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INFLUENCE OF SOURCE AND LEVEL OF DIETARY OIL SEEDS ON THE PERFORMANCE OF LACTATING GOATS.

El-Shabrawy, H. M.
Animal nutrition Dept. Animal Prod. Res. Instit., Agric. Res. Centre, Ministry., of, Agric., Dokki, Giza, Egypt.

ABSTRACT

Thirty lactating Zaraibi goats in mid lactation were randomly assigned into five groups, six in each to evaluate two different sources and levels of canola or sunflower seeds. Five experimental diets were formulated to study their effects on digestion coefficients, some rumen parameter, some blood constituents and milk production and its components. The first group received a diet with no supplemented oil seeds (control), 2nd received a diet containing 5% canola seeds (LCS), 3rd received a diet containing 10% canola seeds(HCS), 4th received a diet containing 7% sunflower seeds (LSFS) and 5th received a diet containing 14% sunflower seeds(HSFS).

The obtained results indicated that digestibility coefficients of DM, OM and EE and the nutritive value in terms of TDN% were increased but CF digestibility coefficient were decreased by using canola and sunflower seeds in diets. The differences among all the experimental diets in the digestibility coefficients of CP and NFE and the nutritive value in term of DCP% were not significant. The digestibility coefficients of DM and OM were similar among the tested diets containing canola and sunflower seeds. On the other hand, digestibility coefficients of EE ~~were~~ increased and but that of CF decreased as the level of canola or sunflower seeds were increased in the diet.

No significant differences were noticed with respect to ruminal pH values among the tested diets. The concentrations of ruminal total volatile fatty acids (VFA's), acetic acid and the ratio of acetate to propionate were increased, but NH_3-N, propionic acid and butyric acid were decreased for goats fed canola or sunflower diets than those fed the control diet. The improvements in rumen parameters for goats fed high canola seeds were more than the other tested diets.

No significant differences were noticed in plasma urea nitrogen, albumin and globulin concentrations among the tested diets. The highest values of plasma total protein were recorded with diet contained high canola seeds and the lowest value was recorded with the control diet.

Yields of milk, 4% fat corrected milk (4% FCM) and its components were improved ((P<0.05) when goats were fed diets contained canola or sunflower seeds than those fed the control diet. The improvements were more pronounced as the levels of canola or sunflower seeds were increased in the diet.

Within the milk fat, the concentration of saturated fatty acids (FA) was reduced and unsaturated FA was increased in response to dietary oil seeds. The concentrations of saturated FA were decreased, but unsaturated FA was increased as the level of canola or sunflower seeds were increased in the diet.

Feed cost per one kg 4% FCM decreased by 11.61%, 10.97%, 9.03% and 8.39% for goats fed HCS, HSFS, LCS and LSFS, respectively. Accordingly, economic efficiency value was the ~~highest~~ best with HCS diet followed by HSFS diet and then LCS and LSFS diets.

Keywords: Canola seeds, sunflower seeds, dairy goats.

INTRODUCTION

Egyptian Zaraibi goats are considered to be of high genetic potentiality as a dairy and prolific goat breed in comparison with other prevailing breeds in Egypt (Aboul-Naga *et al.,* 1993). Mousa (1996) reported that Egyptian Zaraibi goats produced higher milk yield (400.4 kg during 244.7 days lactation period) than the milk yield observed for most breeds in tropical and sub-tropical areas. It has become more difficult to meet the energy needs of lactating goats because of the improvement in their genetic potential to produce milk. Feeding oil seeds to high producing dairy animals may increase energy intake because of its high energy density. The whole oil seeds were used as a source of energy (Palmquist and Jenkein, 1980), as well as a source of protein. They contain high oil (40-60%) and high protein (about 20%).

Many sources of oil seeds are used as supplements in concentrate feed mixtures for lactating and growing animals. Among those, canola and sunflower seeds are characterized by high levels of lipids and proteins. Whole canola seed contains high levels of lipid (approximately 55%), of which over 85% is 18-carbon fatty acids; 18:1 is the predominant fatty acid (> 60% of total fatty acids; Ackman, 1990). Whole canola and sunflower seeds contain approximately 34 and 22% lipids, respectively~~, ~~ as reported by El-Kholy *et al.* (2005) and El-Shafie and El-Ashmawy (2010).

Several researchers reported that lactating animals fed oil seeds supplemented diets have increased milk yield (Johnson *et al.,* 2002; Bernared *et al.,* 2009 and El-Shafie and El-Ashmawy 2010). Feeding oil seeds to lactating dairy cows is one method to change the proportion of unsaturated fatty acids in milk fat, with increase a high as 40% (Aldrich *et al.,* 1997; Johnson *et al.,* 2002; Abo-Donia *et al.,* 2003; Petit, 2004 and Jacobs *et al.,* 2011), although extensive biohydrogenation occurs normally in the rumen (Palmquist and Jenkins, 1980). Sunflower seeds increase the proportion of unsaturated fatty acids in milk compared to cows fed no supplemental fat (Petit, 2003).

Canola oil is high (61%) in the monounsaturated fatty acids~~-~~, oleic acid (C18:1). However, canola oil has a much lower level of the saturated fatty acid, palmitic acid (7%). Canola oil contains a moderate level (22%) of the polyunsaturated omega 6 fatty acid~~-~~, linoleic acid (C18:2), and appreciable amount (11%) of the polyunsaturated omega 3 fatty acid, alpha-linolenic acid (C18:3). Sunflower oil is rich in polyunsaturated omega 6 fatty acid, linolenic acid (C18:2, 66% of total fatty acids).

Data from several experiments that evaluated supplementation of oil seeds to diets for lactating animals have shown no major deleterious effect on ruminal fermentation (Chichlowski *et al.,* 2005) or total tract nutrient digestibilities (Petit, 2004 and E~~L~~l–Shafie and E~~l~~l-Ashmawy, 2010) or protein utilization (Petit, 2004). However, data are not available to determine the optimal or maximal amount of oil seeds to incorporate in diets fed to lactating goats producing large amount of milk. Therefore, the objective of this study was to investigate the effects of source and level of oil seeds canola or sunflower seeds in the diets of goats on nutrient digestibilities, some rumen fermentation characteristics, blood constituents and their reflection on milk yield and its component. Milk fatty acids profile and economic efficiency were also studied.

