Egyptian Journal of Sheep & Goat Sciences, Vol. 12, No. 3, P: 25-35, December 2017

Effect of dietary roughage to concentrate ratios with sunflower oil supplement, on digestibility, rumen fermentation, milk production and milk fatty acid profile of dairy goats.

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ABSTRACT

The aim of this study was to evaluate the effect of high- or low-concentrate ratio in the present of sunflower oil (SFO) in all tested diets on rumen fermentation, nutrient utilization, and fatty acid profile in milk fat of lactating goat's. Eighteen Zaribi goats (averaged 43 kg ± 1Kg body weight) were divided into three similar groups (6 goats each) for use in the feeding trial, which lasted 90 days. A randomized complete block designs was applied. Experimental rations comprised iso-nitrogenous and iso caloric based on concentrate feed mixture (CFM) and berseem hay in three roughage to concentrate ratios as follow: 50:50(T1), 55:45(T2) and60:40(T3). The three rations were supplemented with 30 g SFO /kg of DM intake

The results showed that dry matter intake ($P < 0.05$) decreased with increasing the ratio of roughage by 26.9% and 41.0 % for T2 and T3 compared with T1, respectively. There were no significant differences among groups in DM digestibility, while OM and EE digestibility ($P < 0.05$) were higher in T1 ration (high concentrate) than both T2 and T3 rations (lower concentrate). All nutrients digestibility significantly ($P < 0.05$) increased with T1 (high concentrate and low roughage) than T3 (low concentrate and high roughage), while, no significant difference between T1 and T2 rations. On the other hand, TDN values did not affected by concentrate to roughage ratios. While, DCP decreased in T2 and T3 by increasing roughage ratio. High-roughage diet (T2 and T3) resulted in a lower rumen pH and higher total rumen VFA concentration, whereas, high concentrate diet increased rumen pH and decreased rumen VFA concentration. High-concentrate diet increased rumen ammonia-N ($P < 0.05$) and molar proportion of acetate to propionate. There were no significant differences in milk yield, as 4% fat corrected milk, among animals fed the tested rations supplemented with sunflower oil (SFO) as source of unsaturated fatty acids. The high roughage diets (T2 and T3) resulted in increase in linoleic (c18:2) and linolenic acid (c18:3) concentration by 69 and 45%, respectively compared with control (T1). Also, kids of T1 group had significant ($P < 0.05$) higher birth weight than other groups, while, there were no significant difference in daily gain among kids of the three groups.

In conclusion, high concentrate diet could have better milk yield and protein percentage, while have less fat % and yield, compare to high roughage diet. Suckling kids could benefit more gain with dams fed high concentrate diet. Low roughage diet also develop better fat profile in milk. However, more studies are needed to identify the best economic combination for feeding dairy goats.

Key words: roughage to concentrate ratio, sunflower oil, digestibility, lactating goats , milk fatty acid profile.

INTRODUCTION

Ruminant feeds usually contain predominant unsaturated fatty acids. Meanwhile, meat and milk of farm animals contain great amounts of saturated fatty acids that produced from metabolic activity in rumen during different processes which known as biohydrogenation (Shingfield and Griinari, 2007). Modifying diet can greatly alter ruminal metabolism, therefore, affect the influx of nutrients that reach the duodenum. One of most recommended modification is lipid supplementation, which used to increase dietary energy density aiming to alter the composition of the final products (*Michelle et. al., 2012).* Meanwhile, the pasture (roughage component) has a major effect by decreasing saturated FA and increasing unsaturated FA (C18:1, C18:3 and C18:2) that consider favorable to human health. The roughage to concentrate ratio (R/C) and the quality of lipids in the diet are the major factors affecting the rate and extent of rumen biohydrogenation for unsaturated fatty acids (UFA), (Antongiovanni *et. al., 2004).*

The difference in fatty acids composition between the ideal and the actual milk fats is enormous. Increasing MUFA and PUFA on the expense of saturated fatty acids (C14:0 and C16:0) is desirable for human health perspective. Human nourishment recommend decreasing intake of medium-chain saturated fatty acids (lauric, myristic and palmitic acids) to reduce the frequency of cardio-vascular diseases. Moreover, an increase in dietary intake of polyunsaturated fatty acids stimulates the immune system and reduces the frequency of cancer and cardio-vascular diseases (Huang *et al.*, 2008).

