Effect of adding sunflower oil in the ration on some productive traits in Awassi ewes

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Accepted: 9/11/2015

Summary

This study was designed to investigate the effects of the addition of different ratios of sunflower oil to the diet of Awasi ewes on the rumen fermentation and milk composition. It was conducted by using 12 Awassi ewes (2-3.5 years old) with average body weight 56.62 kg. The ewes were randomly divided into three groups. Each group had four ewes according to the age, body weight and milk yield. The ewe in each group received 1.4 kg/ dry matter for three rations consisting of barley, wheat bran, soybean meal and alfalfa hay. The first group was fed on control ration, while 2.5 and 5 % of sunflower oil were included in the rations of the second and third groups, respectively. The results showed that the treatments had no significant effect on the average body weight, milk production and milk composition (lactose, protein and SNF percentage). Milk Fat percentage was significantly ($P<0.05$) decreased in second and third groups (4.30 ±0.31 and 4.23 ±0.40) %, respectively as compared with the control group (5.89 ±0.53 %). The pH value of rumen liquor in hours (0 and 3) after feeding showed no significant differences between groups, also there were no significant differences in the volatile fatty acid and ammonia concentration in the rumen liquor in all groups, despite that the volatile fatty acid decreased insignificantly in all treated groups as compared with the control group after feeding. The blood parameters were not affected by the experimental treatments. These results indicated that the fermentation patterns were affected by the increased oil supplementation to the diet of ewes.

Keywords: Sunflower oil, Milk fat, Volatile fatty acid, Blood parameters.

Introduction

Addition of lipid to feeds for ruminants has been a recurrent nutritional issue, aiming to increase milk fat content, to make the most of great quantities of fats available to the feed industry and to match the energy requirements of high producing animals (1). More recently, driven by concerns on human health and environmental sustainability (2), feeding fat has received attention as a mechanism to increase conjugate linoleic acid in ruminant production and to reduce methanogen process in the rumen (3). To reduce the proportion of saturated fatty acid in animal products, it requires the use of unsaturated fats from oily seeds or vegetable oils in feed components (4). However, more recent research is working to reduce the saturated fatty acid content of short and medium-chain, while raising the proportion of long-chain unsaturated fatty acids specially conjugated linoleic acid (2). The sunflower oil is one of plant oils rich in linoleic acid (5 and 6) and it has a positive effect in the prevention of several diseases, including atherosclerosis and colon cancer, prostate and breast disease (7). The potential adverse effects of fat addition, however, still deserve attention, depending on fat characteristics (chain length, saturation, and esterification), basal diet composition (forage *vs* con.), and level of inclusion (8 and 9). So that effects of specific oil sources on rumen fermentation, microbial population and digestibility need to be assessed (10). Accordingly, this study was designed to investigate the effects of the addition of different ratios of sunflower oil to the diet of Awasi ewes on the rumen fermentation and milk composition.

Materials and Methods

Twelve Awasi ewes weighing (54±0.57) kg and (2-3.5) years of age at the start of the experiment were used. Table (1) showed the composition formulation and chemical composition of the experimental diets used. The ewes were randomly divided into three groups. Each group had four ewes according to the age, body weight and milk yield. The ewe in each group received 1.4 kg/ dry matter for three rations consisting of barley, wheat bran, soybean meal and alfalfa hay. The first group

was fed on control ration, while 2.5 and 5 % of sunflower oil were included in the rations of the second and third groups, respectively. The experiment was conducted in the animal field belonging to the College of Veterinary Medicine, Baghdad University. The individual milk production was recorded each day, both at morning and evening milking. Milk samples were used to determine fat, protein and total solid concentrations (11). At the last week of the feeding trail and within one day, ruminal fluid samples are withdrawn from all ewes before feeding (zero time) and 3 hrs. post feeding by using suction pump, and strained through double layer cheese cloth and pH was immediately measured with pH meter, then the samples was acidified with three drops of concentrated H_2SO4 and kept frozen for further analysis to study the ruminal fermentation characteristics through the determination of the ruminal NH_3N and total volatile fatty acid concentrations following the method described by (12). Blood biochemical changes, were studied during the experiment and within every ten days. Blood samples (5ml) were withdrawn via jugular vein puncture into vacutainer tubes from all the animals, blood samples were centrifuged, the separated serum was collected and stored at (-20°C) till analysis was performed using commercial kits.

Table, 1: Formulation of the experimental dietary composition (%) and chemical analysis.