MATERIALS AND METHODS

The current investigation was carried out at EL-Serw Experimental Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

Thirty lactating Zaraibi goats (after weaning period) were balanced for body weight, milk yield, days after calving and parity. The animals were divided into five groups (6 does each) and received one of five experimental diets (Table, 1). Diets were formulated to contain (% of DM) 40% berseem hay and 60% concentrate feed mixture (-control, diet 1), low canola seeds (LCS; 5% of CFM as DM, diet 2), high canola seeds (HCS; 10% of CFM as DM, diet 3), -low sunflower seeds (LSFS; 7% of CFM as DM, diet 4) and high sunflower seeds (HSFS; 14% of CFM as DM, diet 5). The CFM consisted of 22% yellow maize, 26% wheat bran, 32% undecorticated cotton seed cake, 5% linseed meal, 9% rice bran, 3% molasses, 2% limestone and 1% sodium chloride.

Canola seeds (*Brassica mopus*), variety Serw 4 used in this study are characteried by free erucic acid in oil, low glocosinolate in the seeds. They are produced in EL-Serw Agriculture Research Station, oil crops section, Agricultural Research Center, Ministry of Agriculture, Egypt.Regsterd)

Animals of each group were housed in stalls (-6x4 m) and fed in groups. Fresh and clean drinking water was available all times. The experimental started after weaning and began after 10 days of adaptation to the tested diets and lasted for 12 weeks. The experimental diets were formulated and offered to the experimental animals in quantities to cover their requirements according to NRC (1989) recommendations.

Daily amounts of feed were readjusted every two weeks based on the average milk production and body weight changes. The berseem hay and concentrate were offered two times daily.

Table (1): Formulation of the experimental diets (% of DM).

Ingredients	Experimental diets*				
	Control (diet1)	LCS (diet2)	HCS (diet3)	LSFS (diet4)	HSFS (diet5)
Berseem hay, BH	40	40	40	40	40
Concentrate feed mixture, -CFM	60	55	50	53	46
Canola seeds, CS	-	5	10	-	-
Sunflower seeds, SFS	-	-	-	7	14

*** LCS, low canola seeds-, 5%-;HCS-, high canola seeds-, 10%-; LSFS-, low sunflower seeds , 7%-; HSFS-, high sunflower seeds-, 14%.**

Samples of the five tested diets (Table 2) were analyzed for dry matter, ash, crude fiber, crude protein and ether extract according to AOAC (1990).

Table (2): Chemical composition of the ~~tested~~ ingredients and the experimental diets.

Ingredients	DM(%)	Chemical composition on DM basis (%)					
		OM	CP	EE	CF	NFE	Ash
BH	88.20	89.30	12.52	2.15	27.80	46.83	10.70
CFM	90.40	91.80	16.30	2.75	12.45	60.30	8.20
CS	90.60	94.60	15.60	38.20	12.40	28.40	5.40
SFS	90.52	93.40	16.25	27.60	18.20	31.35	6.60
Calculated chemical composition of the tested diets(%)							
Control	89.52	90.80	14.79	2.51	18.59	54.91	9.20
LCS	89.53	90.94	14.75	4.28	18.59	53.31	9.06
HCS	89.54	91.08	14.72	6.05	18.58	51.73	8.92
LSFS	89.53	90.91	14.79	4.25	18.99	52.88	9.09
HSFS	89.53	91.03	14.78	5.98	19.40	50.87	8.97

Animals were hand milked twice daily at 5.00 a.m and 5.00 p.m and milk yield of individual animals was recorded at each milking. Milk was sampled biweekly from two consecutive milkings and composited according to milk yield. Composite milk samples were analyzed for contents of total solids (TS), ash, fat and protein.

Total solids in milk were determined by drying at 105°C for 4 hours to a constant weight, milk fat was analyzed following the Gerber method (British Standard Institution's Method, 1955) and protein was analyzed using the Kjeldahl method (N x 6.38). Lactose was determined by difference after ashing in a muffle furnace (Model RHF, 1200, England) at 750°C for 4 hours. Solids-not fat (SNF) were calculated as the difference between TS and fat.

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Methyl esters of fatty acids of milk lipids were analyzed according to the method described by Chouinard *et al.* (1997).

Diggestibility trials were carried out at the end of the feeding experiment using 3 random animals from each group to determine the digestion coefficients and nutritive values of the tested diets which used in the feeding trial. Fecal samples were gripped from the rectum of each animal twice daily during the collection period (5 days). Acid insoluble ash (AIA) was used as a natural marker (Van Keulen and Young, 1977).

At the end of digestibility trial, rumen fluid samples were taken from three animals in each group just before offering morning meal-,2, 4, 6 and 8 hours post-feeding using stomach tube. Rumen-fluid pH was immediately measured on a fresh aliquot using battery operated pH meter (Orion Research, model 201 digital pH meter) and then samples were filtered through two layers of surgical gauze. Total volatile fatty acids (VFA's) concentrations were estimated using steam distillation method (Warner, 1964). Ammonia-N (NH_3-N) concentration was assayed according to Conway and O'Mally (1957). Molar proportions of VFA's were determined according to Erwin *et al.* (1961).

During the last week of the experimental period, blood samples were collected in heparinized test tubes from the jugular vein from three animals of each group before morning feeding, 2 and 4 hours post-feeding. Blood samples were centrifuged immediately at 3500 revolution per minute (rpm) for 15 minutes to separate blood plasma and stored at -20°C until further analysis. Blood plasma was analyzed for urea-N (Patton and Crouch, 1977), total protein (Peters, 1968), and albumin (Webster, 1974). Globulin concentration was calculated by difference (total protein-albumin).

Data were subjected to statistical analysis by the computer program of SAS (1996) using the General Linear Model (GLM).

The data of digestibility coefficients and milk yield and its components were subjected to one-way analysis variance for examining the effects of treatments (diet 1, diet 2, diet 3, diet 4 and diet 5), according to the following model:

$$Y_{ij} = \mu + Ai + e_{ij}$$

Where: y_{ij} = observed traits, μ = overall mean, A_i = experimental diets 1-5 (1=diet 1, 2 = diet 2-, 3 = diet 3-, 4 = diet 4 and 5 = diet 5)-, e_{ij} = random error.

The data of blood metabolites and rumen individual volatile fatly acids were subjected to analysis of variance for examining of effects of treatments (diet 1, diet2-, diet3-, diet 4 and diet 5) and time of sampling (0 and 4 hours) and their interaction according to the following model:

$$Y_{ijk} = \mu + A_i + T_j + AT_{ij} + e_{ijk}$$

Where: y_{ijk} = observed traits, μ = overall mean, A_i = experimental diets 1-5 (1=diet 1, 2 = diet 2, 3 = diet 3, 4 = diet 4 and 5 = diet 5)-, T_j = Time of sampling, AT_{ij} = interaction experimental diets x time of sampling, e_{ijk} = random error.