The aim of this study was to evaluate the effect of feeding goats different roughage to concentrate ratios, in the presence of sunflower oil (SFO), on milk production and milk fat profile, besides, nutrients digestibility and rumen fermentation.

MATERIALS AND METHODS

This experiment carried out at Sakha, Animal Production Research Station, Animal Production Research Institute, Agriculture Research Center during summer season.

Experimental rations and animals

All experimental rations consisted of concentrate feed mixture (CFM) and berseem hay (BH) at different ratios. First group offered 50:50 concentrate to hay diet and act as control; the second group received 45:55, while the third group fed 40:60 concentrate to hay diets, respectively. Sunflower oil (SFO) added at rate 3% of total ration, on DM basis, for the three groups. Chemical composition of raw materials and different experimental rations are presented in Table (1).The concentrate feed mixture consisted of 35% decorticated cotton seed cake, 25% corn grain, 30% wheat bran, 5% molasses, 2% limestone, 1.5% salt and mineral and 1.5%vitamins mixture.

Digestibility trials and rumen parameters

A digestibility trial was conducted using 3 animals of each group, using acid insoluble ash (AIA) technique as internal marker according to **Van- Keulen and young (1977)** to determine the digestibility and feeding values of the experimental rations.

Table (1): Chemical composition of CFM, BH, SFO and experimental rations (on DM basis).

	Chemical composition						
Items	DM(%)	OM	CF	CP	EE*	NFE	ASH
BH	88.93	86.43	26.32	11.30	2.06	47.75	13.57
CFM	90.53	91.77	11.12	14.09	2.65	63.91	8.23
Calculated chemical composition of experimental rations%.							
T1	89.74	89.12	18.72	12.70	5.12	52.58	10.88
T2	89.65	88.84	19.48	12.56	5.52	51.28	11.16
T3	89.57	88.57	20.24	12.42	5.30	50.61	11.43

* T1: Control ration (50% CFM +50% BH), T2: (45% CFM +55% BH), T3: (40% CFM +60% BH)
* The percent of EE include the added supplement of sunflower oil at rate 3% of DM to all groups.

Fecal grab samples of nearly 100 g were taken twice daily at 8 am and 6 pm for 3days from rectum. Representative samples of feed and feces from the whole collection period were prepared for proximate analysis according to **A.O.A.C. (1995).** Ruminal fluid samples were collected at the end of the trial using stomach tube before feeding then at 2 and 4 hrs. after feeding. Samples of rumen content, for each animal were filtered through four layers of cheesecloth then ruminal pH was immediately measured using digital pH meter, then, samples were stored at -20 °C for analyses. Ruminal ammonia nitrogen (NH3-N) concentration determined according to Conway (1957). Ruminal total volatile fatty acids (TVFA's) concentration determined according to Warner (1964).

Feeding trials

Eighteen Zaraibi goats (averaged43±1 kg) were chosen for the feeding trial and divided into three similar groups (6 goats each). All groups separately housed under open loose system barns and randomly assigned to receive the three experimental rations, using the randomized complete block design. Rations formulated to meet **NRC (1985)** requirements of goats**.** Animals received CFM plus BH at the different ratios (50:50, 45:55 and 40:60%). The concentrates offered to animals in two equal amounts at 8:00 am and 3:00 pm followed by BH. The feeding trial lasted for 90 days. Daily milk yield was recorded and milk sample were collected at first, middle and end of feeding trial for analysis of milk composition using Milko scan (model 130 series – type 10900 FOSS electric – Denmark), while fatty acid profile was determined via gas liquid chromatograph (GLC) according to **Farag *et al*. (1986).** Body weight changes individually measured biweekly before morning feeding.