Ingredients %	(G1) Control	(G2) fed 2.5%	(G3) fed 5%
Barley	50	50	50
Wheat bran	35	32.5	30
Hay	7	7	7
Soybean meal	6	6	6
Sunflower oil	0	2.5	5
Mineral andvitamin	2	2	2
Chemical composition%			
DM	89.58	92.55	92.55
OM	95.75	94.72	94.72
CP	14.22	14.25	14.25
CF	9.96	9.51	9.51
EE	2.46	5.00	7.50
NFE	64.03	64.71	65.40
ME MJ/Kg *	2.52	2.77	2.93

***Metabolizable energy (ME) values were estimated according to following equation (13)**
ME (MJ/kg DM) = [- 0.45 + (0.04453×% TDN)] × 4.184
TDN for roughages (% of DM) = -17.2649+1.2120(%CP) + 0.8352 % NFE+2.4637 % EE+0.4475 % CF
TDN for energy feeds (% of DM) = 40.3227+0.5398 % CP+0.4448 % NFE+1.4218 % EE–0.7007 % CF.

The experience period were five weeks in mid-lactation, after primary period seven days. The values are given as mean ± SE and $P<0.05$ was considered statistically significant. The data were analyzed by students t–test using SPSS (Version 22).

Results and Discussion

The results in (Table, 2) show no significant effect of sunflower oil in the diet of ewes on body weight changes the values of the end of experimental range in between (58.60 ±2.36 - 59.04 ±1.02) kg. The improvement treatment groups as compared with control group had no significant difference in treated groups in daily milk production, range between (379.32 ±14.29 - 425.23 ±24.15) g/d/ewe, and the average total milk production ranged between (13.38 ±5.78 -14.88 ±8.74) kg. These results agreed with (4) who concluded that the vegetable oil added to the diet of ewes had no significant effect on average body weight and milk production, whilst in the present study the improvement in performance of treated groups (second and third) increased by increase energy intake (sunflower oil) in the diet as compared with control group. On other hands (14) reported that feeding (sunflower oil and linseed oil) improved lactation performance due to increasing energy consumed, while the percentage of milk component (protein, lactose and SNF) showed no affected in milk component of treated and control groups, except the milk fat percent which showed decreased percentage, these result agreed with the present study that showed no affect in milk component of treated and control groups, except milk fat percent in groups which were fed 5% and 2.5% sunflower oil had negative effect significantly ($P<0.05$) decreased in these groups as compared with control group. This result may be due to the treated diet with the oil effected the growth and activity of rumen microorganism responsible for fiber digestion and produced fatty acid trans-11 which is considered the main source for the production linoleic acid isomers (C 18:2) in the mammary glands (15).

Table (3) showed the pH values at zero time in all groups ranged between (7.12 ±0.05 -7.24 ±0.09), the mean value of rumen pH of ewes dropped after feeding and reached to

lower value at (3-4) hrs. post feeding (16). No significant differences (P>0.05) in pH value were observed between different groups in (3) hr post feeding; similar result were found by (4). The average concentration volatile fatty acid (m.eq/100 mL) and NH_3N (mmol/100mL) in rumen fluid of ewes at 0 and 3hrs. after feeding of experimental ewes showed no significant difference (P>0.05) among the experimental groups, regardless of the diet composition. In the present study it was evident that sunflower oil concentration in the diet had an effect on decreasing the volatile fatty acid and NH_3N production in rumen fluid when increased levels of supplementation of sunflower oil in dietary were used. These results are similar to those obtained by (17 and 18), which may be due to rumenal metabolic changing attributed increase sunflower oil in the diet lead to increase trans (18:1) isomer percentage (19).

Table, 2: Effect of adding sunflower oil in the diet on the mean of ewes weights, milk yield and main composition (mean±SE)

Parameters	Treatment groups		
	(G1) Control	(G2) fed 2.5%	(G3) fed 5%
Initial body weight (IBW) kg	56.62 ±2.44	56.50 ±1.32	56.75 ±2.65
Final body weight (FBW) kg	58.60 ±2.36	59.04 ±1.02	59.00 ±2.59
Average milk yield g/day/ewe	379.32 ±14.29	425.23 ±24.15	421.47 ±16.61
Average total milk yield kg/ewe	13.38 ±5.78	14.88 ±8.74	12.64 ±0.14
Fat %	5.89 ±0.35 [a]	4.30 ±0.31 [b]	4.23 ±0. 40 [b]
Protein %	3.91 ±0.22	3.65 ±0.18	3.13 ±0.12
Lactose %	5.88 ±0.40	5.57 ±0.14	4.55 ±25.25
SNF %	10.02 ±0.45	9.78 ±0.33	9.88 ±0.38

Different letters in the same column denoted significant differences between treated groups and control at level P<0.05.

Table, 3: Effect of substitution of sunflower oil in the diet on the mean of ruminal fermentation characteristic of ewes (mean±SE).