The data of rumen liquor was subjected to analysis of variance for examining of effects of treatments (diet 1, diet 2, diet 3, diet 4 and diet 5) and time of sampling (0, 2, 4, 6 and 8 hours) and their interaction according to the following model:

$$Y_{ijk} = \mu + A_i + T_j + AT_{ij} + e_{ijk}$$

Where: y_{ijk} = observed traits, μ = overall mean, A_i = experimental diets 1-5 (1=diet 1, 2 = diet 2, 3 = diet 3, 4 = diet 4 and 5 = diet 5), T_j = Time of sampling, AT_{ij} = interaction experimental diets x time of sampling, e_{ijk} = random error.

Means were compared according to Duncan's Multiple range test at 0.05 level (Duncan, 1955). It was found that the interactions were not significant, the main effects will by only presented in the results and discussion.

RESULTS AND DISCUSSION

Experimental diets:

The results presented in Table (2) show that the chemical analysis of the different ingredients used in this study were within the normal range of similar materials as discussed and reviewed previously by (EL-Kholy *et al.,* 2005, EL-Shabrawy and EL-Fadaly 2006 and EL-Shafie and El-Ashmawy, 2010). The calculated chemical composition of the tested formulated diets using these ingredients seemed to be similar in all nutrients, except for EE and NFE. The EE was higher in diets 2, 3, 4 and 5 compared with diet 1 (control) and this could be attributed to its variable content in both CS

(38.20%) and SFS (27.60%). While, the NFE was lower in diets 2, 3, 4 and 5 compared to diet 1 and its variable content in both CS (28.40%) and SFS (31.35). The control diet (diet 1) composed of BH and CFM (Table, 1) contained only 2.51% fat (Table, 2). The medium fat diets contained 4.28 and 4.25% fat in diets 2 and 4, respectively which the high fat diets contained 6.05 and 5.98% fat in diets 3 and 5, respectively.

Digestibility coefficients and nutritive values:

The nutrients digestibility coefficients and nutritive values of the experimental diets are presented in Table (3). Supplementation of full fat CS and SFS had significant (P<0.05) effect in increasing DM, OM and EE digestibilities. However, they decreased the digestibility of CF. These results are in agreement with the results obtained by EL-Kholy *et al.,* (2005). The CP digestibility is slightly increased by adding CS and SFS but the differences were not significant as shown in Table (3).

Table (3):Effects of feeding the experimental diets on means of digestion coefficients and nutritive values.

Item	Experimental diets					±SE
	Control	LCS	HCS	LSFS	HSFS	
Digestibility coefficients (%)						
DM	66.4[b]	69.47[a]	70.54[a]	69.61[a]	69.55[a]	0.697
OM	68.48[b]	71.51[a]	72.58[a]	71.65[a]	71.75[a]	0.583
CP	70.81	72.42	72.81	72.49	72.68	0.788
CF	66.47[a]	63.41[b]	61.07[c]	63.39[b]	61.25[c]	0.562
EE	68.52[c]	71.49[b]	73.61[a]	71.31[b]	73.47[a]	0.497
NFE	75.38	74.57	73.72	74.35	75.27	0.728
Nutritive value (%)						
TDN	68.09[c]	69.09[bc]	70.21[ab]	68.89[c]	70.79[a]	0.389
DCP	10.47	10.66	10.72	10.72	10.74	0.116

Means within the same row having different superscripts are significantly different (P<0.05).

EL-Kholy *el al*.(2005) and EL-Shafie and El-Ashmawy (2010) reported that CP digestibility was not affected by fat supplemented to goat's ration. The EE digestibility was increased (P< 0.05) for goats fed diets containing HCS (10%) and HSFS (14%) compared to those fed diets containing LCS (5%) and LSFS (7%). These results are in agreement with the results obtained by EL-Shafie and El-Ashmawy (2010) who reported that digestion coefficient of EE was increased in 10% SFS supplemented for goats than 5% SFS supplemented for goats diets. Moreover, Petit (2004) reported that cows fed diets containing calcium salts of palm oil and sunflower seeds had higher (P<0.05) ether extract digestibility, compared with those fed diet with no fat supplementation (control). The fat in the control diet contained more nonnutritive lipid, such as waxes, compared with that in the calcium salts of palm oil and sunflower diets, which would have contributed to lower digestibility of ether extract. However, EL-Kholy *et al.,* (2005) reported similar EE digestibility for growing buffaloes fed rations contained canola or sunflower seeds either at 5 or 10% levels.

The digestibility of CF was significantly lower (P<0.05) for goats fed diets containing CS and SFS than those fed control diet. These results could be supported by the findings of EL-Kholy *et al*.(2005) and EL-Shafie and

El-Ashmawy (2010) who reported that digestion coefficient of CF tended to be lower with CS and SFS supplemented diets. Ruminal digestion of fiber is decreased because fiber digestibility is adversely affected by dietary fat (Jenkins 1993).

Grummer (1988) and Schaulf and Clark (1989) found the digestibilities of NDF and ADF were decreased when diet was supplemented with calcium salts of palm oil, whole flaxseed ~~and~~ or whole sunflower seed. On the other hand, Petit (2004) reported similar NDF and ADF digestibilities for early lactating cows fed calcium salts of palm oil, flaxed seeds, sunflower seeds and control (diet not supplemented with fat).

Concerning the effect of level oil seeds, lower significant (P<0.05) values of CF digestion recorded for goats given diets contained HCS and HSFS than those given diets contained LCS and LSFS. These results are in harmony with the findings of EL-Kholy *et al.* (2005). On the same line, ~~El~~-Shafie and ~~El~~-Ashmawy (2010) reported that feeding goats on a diet containing sunflower seeds, 10% decreased CF digestibility than those fed on diet containing sunflower seeds, 5%. Devendra and Lewis (1974) found that fat inclusion at high levels depressed the attachment of rumen microorganisms to the fiber so reducing the apparent digestibility of crude fiber.

Positive improvements were recorded for TDN values with HSFS and HCS diets compared to those of LSFS, LCS and control diets in a decreasing rate, respectively with significant differences (P<0.05) among them. On the other hand, no significant effect on DCP was recorded. Jenkins (1998) and EL-Kholy *et al,* (2005) reported that fat addition for diets of goats and cows did not improve the nutritive value. On the other hand, EL-Shafie and EL-Ashmawy (2010) reported that TDN was decreased with increasing level of sunflower seed in diets, while DCP was increased.