Statistical analysis

Data collected for lactation, digestibility trial, rumen parameters subjected to statistical analysis as one-way analysis of variance using **SAS** (1999) according to the following model:

$Yij = \mu + Ti + eij$

where:

Yij= the observation

μ = Over all mean

T_i = Effect of treatment

e_{ij} = Experimental error

Differences among means subjected to **Duncan (1955).**

RESULTS AND DISCUSSION

Nutrients digestibility and feeding values.

Data of Table (2) showed that total dry matter intake significantly ($P <0.05$) decreased with increasing the level of roughage by 18.8 % and 31.02% for T2 and T3,respectively compared with T1). This is similar to the response of DMI by Soita *et al.* (2005) who reported that feeding diet of 45:55 R:C ratio increased DMI by 1.6 kg/d than diet contained lower proportion of concentrate (55:45 R:C ratio). The lower DMI with high roughage in diet may be due to the limited gut fill capacity. This result agree with those found by Netsanet *et al*., (2015) when cows fed roughage (berseem hay, green sorghum forage and wheat straw) and concentrate at different ratios.

In addition, data showed no significant differences in DM digestibility among goats fed the experimental rations. While, OM digestibility significantly ($P<0.05$) decreased when goats fed T2 and T3 rations compared with control ration (T1). This may be due to the greater proportions of concentrate in T1 and T2 diets, which associated with more extensive digestion of OM in the rumen that reflects the greater intrinsic digestibility of non-structural carbohydrates compared with hemicellulose and cellulose (Bayat *et al*., 2017).

Data in Table (2) showed that T3 goats significantly ($P<0.05$) had decrease in CP digestibility (less by 3.56% than T1). This may be due to replacing fibrous carbohydrates in low concentrate diets with starch in high concentrate diets, which expected to facilitate better utilization of ammonia and reduction in deamination of amino acids by rumen microorganisms (Nocek and Russell, 1988). Similar result was reported by Cantalapiedra-Hijar *et al*.(2014)when examined forage types of grass hay vs. alfalfa hay and high forage vs. low forage (at 70:30 and 30:70, F:C ratios, respectively).There were no between T1 and T2 rations in CP digestibility (table 2). There was a significant ($P<0.05$) decrease in CF digestibility only with T3 ration compared to T2 and control

Table (2): Daily feed intake, digestibility coefficient and feeding values of experimental rations.

	Treatments			
Items	T1	T2	T3	± SE
Daily feed intake (kg DM / h)				
CFM	0.82	0.73	0.67	
BH	0.78	0.57	0.46	
Total DM intake	1.60^{a}	1.30^{b}	1.10^{b}	0.25
Digestibility coefficients(%).				
DM	75.40	74.90	74.70	0.60
OM	70.10^{a}	66.67^{b}	66.10^{b}	0.71
CP	73.32^{a}	71.41^{ab}	70.71^{b}	1.93
CF	65.73^{a}	64.20^{ab}	63.21^{b}	1.57
EE	73.42^{a}	72.04^{b}	71.69^{b}	1.40
NFE	70.47^{a}	69.94^{ab}	68.55^{b}	1.42
Feeding values on DM basis(%).				
TDN	74.23	73.60	71.60	1.89
DCP	9.31^{a}	8.96^{b}	8.77^{b}	0.19

^{a,b}: Means of different superscripts in the same row are significant (P<0.05) different

rations. The decrease in fiber digestion in the rumen caused by the inhibited growth of cellulolytic bacteria when ruminal pH decrease below 6.2 (Grant and Mertens, 1992).

Digestibility of EE was decreased by 1.88 and 2.36 for T2 and T3 rations compared with T1 ration, respectively, while there was insignificant (P<0.05) differences between T2 and T3.

Results also, showed increase in NFE digestibility in ration T1 than T2 and T3 rations. This may be due to the greater proportion of starch digestion in the rumen when animals fed high concentrate diets T1 which

Gaafar *et al.*(2009) reported that feeding high concentrate to low roughage ratio (40:60 R:C) in buffalos diets substantially increased DCP intakes by 30%.