Ruminal characteristic	Treatment groups		
	(G1) Control	(G2) fed 2.5%	(G3) fed 5%
pH before feeding at zero time	7.24 ±0.09	7.20 ±0.20	7.12 ±0.05
pH after feeding at 3hr	6.63 ±0.06	6.82 ±0.11	6.61 ±0.02
TVFA(mEq/100cm^3) before feeding at zero time	5.97 ±0.30	5.97 ±0.20	5.82 ±0.29
TVFA(mEq/100cm^3) after feeding at 3hr	8.52 ±0.50	7.88 ±0.54	8.03 ±0.42
NH_3N(mg/100ml) before feeding at zero time	8.12 ±0.13	9.20 ±0.36	9.55 ±037
NH_3N(mg/100ml) before feeding at 3hr	11.12 ±0.65	12.40 ±0.54	12.17 ±0.34

Table (4) shows the effect of levels of sunflower oil in the diet of ewes on some blood serum parameters and the result refer to no significant differences (P>0.05) between treated groups in average concentration of blood glucose which were between (75.66 ±1.34 - 81.60 ±4.84) mg/100 mL, cholesterol between (42.55 ±5.26 - 56.26 ±8.12) mg/100 mL, triglyceride between (18.11 ±0.88 - 21.00 ±4.2) mg/100 mL, total protein (6.00 ±0.97 - 6.52 ±1.33) g/100 mL and serum urea between (33.05 ±1.21 - 34.24 ±0.87) mg/ 100 mL, respectively. This study is in agreement with several investigation which used some oil sources in the ration of dairy animals. Addition 3% of sunflower oil to goat diet caused no significant difference (P>0.05) in triglyceride, glucose and blood urea concentration (20), whereas significant increase in total protein, cholesterol and serum glucose concentration was observed in ewes exposed to 4% fish oil in ration (21).

Table, 4: Effect of adding sunflower oil in the diet on the mean of blood parameters of ewes.

Item Blood parameters	Treatment groups		
	G1	G2	G3
Glucose(mg/100ml)	75.66 ±1.43	78.10 ±1.49	81.60 ±4.84
Urea(mg /100ml)	33.05 ±1.21	34.24 ±0.87	33.47 ±1.55
protein(g /100ml)	6.35 ±1.75	6.52 ±1.33	6.00 ±0.97
Cholesterol(mg /100ml)	42.55 ±5.26	50.75 ±3.14	56.26 ±8.12
Triglyceride(mg/100ml)	21.00 ±4.2	19.25 ±1.95	18.11 ±0.88

Acknowledgements: I express my thanks and appreciation to the Dean of College of Veterinary Medicine and Management of Animal Field.

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تأثير إضافة زيت زهرة عباد الشمس إلى ألعليقة في بعض الصفات الإنتاجية في النعاج العواسية

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الخلاصة

صُممت الدراسة لمعرفة تأثير إضافة زيت زهرة عباد الشمس إلى العليقة في بعض الصفات الإنتاجية في النعاج العواسية، وقد أجريت الدراسة باستعمال 12 نعجة عواسية بعمر(2 -3.5) سنة ومعدل اوزانها (56.62) كغم. وزعت النعاج عشوائيا إلى ثلاثة مجاميع تبعا لأوزانها واعمارها وإنتاجها من الحليب، حيث ضمت كل مجموعة اربع نعاج، والتي غذيت بمعدل 1.4 كغم مادة جافة /نعجة يوميا قُسمت على ثلاث علائق والتي أحتوت شعير ونخالة حنطة وكسبة فول الصويا ودريس الجت. غذيت المجموعة الأولى على عليقة السيطرة أما المجموعة الثانية والثالثة فقد غذيت على عليقة مشابهة للسيطرة أضيف إليها زيت زهرة الشمس بنسبة (2.5- 5) % على التوالي. لم تظهر النتائج وجود اختلافات معنوية بين المعاملات في أوزان النعاج نهاية التجربة ومعدل إنتاج الحليب او مكونات الحليب (نسبة اللاكتوز والبروتين والمادة الصلبة) في حليب النعاج. أما نسبة دهن الحليب فقد انخفضت معنويا ($P<0.05$) في المعاملة الثانية والثالثة إذ بلغت (0.31± 4.30 و0.40± 4.23)% على التوالي، مقارنة بالمعاملة الأولى (0.53± 5.89) %. أما درجة حموضة سائل الكرش لم تظهر اختلافات معنوية قبل التغذية وبعد ثلاث ساعات من التغذية، وكذلك معدل الأحماض الدهنية الطيارة وأمونيا سائل الكرش لم تظهر اختلافات معنوية بين المجاميع، في حين سجلت المجاميع المعاملة إنخفاض غير معنوي بتركيز الأحماض الدهنية الطيارة مقارنة بالمعاملة الاولى بعد ثلاث ساعات من التغذية، لم تظهر فروق بين المعاملات في قياسات الدم. هذة النتائج تشير إلى أنّ زيادة الزيوت في عليقة النعاج لها تاثير سلبي على تخمرات الكرش.

الكلمات المفتاحية: زيت زهرة الشمس، دهن الحليب، أحماض دهنية طيارة، معايير الدم.