

كانت الزيادة فى مجموعتى المعاملة فى معاملات هضم المادة الجافة والعضوية ، البروتين الكلى ومستخلص الاثير معنوية ($P>0.5$) بينما لم تتأثر قيمة الكربوهيدرات الذائبة. كانت كمية الغذاء المأكول يوميا أعلى فى المجموعة التى غذيت على مجروش بذرة عباد الشمس وتليها مجموعة الكنترول ثم المجموعة التى تمت تغذيتها على مجروش بذرة الكانولا. بينما كان معدل النقص فى وزن جسم الجاموس 22، 34 ثم 40 كجم فى كل من مجموعة الكنترول وبذرة عباد الشمس وبذرة الكانولا) على التوالى. زيادة إنتاج اللبن واللبن معدل الدهن معنويا عند إضافة بذرة عباد الشمس أو الكانولا فى العليقة الأساسية. أدى إضافة مجروش كل من بذرة عباد الشمس والكانولا كمصدر للدهن فى كل من المجموعتين الثانية والثالثة أدى الى نقص نسبة دهن اللبن والمواد الصلبة الكلية. بينما كانت الفروق غير معنوية بالنسبة لبروتين اللبن والرماد والمواد الصلبة الخالية من الدهون واللاكتوز. لم يكن لإضافة أى من مجروش بذرة عباد الشمس أو الكانولا أى أثر معنوي على قيم كلسترول مصل الدم بينما وجدت فروق معنوية فى كل من الجليسيريدات الثلاثية والدهون الكلية فى مصل الدم بالمجاميع التى غذيت على مجروش بذرة عباد الشمس والكانولا عن مجموعة الكنترول. تظهر الدراسة تحسن الأداء الانتاجي للجاموس عند إضافة بذور عباد الشمس أو الكانولا المجروشة للعليقة بنسبة 10% الى مخلوط العليقة المركزة.

الكلمات التصنيفية: الجاموس- الهضم - إنتاج ومكونات اللبن- مجروش بذرة عباد الشمس والكانولا.