Rumen fluid parameters:

The results in Table (4) indicated that ruminal pH values did not differ among the tested diets. With sampling time order advancement, pH values followed its known curve, since it significantly (P<0.05) decreased after 4 hrs of feeding and started to slightly increase after 6 hrs post feeding. In general, the range of pH values was between 5.47 and 6.63 and remained above 5.58 during all sampling times. The ruminal pH values tended to increase as the level of oil seeds increased but not significantly. Abo-Donia *et al.* (2003) and Chichlowski *et al.* (2005) reported similar pH values for lactating cows fed diet contained soybean seeds or canola seeds compared to the control diet. Similar results were found by Onetti *et al.* (2001) and El-Bedawy *et al.* (2004) for dairy cows or finishing lambs, respectively when fed diets contained fat.

The concentration of NH_3-N gave the lowest values with diets contained oil seeds (diets 2, 3, 4 and 5) compared to control diet with significant (P<0.05) differences (average 17.56 *vs.* 19.26 mg/100ml). Moreover, level of oil seeds positively (P<0.05) affected NH_3-N concentration, since it decreased with diets contained HCS and LSFS than with those contained LCS and HSFS (16.83 and 17.01 vs. 17.78 and 18.62 mg/100ml). The concentration of NH_3-N was decreased by 12.6% for goats fed diet contained HCS than those fed control diet. The obtained results in this study

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were closer to the previous findings reported by Chichlowski *et al.* (2005) who found that feeding dairy cows on diet containing canola seeds (14% of DM) reduced NH_3 by 15% compared to those fed the control diet. Onetti *et al.,* (2001) found that ruminal NH_3-N concentration tended to increase (P< 0.05) when fat was included in the diets. Concerning the effect of sampling time, NH_3-N concentration gradually (P<0.05) increased from 14.45 before feeding to 20.41 mg/100ml after 4 hrs of feeding and started to slightly decrease after 6 hrs post feeding to 18.75 mg/100 ml. The obtained values in this study were in harmony with those reported by Alvarez *et al.,* (1983), being 15 mg/100ml RL necessary for maximal rate of fermentation of whole roughage diets and El-Shabrawy (2000), being 17.54 mg / 100 ml RL for better fermentation rate. Also, the obtained results are supported by Mehrez (1992) who reported that the optimal NH_3-N concentration for maximal rates of fermentation of feeds in the rumen varies with roughage: concentrate ratio, being lower with increasing roughage proportion in the diet.

Table (4): Effects of feeding the experimental diets on the means of some rumen liquor parameters of lactating Zaraibi goats.

Item	Time from feeding (hrs)	Experimental diets					±SE	Times' means
		Control	LCS	HCS	LSFS	HSFS		
pH	0	6.48	5.96	6.61	6.53	6.63		6.44 ^{a}
	2	5.87	5.78	5.92	5.80	5.77		5.83 ^{b}
	4	5.62	5.57	5.68	5.47	5.57	0.132	5.58 ^{c}
	6	5.77	5.80	5.81	5.56	5.72		5.73 ^{bc}
	8	5.77	5.85	5.86	5.67	5.83		5.79 ^{b}
Rations' means		5.90	5.79	5.97	5.81	5.90	0.059	
(NH_3-N mg/100ml RL)	0	14.40	12.60	14.47	15.33	15.46		14.45 ^{d}
	2	18.59	19.37	16.53	16.60	18.13		17.84 ^{c}
	4	22.47	21.37	19.33	18.40	20.47	0.217	20.41 ^{a}
	6	20.40	18.83	17.40	17.27	19.83		18.75 ^{b}
	8	20.47	16.73	16.40	17.47	19.20		18.05 ^{c}
Rations' means		19.26 ^{a}	17.78^{c}	16.83^{d}	17.01^{d}	18.62^{b}	0.097	
Total VFA'S(meq/100 ml RL)	0	6.38	6.82	6.82	6.57	6.67		6.65 ^{e}
	2	6.70	7.52	7.63	7.07	7.53		7.29 ^{d}
	4	7.25	8.30	8.60	8.01	8.55	0.041	8.14 ^{a}
	6	7.13	8.15	8.53	7.90	8.48		8.04 ^{b}
	8	7.09	8.05	8.25	7.55	8.27		7.84 ^{c}
Rations' means		6.91 ^{e}	7.77 ^{c}	7.97 ^{a}	7.42 ^{d}	7.90 ^{b}	0.018	

a, b, c, e means within the same row or column having different superscripts are significantly different at P<0.05.

Ruminal total volatile fatty acids (VFA's) concentration was higher (P<0.05) by 12.4% for goats fed oil seeds diets than those fed control diet. On the same line, Abo-Donia *et al.* (2003) reported that ruminal total VFA's concentrations were higher by 17.0% for animals fed soybean seeds. While, Abou Hussein *et al.* (2003) showed that ruminal NH_3-N and total VFA's concentrations were not significantly affected by oilseed feeding.

Concerning the effect of levels of CS and SFS on VFA's concentration, there were significant (P<0.05) improve effect with goats fed HCS and HSFS than those fed LCS and LSFS. It is clear that the highest values of VFA's concentration were recorded for diet 3, HCS being 7.97 meq/100ml RL. With sampling time order advancement, total VFA's values significantly (P<0.05) increased after 4 hrs of feeding and started to significantly (P<0.05) decrease at 8 hrs post feeding.

The effects of oil seeds (CS and SFS) on ruminal individual VFA's are presented in (Table, 5). Molar proportions of acetic acid were higher (P<0.05) being on average 55.37 *vs.* 51.62 mol/100 mol) for goats fed the oil seeds diets than for those fed control diet, respectively. In contrast, molar proportions of propionic acid and butyric acid were lower (P<0.05), being on average 24.64 and 16.33 vs. 27.54 and 17.27 mol/100 mol) for goats fed the oil seeds diets than those fed control diet, respectively. Ruminal proportions of valeric acid were not different among tested diets. Proportions of iso-butyrate were higher (P<0.05) for goats fed LCS diet than those fed other diets. Proportions of iso-valarate were higher in ruminal fluid of goats fed on the HSFS diet, but were lower for goats fed on the HCS diet. Control, LCS and LSFS diets were recorded intermediate values between HSFS and HCS diets. The acetate to propionate ratios were greater (P<0.05) for goats fed oil seeds diets than those fed the control diet (average 2.25 *vs.* 1.87 mol/100 mol, respectively). It is clear that the highest values for acetic acid and acetate to propionate ratios were recorded for HCS diet (56.37mol/100 mol and 2.41, respectively). These results are similar to those of Aldrich *et al.* (1997) who found that ruminal proportions of acetic acid and acetate to propionate ratios were higher (P<0.01) and those of propionic acid were lower (P<0.01) for cows fed canola seeds diets than for cows fed the control diet. They also, found that valerate molar proportions were not different among treatment groups (diets supplemented with fat *vs.* control diet). Schauff and Clark (1992) found that molar percentages of ruminal propionate tended to be lower in cows fed high fat rations. Onetti *et al.* (2002) reported that molar proportions of butyrate and valerate were increased when supplement fat diet was fed for lactating cows.