Rumen parameters of dairy goats

Rumen Fluid pH

Data in Table (3) presented that pH-values of the three rations ranged between 4.87 and 7.08. pH value was significantly(P<0.05) higher with goats fed T1 (7.08) than those fed T3 ration (4.87) , while, difference was insignificant with those fed ration T2 (5.43).The greater amount of starch in T1 (high-concentrate diets) might produce more lactic acid in rumen which increased pH value. A similar trend observed by Cantalapiedra-Hijar *et al.* (2009). These results might also cause by a lower rumination and a more intensive fermentation of easily fermentable carbohydrates from concentrates. While, there were no significant differences between T2 and both other rations (T1 and T3).This result agree with that obtained by Flachwasky (2006).

Ammonia Nitrogen Concentration in Rumen Fluid.

NH_3-N is the end-product of fermentation for feed proteins and other nitrogenous compounds in rumen, which function as raw materials for rumen bacteria to synthesize microbial proteins. Results in Table (3) show that the NH_3-N concentration of T3 ration significantly ($p < 0.05$) decreased (by 6.4%) than control (T1).Moreover, the tendency to increase NH3-N concentrations with T1 may be due to the higher OM and higher rate of protein breakdown. Also, replacing fibrous carbohydrates in low diets with starch in high diets is expected to facilitate better utilization of ammonia and reducing of

Table (3): Effect of feeding the experimental rations on some rumen Parameters of dairy goats.

ITEMS	T1	T2	T3	±SE
pH	7.08[a]	5.43[ab]	4.87[b]	1.67
NH_3-N(mg/ dL)	29.47[a]	28.12 [ab]	27.59[b]	1.54
VFA				
Total(mmol/ L)	60.10[b]	61.04[ab]	63.24[a]	1.57
Acetate	38.80[b]	40.10 [ab]	41.56[a]	1.47
Propionate	15.01[a]	14.11[ab]	13.44[b]	0.98
Butyrate	4.11	3.98	3.77	0.31
A/P ratio	2.53[b]	2.84[ab]	3.09[a]	0.30

[a, b] Means with different superscripts in the same row differ significantly (P<0.05).

* T1:Control ration (50% CFM+50% BH),T2:(45% CFM +55% BH),Control,T3:(40% CFM +60% BH).

deamination of amino acids by rumen microorganisms (Nocek and Russell, 1988).

These results agree with finding of Manatbay *et al.* (2014) who reported that lower F:C ratios of substrates significantly ($p < 0.05$) increased NH3-N and VFA concentrations compared with the higher forage substrates in *in vitro* study. On the other hand, there were no significant difference between T2 and (T1).Generally, ruminal NH3-N concentrations in the experimental groups were within the normal range (10-45mg/100) reported by Church (1976).

VFA in Rumen Fluid.

Data in Table (3) show that the differences in VFA's concentrations between T1and T2 rations and between T2 and T3 rations were not significant. Whereas, total volatile fatty acid concentration was higher ($p<0.05$) in animals fed T3 ration compared with T1 ration. The higher VFA concentration in goats fed T3 ration may be due to a higher activity in the rumen.

Molar proportion of VFA in the goats' rumen are shown in Table (3). Data showed significant ($p<0.05$) decrease in propionic and butyric acid concentrations and increase in the molar proportion of acetic acid in T3 group compared to control group (T1), while , no significant difference between T2 and control group (T1). These increases in the butyric acid concentration might be related to the increase in rumen protozoa concentration. This results agree with finding of Eun *et al*., (2004) who reported a linear increase in butyric acid concentration with increase of rumen protozoa concentration when corn level increase in grass silage. On the other hand, the decrease in acetic acid concentration for goats fed T1 ration may be due to the lower microbial degradation of fiber, which agree with finding of Flachwasky (2006). Also, as ration high in cellulose give higher proportion of acetic acid, while ration contain concentrate diets give higher proportion of propionic acid, thereby proportion of acetic acid reduced (Bauman *et al*., 2008). The acetate to propionate ratio (A/P ratio) significantly ($p < 0.05$) increased with T3 group compared to T1 group, while insignificantly differ than T2 group.

