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EFFECT OF DIETARY INCLUSION OF WHOLE SUNFLOWER SEEDS ON FEEDING LACTATING ZARAIBI GOATS: I. ON DIGESTIBILITY COEFFICIENTS, RUMEN FUNCTION AND LIVE BODY WEIGHT

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ABSTRACT

A total of 30 Zaraibi lactating goat does (42.46±0.86 kg LBW and 4-5 years of age) were used in this study to investigate the effect of partially replacing concentrate feed mixture (CFM) containing cotton seed cake in the diet by two levels of sunflower seeds (SFS), being 15 % (G_2) and 20 % (G_3) on chemical composition, digestibility coefficients, rumen liquor parameters and live body weight of Zaraibi goats. At the last month of pregnancy, goat does were divided into three similar groups (10 in each). Goat does in the 1st group (G_1, control) were fed a basal ration containing 25% CFM and 75% fresh berseem (FB) during winter feeding or 50% CFM and 50% berseem hay (BH) during summer feeding. During an experimental period from 30 d pre-partum up to the next mating season, does in all groups were biweekly weighed. Two digestibility trials were conducted during the suckling period (winter feeding) and mid of the lactation period (summer feeding). Results revealed that contents of EE and OM % were higher, while contents of DM, CP and ash were lower in SFS treatment groups than in control group. However, contents of CF and NFE % were nearly similar in SFS and CFM treatment groups. ♂Winter feeding was characterized by higher CP (about 15 *vs*. 13%) and lower CF (about 12 *vs*. 16%) than summer feeding. By increasing level of SFS from 15 to 20 %, only digestibility coefficients (DCs) of DM, OM and EE increased ($P<0.05$) during winter feeding; however, DCs of all nutrients, except of CP, increased ($P<0.05$) during summer feeding. During the winter and summer feeding, nutritive value of experimental rations as TDN increased ($P<0.05$) by increasing level of SFS, while nutritive values as TDN or DCP was higher ($P<0.05$) for both SFS levels, being the highest for 20 % SFS diet. **I**nclusion of both SFS-levels during winter feeding increased ($P<0.05$) pH value and decreased concentration of VFAs, but did not affect ammonia concentration in ruminal liquor (RL). Only 20 % SFS diet decreased ($P<0.05$) pH value and increased concentration of VFAs and ammonia in RL sampled before or post-feeding during summer feeding. The differences in live body weight of does among the experimental groups and within each group were not significant ($P\geq0.05$) at different experimental periods. It could be concluded that replacing 20% of CFM by sunflower seed has beneficial effects on digestibility coefficient and nutritive values without marked change in rumen liquor parameters and goat performance.
Keywords: Goats, sunflower, digestibility, nutritive values, rumen, performance.

INTRODUCTION

Goat is one of the most important livestock species in rural areas. In Sudan, Pakistan, Turkey, Egypt and Tunisia researches showed that goats

are reared for their meat, milk or both meat and milk (Gaddour *et al.*, 2007; El-Hassan El-Abid *et al.*, 2008; Arain *et al.*, 2010 and Mousa, 2011).

Sunflower is popular with small-scale communal farmers because it is an easy crop to produce. The general practice is to plant sunflower and leave it to grow on its own with little inputs and weeding. Sunflower is known to be an efficient user of residual fertilizer because of its extensive root system (Chiduza *et al*., 1995). Therefore the crop does well in a rotation following a well-fertilized crop.

Protein is the most expensive feed ingredient in animal ration and there was always shortage in its supply particularly in developing countries. This shortage is very critical in both human and animal nutrition (Yagoub and Babiker, 2009). Traditionally, the farmers have been using cottonseed cakes for feeding their livestock as a source of vegetable protein and its prolonged use can affect the fertility of these animals (Zahid *et al.*, 2003). Earlier investigators (Ahmed *et al.*, 2004 and Garcia *et al.*, 2004) indicated that sunflower meal has good effect on performance; yet, the cost of sunflower meal based rations was the lowest.

To cover the required nutrients for goats, energy and protein of their feed should be increased, as these dairy animals have a small rumen capacity. Green fodders, including silage, high in fiber and/or water are low energy and protein components. On the other hand, grain, seed fats (sunflower, soybeans) contribute to increased energy intake of goats and flours of defatted oilseeds in the diet increase protein intake (Antunac *et al.*, 2001).