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Table (5): Effects of feeding the experimental diets on the means of ruminal individual volatile fatty acids (mol /100 mol) for Zaraibi goats.

Items	Experimental diets					±SE	Sampling time (hr)		±SE
	Control	LCS	HCS	LSFS	HSFS		0	4	
Acetic acid	51.62[c]	55.34[b]	56.37[a]	55.07[b]	54.69[b]	0.245	53.44[b]	55.81[a]	0.155
Propionic acid	27.54[a]	25.20[b]	23.36[c]	24.84[b]	25.17[b]	0.138	25.42[a]	25.06[b]	0.088
Butyric acid	17.27[a]	15.77[c]	16.79[b]	16.38[b]	16.37[b]	0.142	17.89[a]	15.15[b]	0.090
Iso-butyric acid	1.11[b]	1.21[a]	1.10[b]	1.12[b]	1.16[ab]	0.022	1.11[b]	1.17[a]	0.014
Valeric acid	1.52	1.48	1.46	1.59	1.57	0.040	1.27[b]	1.78[a]	0.025
Iso-Valeric acid	0.94[bc]	1.00[ab]	0.92[c]	1.00[ab]	1.04[a]	0.023	0.92[b]	1.04[a]	0.014
Acetic/propionic	1.87[c]	2.19[b]	2.41[a]	2.22[b]	2.17[b]	0.020	2.11[b]	2.24[a]	0.012

Means within the same row having different superscripts are significantly different (P< 0.05).

Concerning the effect of sampling time, proportions of acetate, iso-butyrate, valerate, iso-valerate, and A:P in rumen liquor of goats were significantly (P<0.05) increased after 4 hrs post feeding compared to those recorded before feeding. While proportions of propionate and butyrate were significantly (P<0.05) decreased after 4 hrs post feeding.

In general, the fermentation parameters indicated quite clearly that the pattern of NH_3-N and VFA's values followed the reverse trend to the obtained pH values and reflect the pattern of fermentation in the rumen. It appears that the relatively high ether extract in diets did not adversely affected the fermentation pattern in the rumen.

Blood constituents:

The results in Table (6) indicated that the blood urea-N concentration values did not differ among the tested diets. In contrast, higher (P<0.05) values of total protein concentration were recorded for goats given diets containing oil seeds than those given control diet.

Table (6): Mean values of the concentrations of blood constituents of lactating goats fed the different experimental diets.

Items	Experimental diets					±SE	Sampling time (hr)		±SE
	Control	LCS	HCS	LSFS	HSFS		0	4	
Urea-N (mg/100 ml)	22.94	23.30	21.84	22.85	23.23	0.534	23.79^{a}	21.88^{b}	0.338
Total protein (g/100 ml)	7.02^{b}	7.19^{ab}	7.27^{a}	7.22^{ab}	7.19^{ab}	0.069	7.15	7.20	0.044
Albumin (A, g/100 ml)	3.99	4.00	4.17	4.05	4.17	0.060	4.06	4.10	0.038
Globulin (G,g/100 ml)	3.03	3.19	3.10	3.17	3.02	0.052	3.09	3.11	0.033
A / G ratio	1.32^{ab}	1.26^{b}	1.34^{ab}	1.28^{ab}	1.38^{a}	0.032	1.31	1.32	0.020

Means within the same row having different superscripts are significantly different (P< 0.05).

The obtained results in this study were close to the previous findings reported by Petit (2003) who found that blood urea-N concentrations were similar for cows fed diet containing flax seed compared with those fed diet containing sunflower seeds. On the other hand, Chichlowski *et al.* (2005) found lower blood urea-N (P<0.08) for cows fed canola seed (14% of diet DM) than those fed diet no containing canola seeds. Johson *et al.*, (2002) found that feeding cows on diet containing oil seeds increased blood urea-N compared to those fed diet no containing oil seeds. Bernared *et al.* (2009) noticed increase in blood urea-N concentrations (P<0.05) for lactating Alpine goats fed maize silage based diets containing sunflower seeds oil (6.1% of diet DM) or lin-seed oil (6.2% of diet DM) compared with the control (no additional oil).

The concentrations of albumin and globulin in blood were slightly increased for goats fed diets containing CS and SFS compared to those fed control diet but the differences were not significant. Moreover, sampling time as well as its interaction with tested diets did not show significant effect on all measured blood parameters, expect the sampling time for urea-N concentration which showed to was significant (P<0.05). Generally, all values were within the normal ranges for healthy goats.

Milk yield and its components:

The results in Table (7) indicated that milk and 4% FCM yields were significantly (P<0.05) increased by 17.9 and 17.0% for goats fed oil seeds than for goats fed control diet, respectively. Johson *et al.* (2002) showed that milk and 3.5% FCM yields were improved by 22 and 17% for lactating cows fed diets containing oil seeds than those fed diet no additional oil seeds, respectively. Similarly, Bernard *et al.* (2009) and EL-Shafie and EL-Ashmawy (2010) noticed an increase in milk production by lactating goats fed diets containing sunflower seeds oil or full sunflower seeds as compared to those fed diet containing no additional oil or sunflower seeds.

Concerning effect of levels of CS and SFS on milk yield, it could be noticed that adding and increasing seeds level in rations tended to significantly (P<0.05) higher milk yield. Moreover, the increasing in milk yield with SFS was not significant. The 4% FCM yield followed the same trend as milk yield. EL-Shafie and EL-Ashmawy (2010) indicated higher response in milk yield by lactating goats when they were fed a diet containing 10% sunflower seeds as compared to those fed a diet containing 5% sunflower seeds. On the other hand, Johson *et al.* (2002) reported that milk yield and 3.5% FCM yields were similar for cows fed high and low levels of oil seeds.