Productive performance of lactating goats

Data of milk and 4% fat corrected milk (FCM) yield and composition are presented in Table (4). Data showed that increasing roughage to concentrate ratio significantly ($P < 0.05$) decreased milk production (by 9.89 and 14.29% for T2 and T3compared with control, respectively). However, fat % and fat yield were more with low concentrate diet (T3, 4.14 % & 32.3 g/d) than high concentrate one (T1, 3.12 % & 28.4 g/d), respectively. The increase in milk production of T1 group may be due to the high percentage of nutrients digestibility and feeding

Table(4): Effect of the experimental rations on milk yield and compositions of lactating goats.

Items	T1	T2	T3	±SE
Milk yield(g/h/d)	910[a]	820[b]	780[b]	0.04
4% FCM yield(g/h/d)	860	790	800	0.03
Milk composition and its yield				
Fat%	3.12[c]	3.55[b]	4.14[a]	0.40
Fat yield (g/goat /d)	28.39	29.11	32.29	
Protein%	2.47 [a]	2.28 [b]	2.07 [c]	0.16
Protein yield (g/goat /d)	22.47	18.70	16.15	
Lactose%	3.66[b]	4.74[a]	4.71[a]	0.20
Total solids%	10.84 [b]	10.65[b]	11.92[a]	0.25
Solids not fat%	7.72	7.10	7.78	0.63

[a,b …c] Means of different superscripts in the same row are significant different($P<0.05$).
*T1: Control ration (50% CFM+50% BH),T2: (45% CFM +55% BH,T3: (40% CFM +60% BH)

values (Table 2)which reflected on milk production, while the moderate differences among groups in 4% fat corrected milk yields was due to the changes in amounts of milk accompanied adjustment for changes in fat%. A similar increase in milk yield with increasing concentrate in the diet was reported by Tuan, (2000); Sanh *et al.*, (2002) and Kuoppala *et al*., (2004). This may attributed to increase of DM and energy intake.

The different trend noticed on fat % and yield agree with findings of Loor *et al*., (2005) who observed that feeding high concentrate diet (35:65 R:C ratio) substantially reduced milk fat percentage (by 28%) as compared to diet of65:35 R:C ratio . Similarly, Kalscheur *et al.* (1997) observed a reduction ($P<0.01$) in milk fat % (3.67) of cows fed low fiber diets (F:C ratio 25:75) compared with high fiber diets (4.16%for F:C ratio 60:40).The improve in milk fat content in T2 and T3 groups (table 4) was associated with decrease in milk yield of these groups compared to T1 group.

High levels of concentrate are conducive to production of propionic acid in the rumen, which in turn promotes partition of energy towards synthesis of body fat instead of milk fat synthesis, resulting decrease in milk fat content (Randby, 1996; Sanh *et al*., 2002). On the other hand, goats fed T3 ration was ($P<0.05$) lower in protein percentage compared with those fed T2 and control rations. This decrease may be due to the decrease in efficiency of N utilization, as well as a decrease in conversion and availability of nutrients for milk synthesis (Abu Ghazaleh and Holmes,2007). There was a significant ($P<0.05$) increase in milk lactose percentage for goats fed T2 and T3 rations compared with those fed control ration (T1) (by 29.51 and 28.69%, respectively). The content of total solids were significantly ($P<0.05$) increased for T3 compared to T1 but no significant difference was found between T1 and T2 rations. Regarding solid not fat (SNF) percentage, the differences among the dietary treatments were not significant.

Milk fatty acid profile

The results in table (5) indicate the profile of goat's milk which affected by feeding different ratios of roughage to concentrate and the addition of sunflower oil to all diets. Percentage of long chain fatty acids (C18:1 to C18:3) significantly ($P<0.05$) increased with T3 (containing high roughage to low concentrate) compared with both

Table (5). Fatty acid profile of goat's milk fat as affected by dietary treatments .