Ruminants have unique ability to utilize the fibrous material through anaerobic fermentation (Kibria *et al.,* 1991); therefore, sunflower seed meal (SFM) can be efficiently used as a sole source of supplemental protein for ruminants (Lardy and Anderson, 2002). Cottonseed cakes (CSC) are being traditionally used in the feed of dairy animals. However, limited supply and seasonal availability of CSC result in high price. On the other hand, SFM is cheaper protein source and can be used in ruminants feed supplements (Yunus *et al.*, 2004).

The present study was conducted to investigate the effect of partially replacing concentrate feed mixture (CFM) containing cottonseed cake in the diet with two levels of sunflower seed (15 and 20%) on chemical composition, digestibility coefficients, rumen liquor parameters and live body weight of Zaraibi goats.

MATERIALS AND METHODS

This study was carried out at Sakha Experimental Station, belonging to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, in cooperation with Department of Animal Production, Faculty of Agriculture, Mansoura University during the period from December 2008 to December 2010.

Animals and experimental groups:

Total of 30 local breed (Zaraibi) goats (42.46±0.86 kg LBW and 4-5 years of age) were used in this study. At the late stage of pregnancy (last

month of pregnancy, January 2009), goat does were divided into three similar groups (10 in each) according to their LBW and age. Goat does in the 1st group (G_1, control) were fed a basal ration contained 25% CFM and 75% fresh berseem (FB, *Trifloium alexanrium*) during winter feeding period or 50% CFM and 50% berseem hay (BH) during summer feeding period according to the NRC feeding requirements (NRC, 2001) for production of 1-2 kg milk/head/day. The CFM consisted of cotton seed cake, linseed cake, yellow corn, wheat bran, molasses, calcium chloride and common salt. The daily feed intake per doe composed of 1.250 kg CFM and 4 kg FB or 1.3 kg BH for each doe. In ration of the 2nd group (G_2) and 3rd group, 15 and 20% of CFM of the control ration was replaced by 15% and 20% SFS (*Halianthus annuus*) on DM basis, respectively.

After kidding, during the suckling period up to 90 d post-partum, does were suckled by their kids produced in each group. However, during milking period, machine milking was applied for all does. All does were kept under similar management conditions.

Experimental procedures:

During an experimental feeding period (from 30 d pre-partum up to the next mating season), does in all groups were biweekly weighed. Two digestibility trials were conducted during the experimental period to determine nutrients digestion coefficient and nutritive values of the experimental rations, during the suckling period (winter feeding) and mid of the lactation period (summer feeding). Three does from each group were chosen to determine digestibility coefficients and nutritive values of the experimental rations using acid insoluble ash (AIA) as a natural marker according to Van Keulen and Young (1977). Feces samples were taken from the rectum of each doe twice daily at 12 hour-interval during the collection period (5 days). Representative samples of the tested feedstuffs were taken at the beginning; middle and end of the collection period as well as samples of feces were taken to determine chemical analysis according to A.O.A.C. (1990).

During the digestibility trials, rumen liquor was obtained *via* rubber stomach tube using gentle mouth suction. Rumen liquor was sampled before feeding and at 3 and 6 hours after feeding. The samples were filtered through two layers of surgical gauze. Values of ruminal pH were determined using a pH meter (SA-720, Orion Research, Boston, MA) immediately after sampling. Then, 1 ml of saturated $HgCl_2$ solution was added to inhibit microbial fermentation. After acidification of rumen liquor samples using concentrated orthophosphoric acid and 0.1 N hydrochloric acid, concentration of volatile fatty acids (VFAs) was determined by steam distillation methods as described by Warner (1964). However, determination of NH_3-N concentration was carried out according to Conway and O'Malley (1957).

Statistical analysis:

The data were subjected to statistical analysis using General Linear Models Procedures (GLMP) adapted by SPSS (2004) for windows for user's guide with one-way ANOVA. Duncan test within program SPSS was done to determine the level of significance between the means.