Milk components were significantly (P<0.05) increased for goats fed diets containing CS and SFS than those fed the control diet, except milk fat percentage which showed an increase (P<0.05) for diet the control diet compared with CS and SFS diets. These results are agreement with the previous results of Johson *et al.* (2002) and Chichlowski *et al.* (2005) who found that feeding lactating dairy cows diets supplemented with oil seeds decreased milk fat percentages. On the other hand, Aldrich *et al.* (1997) reported that feeding lactating dairy cow diets supplemented with canola seeds (11.2% of DM) maintained or increased milk fat percentages. The percentage of milk fat tended to decrease as the level of CS was increased. Some researchers have suggested that increased production of trans fatty acids in the ruminal fluid and concentrations in blood of cows may cause reduced milk fat (Wonsil *et al.,* 1994).

Table (7): Effects of feeding the experimental diets on the means of milk production and milk components.

Item	Experimental diets					±SE
	Control	LCS	HCS	LSFS	HSFS	
Milk yield (g/day)	1350^{c}	1540^{b}	1650^{a}	1580^{b}	1600^{ab}	22.36
4% FCM (g/day)	1299^{c}	1474^{b}	1565^{a}	1508^{ab}	1534^{ab}	20.99
Fat						
%	3.75^{a}	3.72^{ab}	3.66^{c}	3.70^{b}	3.73^{ab}	0.011
g/day	50.6^{c}	57.2^{b}	60.3^{a}	58.4^{ab}	59.6^{ab}	0.810
Protein						
%	2.88^{b}	3.23^{a}	3.14^{a}	3.20^{a}	3.22^{a}	0.075
g/day	38.9^{b}	49.7^{a}	51.9^{a}	50.6^{a}	51.6^{a}	1.49
Lactose						
%	4.32^{c}	4.61^{ab}	4.61^{ab}	4.52^{b}	4.66^{a}	0.040
g/day	58.2^{c}	70.9^{b}	76.1^{a}	71.4	74.5^{a}	0.671
Solids not fat (SNF)						
%	7.93^{d}	8.56^{ab}	8.31^{c}	8.45^{b}	8.60^{a}	0.039
g/day	107.1^{b}	112.9^{ab}	137.1^{a}	133.5^{ab}	137.6^{a}	9.07
Total solids (TS)						
%	11.68^{d}	12.28^{a}	11.97^{c}	12.15^{b}	12.33^{a}	0.041
g/day	157.7^{c}	189.1^{b}	197.5^{a}	191.9^{ab}	197.3^{a}	2.21
Ash						

%	0.74	0.72	0.72	0.73	0.72	0.008
g/day	10.0^{c}	11.1^{b}	11.9^{a}	11.5^{ab}	11.5^{ab}	0.182

Means within the same row for each effect having different superscripts are significantly different at P<0.05.

Yields of fat, lactose, SNF and TS milk tended to increase as the level of CS and SFS were increased in the diet, resulting in increases in milk yield. Data presented in Table (7) showed that, the amounts of milk lactose of goats fed tested diets were greater than those fed control diet (73.2 and 58.2 g/d, respectively). Brenard *et al.* (2009) reported that feeding lactating goats diets supplemented with sunflower seed oil and linseed oil increased milk lactose secretion by 12 and 8% respectively, compared to diet with no additional oil.

Fatty acids composition of milk:

Table (8) shows the effects of oil seeds (CS and SFS) on fatty acids (FA) profile of goat's milk. The percentages of milk saturated FA decreased (P<0.05) when goats were given CS and SFS diets than when they were given the control diet, while~~,~~ the percentage of unsaturated FA increased (P<0.05). These changes in milk FA are similar to those of reported by Johson *et al.* (2002), Abo-Donia *et al.* (2003) and Petit (2004) who fed canola seeds, cotton seeds, heated soybeans, calcium salts of palm oil and sunflower seeds to dairy cows. Feeding oil seeds reduced (P<0.05) the proportion of both short-chain and medium-chain fatty acids and increased (P<0.05) the proportion of long-chain fatty acids in milk fat. These results agree with those reported by Aldrich *et al.* (1997), Abo-Donia *et al.* (2003), Petit (2003) and Chichlowski *et al.* (2005) who used canola seeds, heated soybeans and sunflower seeds. They are also in accord with those reported by Jacobs *et al.* (2011) who ~~used~~ found that soybean oil and linseed oil in diets of dairy cows increased long-chain FA in milk fat. In the present study, the secretion of long-chain FA increased in response to CS and SFS by 46.18 and 43.33%, respectively. Bernard *et al.* (2009) reported increases in the secretion of long-chain FA which ranged between 109 and 111% in goats fed maize silage based diets supplemented with plants oil.

Table (8): Effects of feeding the experimental diets on the means of milk fatty acids composition.

Item	Experimental diets					±SE
	Control	LCS	HCS	LSFS	HSFS	
Butyric (c_4)	3.11^{b}	3.87^{a}	3.31^{b}	3.29^{b}	3.22^{b}	0.083
Caproic (c_6)	1.08^{b}	1.46^{a}	1.09^{b}	1.04^{b}	1.07^{b}	0.037
Caprylic (c_8)	2.35^{a}	1.73^{c}	1.90^{b}	1.87^{bc}	2.30^{a}	0.049
Capric (c_{10})	11.46^{a}	7.74^{c}	6.60^{e}	6.79^{d}	8.05^{b}	0.050
Lauric (c_{12})	4.11a	3.71b	2.22 e	3.44c	2.75d	0.057
Myristic (c_{14})	13.70^{a}	9.55^{b}	7.29^{e}	8.44^{c}	8.29^{d}	0.042
Pentadecamic (c_{15})	1.07^{a}	0.94^{b}	0.88^{b}	0.89^{b}	0.79^{c}	0.026
Palmitic (c_{16})	29.60^{a}	28.91^{b}	22.72^{e}	24.11^{d}	25.65^{c}	0.051
(c_{17})	0.49^{c}	0.74^{a}	0.32^{d}	0.47^{c}	0.61^{b}	0.029
Stearic (c_{18})	14.35^{d}	12.71^{e}	18.78^{b}	22.87^{a}	16.86^{c}	0.053
Myrisoleic ($c_{14:1}$)	0.71^{a}	0.75^{a}	0.73^{a}	0.56^{b}	0.55^{b}	0.044
Palmitoleic ($c_{16:1}$)	0.81^{bc}	1.31^{a}	0.94^{b}	0.77^{c}	0.78^{c}	0.045
Oleic ($c_{18:1}$)	17.14^{e}	26.61^{c}	33.23^{a}	25.44^{d}	29.05^{b}	0.065
Saturated fatty acids, %	81.33^{a}	71.35^{c}	65.11^{e}	73.23^{b}	69.62^{d}	0.116
Un-saturated fatty acids, %	18.67^{e}	28.67^{c}	34.90^{a}	26.77^{d}	30.38^{b}	0.115
Short-chain (c_4-c_{12})	22.12^{a}	18.51^{b}	15.11^{e}	16.43^{d}	17.41^{c}	0.104
Medium-chain (c_{14}-c_{16})	44.37^{a}	39.40^{b}	30.90^{e}	33.46^{d}	34.74^{c}	0.062

Long-chain (c_{17}-c_{18})	33.51 [e]	42.11 [d]	53.99 [a]	50.11 [b]	47.86 [c]	0.113

Means within the same row within each category having different superscripts are significantly different at (P< 0.05).