Rations	Fatty acids (mg/100 g fat)								
	C18:1	C18:2	C18:3	T.U. S	C14:0	C16:0	C18:0	C20:0	T. S
T1	25.42[c]	2.68[c]	0.46[c]	28.56 [c]	9.42[a]	25.62[b]	16.63[a]	0.53[a]	52.17 [a]
T2	27.23[b]	3.90[b]	0.55[ab]	31.68 [b]	7.95[b]	28.36[a]	13.92[b]	0.43[b]	50.64 [a]
T3	29.11[a]	4.54[a]	0.69[a]	34.34 [a]	6.66[c]	24.48[c]	12.74[c]	0.33[b]	44.21 [b]
±SE	0.53	0.28	0.14	0.98	0.57	0.75	0.73	0.09	1.25

[a, b, c]…Means with different superscripts in the same column differed significantly (P<0.05).
* T1: Control ration (50% CFM +50% BH), T2: (45% CFM +55% BH), T3: (40% CFM +60% BH)
T. U. S.-------- Total unsaturated fatty acid
T . S. ------- Total saturated fatty acids.

T1 and T2 groups. The present result confirmed by the findings of Marcello Mele (2006) that addition of soybean oil had more pronounced effect on level of linoleic acid in milk when add to high forage diets, as linoleic increased by 20% compared to 3% increase only with low forage diet.

Meanwhile, Martini *et al.* (2010) observed a decreased in some medium chain fatty acids values, viz. C12:0 (14.89%) and C14:0 (4.03%) with the increase of roughage ratio in the diet of lactating ewes. On the other hand, an inverse effect (P <0.05) was observed in relation to the palmitoleic (C16:1), stearic (C18:0), oleic (C18:1), linoleic (C18:2), and linolenic (C18:3) acids, which increased with increasing roughage ratio in the diet.

The increase of unsaturated fatty acids in milk fat (C18:1 to C18:3) in goats fed T3 ration have potential benefits to human health as it prevent the cardiovascular diseases. T3 ration showed decrease in the total saturated fatty acids by 15.26%, in comparison with T1. Also, Huang *et al.* (2008)found that lower proportion of C18:0 in milk fat of cows fed linseed oil and fish oil could be ascribed to an incomplete biohydrogenation process in the rumen of either C18:3n-3 or C18:1 to C18:0, resulting in increased C18:3n-3, C18:1 isomers in milk. Therefore, as increase in the roughage ratio proportionally decreases the concentrate contents, hence positively affect the availability of unsaturated fatty acids that used by the mammary gland in the synthesis of milk lipids (Chilliard *et al*., 2001b and Mesquita *et al*., 2008).

Dairy cows on herbage-based diets derive fatty acids for milk fat synthesis from the diet and rumen microorganisms (400–450 g/kg), from adipose tissues (< 100 g/kg), and from de novo biosynthesis in the mammary gland (about 500 g/kg) (Kalač and Samkova, 2010). The relative contributions of these FA sources to milk fat production are highly dependent upon feed intake, and diet composition. High intake of concentrate diet is associated with a higher level of de novo synthesis resulting in more saturated milk fat.

Growth performance of suckling kids

The Changes in suckling kids weights as affected by dams fed different R:C ratios throughout the experimental period (90 days) (Table 6). Data revealed that kids of (T1) group significantly (P<0.05) had heavier birth weight followed by T2 then T3 group. Daily gain and kids' weight was in favor to high concentrate ration (T1) than T2 and T3. This result because milk yield, protein % and protein yield of milk were higher with the high concentrate ration (T1) than the lower concentrate diets. Accordingly, growth performance of suckling kids likely respond to protein intake more than fat yield (intake) of the milk. Bhuiyan et al. (1996) suggested that higher level of concentrate supplementation increased daily live weight gain of kids.

In conclusion, high concentrate diet could have better milk yield and protein %, while have less fat % and yield, compare to high roughage diet. Suckling kids could benefit more gain with dams fed high concentrate diet. Low roughage diet also develop better fat profile in milk. However, more studies needed to identify the best economic combination for feeding dairy goats.