The decrease of short and medium chain FA and saturated FA indicated lower *de novo* FA synthesis within the mammary gland (Bernard *et al.,* 2009). Depressed proportion of short and medium chain FA and saturated FA because of the decrease in *de novo* FA synthesis has been attributed to a direct inhibition of mammary acetyl-coenzyme-A carboxylase activity (Palmquist and Jenkins,1980). This inhibition may be as the result of formulation of trans isomers, which is a result from biohydrogenation of long chain and unsaturated FA in the rumen (Chichlowski *et al.,* 2005) and increased mammary uptake of long chain and unsaturated FA from plasma triacylglycerols (Storry, 1988).

Concerning the effect of levels of CS and SFS on percentages of saturated, short-chain and medium-chain fatty acids, results indicated that they were decreased (P<0.05) when goats were given HCS and HSFS diets than when they were given LCS and LSFS diets. On the other hand, the percentages of unsaturated and long chain fatty acids increased. Johson *et al.* (2002) reported that the concentrations of unsaturated FA in milk tended to increase as the level of oil seeds was increased in the diet.

In the present study, compared with the control diet, concentration of saturated FA was decreased in goat fed LCS, HCS, LSFS and HSFS by 12.3, 19.9, 10.0 and 14.4%, respectively. Whereas, concentrations of unsaturated FA were increased by 53.6, 86.9, 43.4 and 62.7% respectively.

Regardless the level of CS and SFS, the percentage of saturated FA was lower in goats fed CS or SFS (68.2 and 71.4%) than those fed control diet (81.3%). While, the percentage of unsaturated FA was higher in goats fed CS or SFS (31.8 and 28.6%) than those fed control diet (18.7%). Regardless the level of CS, the concentration of $C_{18}:_1$ in milk fat from goats fed CS diets was approximately 74.5% greater than that from goats fed control diet. This may be related to the higher level of unsaturated $C_{18}:_1$ fatty acid in the CS diets (Chichlowski *et al.,* 2005). Aldrich *et al.* (1997) found that feeding canola seeds (11.2% of diet DM; 55% lipid) increased $C_{18}:_1$ 67% in milk fat. Also, Chichlowski *et al.* (2005) reported that cows fed canola seeds (14% of diet DM; 34% lipid) increased $C_{18}:_1$ in milk by nearly 25%. The differences in the proportion of $C_{18}:_1$ in milk fat between control diet and CS diets in the current study could be attributed to rapid availability of oil in the rumen and its potential to reduce fiber digestibility (Table, 3). Piperova *et al.* (2000) reported that in cows fed a high-grains, low forage diet that contained soybean oil (5% DM), the increases in trans-10 $C_{18}:_1$ and trans-10, cis-12 $C_{18}:_2$ in milk fat were associated with significantly lower levels of *de novo* synthesized fatty acids.

Feed efficiency and economic evaluation:

Data in Table (9) revealed that feed efficiency as kg 4% FCM per one kg DM, kg TDN and Kg DCP were higher with those fed oil seeds (CS and SFS) than those fed the control diet. The highest value was recorded with HCS diet followed by HSFS diet and then LCS and LSFS diets.

Regarding the economic evaluation, data indicated that feed cost to produced one kg 4% FCM was lower for goats received HCS, HSFS, LCS and LSFS diets than those fed the control diet, being 1.37, 1.38, 1.44-, 1.42 and 1.55 L.E., respectively. Consequently, the economic evaluation was improved for goats fed HCS, HSFS, LCS and LSFS diets by 13.27%, 11.95%, 9.73% and 9.29%, respectively, than those fed control diet.

In this connection, EL-Kholy *et al*. (2005) reported that replacing 10% and 20% of CFM by 5% and 10% of canola or sunflower seeds in growing buffalo diets improved the economical efficiency by 6%, 13.7%, 16.0% and 21.4%, respectively than those fed control diet. Awadalla *et al*. (2003) recommended that replacing 20% of the complete ration with 10% soybean seed or sunflower seeds in growing lambs diet's resulted in superior economical efficiency compared with control diet.

Table (9): Feed efficiency and economical evaluation of the experimental diets used in lactating Zaraibi goats.

Item	Experimental diets				
	Control	LCS	HCS	LSFS	HSFS
DM intake-, Kg/h/d	1.555	1.600	1.630	1.640	1.610
TDN intake-, Kg/h/d	1.059	1.105	1.144	1.130	1.140
DCP intake-, Kg/h/d	0.163	0.170	0.175	0.176	0.173
Feed efficiency					
Kg4% FCM / kg DM intake	0.835	0.921	0.960	0.919	0.953
Kg4% FCM / kg TDN intake	1.23	1.33	1.37	1.33	1.35
Kg4% FCM / kg DCP intake	7.97	8.67	8.94	8.57	8.87
Economic evaluation					
Feed intake (kg/h/d) as fed :					
BH	0.705	0.726	0.739	0.744	0.730
CFM	1.032	0.973	0.902	0.961	0.820
CS	-	0.088	0.180	-	-
SFS	-	-	-	0.127	0.248
Feed cost (L.E/day)	2.01	2.08	2.14	2.14	2.12
Milk price (L.E/day)	4.55	5.16	5.48	5.28	5.37
Feed cost / kg4% FCM	1.55	1.41	1.37	1.42	1.38
Net revenue (L.E/h/d)*	2.54	3.08	3.34	3.14	3.25
Increasing rate of net revenue (%)	100	121.3	131.5	123.6	127.9
Economic efficiency* *	2.26	2.48	2.56	2.47	2.53
Improvement	100	109.7	113.3	109.3	111.9

The price list of one ton BH, CFM,CS and SFS were 650-, 1500,1700 and 1600 L.E, respectively and price of kg for row milk was 3.5 L.E. (Based on year 2009 prices)
***Revenue (LE/h/d= money output - money input**
**** Efficiency = money output/ money input**

Aboul-Fotouh *et al.* (1999) found that the profit above feeding cost was higher with oil seeds diets than the control by 14.5% with cotton seeds diet and 29.8% with sunflower seeds diet for lactating buffaloes.

Conclusion:

From these results, it could be concluded that using canola seeds or sunflower seeds in rations of lactating goats tended to higher digestibility coefficients of nutrients and feeding values, with no adverse effect on some parameters of rumen liquid and blood measurements. Moreover, adding HCS and HSFS to lactating goats rations led to significantly (P<0.05) higher milk and 4% FCM yields and improved its milk characteristics, resulting low feed cost to get one Kg 4% FCM with improving in economical efficiency.

Generally, using 10% of canola seeds in lactating goats ration was better to get more milk yield, feed efficiency and economical efficiency.

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تأثير مصدر و مستوى البذور الزيتية في الغذاء علي الأداء الإنتاجي للماعز الحلاب

حامد محمد الشبراوي

قسم بحوث تغذية الحيوان - معهد بحوث الإنتاج الحيواني – مركز البحوث الزراعية –وزارة الزراعة –الدقي – مصر

أجريت هذه الدراسة في محطة بحوث الإنتاج الحيواني بالسرو علي 30 عنزة زرايبي في مرحلة الحليب بعد الفطام - و قسمت عشوائيا إلي خمسة مجموعات (6 حيوانات بكل مجموعة) في تصميم تام العشوائية و ذلك لتقيم مصدرين و مستويين من البذور الزيتية (بذور الكانولا – بذور دوار الشمس). غذيت المجاميع علي خمسة علائق الأولي كنترول لا تحتوي علي البذور الزيتية، الثانية تحتوي علي بذور الكانيولا 5%، الثالثة تحتوي علي بذور الكانيولا 10%، الرابعة تحتوي علي بذور دوار الشمس 7%، الخامسة تحتوي علي بذور دوار الشمس 14%. و تهدف هذه الدراسة إلي معرفة تأثير التغذية علي تلك العلائق علي معاملات الهضم و بعض قياسات التخمر في الكرش و مكونات الدم و إنتاج و تركيب اللبن الناتج من تلك الحيوانات. كما تم دراسة الكفاءة الغذائية والاقتصادية.

أوضحت النتائج المتحصل عليها ما يلي :

- زادت معاملات هضم كل من المادة الجافة والمواد العضوية و مستخلص الاثير و كذلك القيمة الغذائية في صورة مواد كلية مهضومة بينما انخفضت معاملات هضم الألياف الخام عند التغذية علي العلائق التي تحتوي علي بذور الكانولا و دوار الشمس.
- لا يوجد اختلافات معنوية عند مستوى 5% لمعاملات هضم البروتين الخام و مستخلص خالي الأزوت و كذلك القيمة الغذائية في صورة بروتين مهضوم للعلائق التجريبية.
- ازدادت معاملات هضم مستخلص الإثير و انخفضت معاملات هضم الألياف الخام بزيادة مستوى بذور الكانولا و دوار الشمس في العلائق التجريبية.
- سجل pH سائل الكرش قيما متماثلة مع كل العلائق المختبرة.
- ازدادت تركيزات الأحماض الدهنية الطيارة و حمض الخليك و نسبة الخلات إلي البروبيونات في سائل الكرش بينما انخفضت تركيزات نتروجين – الأمونيا و حمض البروبيونك و حمض البيوتريك في سائل الكرش للماعز المغذاة علي العلائق المحتوية علي بذور الكانولا و بذور دوار الشمس بالمقارنة بالمغذاة علي عليقة الكنترول.
- سجلت الماعز المغذاة علي العليقة المحتوية علي 10% بذور الكانولا تحسن في قياسات سائل الكرش بالمقارنة بالماعز علي المغذاة بباقي العلائق المختبرة.
- لا يوجد اختلافات معنوية في تركيزات يوريا الدم و الألبيومين و الجلوبيولين للعلائق التجريبية.
- سجلت الماعز المغذاة علي العليقة المحتوية علي 10% بذور الكانولا أعلي تركيزات للبروتينات الكلية في بلازما الدم بينما سجلت الماعز المغذاة علي عليقة الكنترول أقل تركيزات.

- ازداد إنتاج اللبن و اللبن معدل الدهن (4%) و مكونات اللبن عند مستوى معنوية (0.05) في الحيوانات المغذاة علي العلائق المحتوية علي بذور الكانولا و بذور دوار الشمس مقارنة بمثيلاتها المغذاة علي عليقه الكنترول.
- تحسن في إنتاج اللبن و مكوناته في الحيوانات المغذاة علي العلائق التي تحتوي علي مستوى عالي من البذور الكانولا(10%) و بذور دوار الشمس (14%)بالمقارنة بمثيلتها المغذاة علي العلائق التي تحتوي علي مستوى منخفض من بذور الكانولا (5%) أو دوار الشمس (7%).
- زادت تركيزات الأحماض الدهنية غير المشبعة و انخفضت تركيزات الأحماض الدهنية المشبعة في دهن اللبن للماعز المغذاة علي العلائق المحتوية علي بذور الكانولا و دوار الشمس بالمقارنة بمثيلتها المغذاة علي عليقة الكنترول.
- ازدادت تركيزات الأحماض الدهنية غير المشبعة بينما انخفضت تركيزات الأحماض الدهنية المشبعة في دهن اللبن للماعز المغذاة علي العلائق المحتوية علي مستوى عالي من بذور الكانولا أو دوار الشمس بالمقارنة بمثيلتها المغذاة علي علائق المحتوية علي مستوى منخفض من بذور الكانولا أو دوار الشمس.
- انخفضت تكلفة الغذاء لكل كجم لبن معدل الدهن (4%) بمقدار 11.61، 10.97، 9.03، 8.39% مما أدى ذلك إلي حدوث تحسن في الكفاءة الاقتصادية بمعدل 13.27، 11.95، 9.73، 9.29 % للعلائق المحتوية علي بذور الكانولا (10%)، بذور دوار الشمس (14%)، بذور الكانولا (5%)، بذور دوار الشمس (7%) علي التوالي، مقارنة بعليقه الكنترول.

وعلي ضوء ما سبق ذكره من نتائج توصى هذه الدراسة باستخدام البذور الزيتية (بذور الكانولا – بذور دوار الشمس) و خاصة بذور الكانولا بمستوى 10% في علائق الماعز الزرايبي الحلابة لما له من مردود إيجابي علي إنتاج و صفات اللبن.

قام بتحكيم البحث

أ.د / محمود يوسف العايق	**كلية الزراعة – جامعة المنصورة**
أ.د / كامل عتمان ابراهيم	**مركز البحوث الزراعية**