Table (6): Changes in suckling kids weights (kg) during the experiment (90 days).

Items	**Periods (days)**							
	0	15	30	45	60	75	90	**Av Daily gain(g)**
T1	4.00[a]	7.50[a]	11.00[a]	12.67[a]	14.50[a]	15.33[a]	16.33 [a]	137
T2	3.33[b]	7.17[a]	8.67[b]	10.50[b]	13.50[ab]	14.00[b]	14.83[ab]	127
T3	3.17[b]	7.00 [a]	7.67 [c]	9.33 [c]	12.67 [b]	13.00 [c]	14.17 [b]	122
±SE	0.28	0.44	0.56	0.51	1.31	0.36	1.39	5.36

[a,b .. c]**: Means of different superscripts in the same row are significant (P<0.05) different.**

* T1: Control ration (50% CFM +50% BH), T2: (45% CFM +55% BH), T3: (40% CFM +60% BH)

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تأثير نسبة العلف المركز الى العلف الخشن، مع وجود زيت عباد الشمس فى العليقة، على معاملات الهضم ، تخمرات الكرش، انتاج اللبن وتركيبه والمحتوى من الاحماض الدهنية للماعز الحلابة

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تهدف هذه الدراسة إلى تقييم تأثير نسب مختلفة من العلف المركز الى العلف الخشن في علائق الماعز الحلابة على معاملات الهضم والإنتاج و التركيب الكيماوى للبن ومحتواه من الأحماض الدهنية المشبعة والغير مشبعة . تم اختيار ثماني عشر عنزة حلابةمتوسط وزن 34 كجم قسمت الى ثلاثة مجموعات متماثلة (ستة حيوانات بكل مجموعة) لمدة 90 يوم وتم تغذية جميع الحيوانات على علف مركز و دريس برسيم بنسب مختلفة وكانت النسب كالتالى المجموعة الأولى (الكنترول) 50:50و المجموعة الثانية 55:45 و المجموعة الثالثة 60:40مادة مركزة لمادة خشنة وقد تم إضافة زيت عباد الشمس بنسبة 3% من المادة الجافة المأكولة لجميع العلائق وقد روعى أن تكون العلائق متساوية فى الطاقة والبروتين

أوضحت النتائج ان هناك انخفاض معنوى في المادة الجافة المأكولة عند زيادة مستوى الخشن (حوالى 26,90و 41% للمعاملات T2 و T3 مقارنة بالكنترول) وايضا لا يوجد هناك فرق معنوى بين المعاملات فى معدل هضم المادة الجافة بينما هناك ارتفاع فى معدل هضم المادة العضوية و مستخلص الايثير فى المعاملة التى تحتوى على نسبة عالية من المركز. جميع معاملات الهضم ارتفعت مع زيادة نسبة المركز عن الخشن بينما لا توجد هناك اختلافات معنوية بين T2 وT3 ومن ناحية اخرى لم تتاثر قيم المركبات الكلية المهضومة باختلاف تركيز العلف المركز للخشن بينما حدث انخفاض بكمية البروتين المهضوم عند زيادة نسبة الخشن عن المركزو أيضا لم يوجد فرق معنوى فى إنتاج اللبن المعدل الدهن 4% بين المجموعات ولكن يوجد اختلافات معنوية فى التركيب الكيماوي الخاص باللبن .واظهرت النتائج أيضا ان زيادة نسبه الخشن أدى الى انخفاض قيمه pHوالمحتوى من الاحماض الدهنية الطيارة وخصوصا نسبة حمض الاسيتيك مقارنتا بحمض البروبيونيك مع الزيادة فى نسبه الامونيا.كما وجد ان الغذاء المرتفع في نسبة الخشن، وخاصة مع وجود زيت عباد الشمس،ادى الى زيادة المحتوى من الأحماض الدهنية الغير مشبعة، اللينوليك واللينولينك حيث كانت 69 و 50% على التوالى ولم تحدث اى تاثيرات سلبية على صحة الحيوانات او كفاءتها الإنتاجية.