RESULTS AND DISCUSSION

Chemical composition for tested rations:

Data presented in Table (1) show that contents of EE and OM were higher, while contents of DM, CP, and ash were lower in SFS than in CFM. Increasing OM in SFS as compared to CFM was due to ash content in SFS and CFM. However, contents of CF and NFE were nearly similar in SFS and CFM. The present results indicated that all experimental rations during winter or summer feeding were isonitrogenous and isocaloric, but winter feeding was characterized by higher CP (about 15 *vs.* 13%) and lower CF (about 12 *vs.* 16%) than those of summer feeding (Table 1). The calculated chemical composition is in agreement with the chemical composition of experimental rations obtained by Landau *et al.* (1995) in Damascus and Mamber goats browsing a Mediterranean shrub land. Average crude protein (CP) in treated groups was about 15 g/kg DM with feeding fresh berseem and 13.0 g/kg DM with feeding berseem hay which had enough N for microbial activities in rumen (Norton *et al.*, 1994).

Digestibility coefficients:

During winter feeding, data in Table (2) indicated that only digestibility coefficients of DM, OM and EE were significantly increased by increasing level of SFS from 15 to 20%. However; during summer feeding, digestibility coefficients of DM, OM, CP, NFE, except CF were significantly ($P<0.05$) increased by increasing level of SFS. During the winter and summer feeding, nutritive value of experimental rations as TDN showed significant ($P<0.05$) increase by increasing level of SFS, being the highest for ration containing 20% SFS. However, the effect of SFS diets on nutritive values as TDN and DCP was significant ($P<0.05$) during summer feeding, being also the highest for 20% SFS diet (Table 2). These results indicated significant ($P<0.05$) improvement in digestibility coefficients of most nutrients and in nutritive values as TDN and DCP of ration, when 20% of CFM were replaced by SFS, in particular during summer feeding with berseem hay.

Table (1): Chemical composition of different feed ingredients and experimental rations.

Item	DM (%)	Chemical composition (%) on DM basis					
		OM	CP	CF	EE	NFE	Ash
Feed ingredients:							
CFM	89.95	87.76	14.40	7.08	2.40	63.88	12.24
SFS	85.65	96.91	11.91	8.08	14.66	62.26	3.09
FB	17.06	88.59	16.65	20.98	2.35	48.61	11.41
BH	86.19	89.19	12.65	27.85	3.41	45.29	10.81
Calculated composition of winter ration (R):							
R_1 (G_1)	34.41	88.07	15.24	12.32	2.37	58.14	11.93
R_2 (G_2)	34.26	89.43	14.86	12.47	4.20	57.90	10.57
R_3 (G_3)	34.21	89.90	14.74	12.51	4.82	57.83	10.10
Calculated composition of summer ration (R):							
R_1 (G_1)	88.27	88.36	13.63	16.09	2.83	55.81	11.64
R_2 (G_2)	87.91	89.73	13.25	16.24	4.66	55.58	10.27
R_3 (G_3)	87.80	90.19	13.03	16.28	5.28	55.6	9.81

CFM: Concentrate feed mixture. SFS: Sun flower seeds. FB: Fresh berseem. BH: Berseem hay.

It is of interest to note that digestibility coefficients of CF were not affected significantly by level of SFS during winter or summer feeding. It was found that fiber digestibility is adversely affected by dietary fat supplementation (Jenkins, 1993). In this line, Schauff *et al.* (1992) found that feeding flaxseed compared with sunflower seed could result in less oil being released in the rumen, which would limit the negative effect of oil on fiber digestion. Also, it was observed that digestibility coefficients of all nutrients were higher during winter than summer feeding, except for EE digestion, which showed an opposite trend. Such finding was mainly related to differences in digestibility coefficients of nutrients of FB or BH during winter and summer feeding, respectively. This difference may be due to feed intake and that whole SFS did not contained more non-nutritive lipid (Grummer and Carroll, 1988 and Schauff and Clark, 1989). Also, Min *et al.* (2005) found that the response to oil seeds supplementation can be high if forage quality is low and minimal if the forage quality is high as in the FB and BH.

Table (2): Average digestibility coefficients of nutrients and nutritive value (TDN and DCP) of the experimental rations (R).

Item	Winter feeding			Summer feeding		
	R_1 (G_1)	R_2 (G_2)	R_3 (G_3)	R_1 (G_1)	R_2 (G_2)	R_3 (G_3)
Digestibility coefficients (%) of nutrient:						
DM	68.94^{c}	71.97^{b}	74.60^{a}	63.98^{c}	68.26^{b}	70.06^{a}
OM	68.94^{c}	71.97^{b}	74.60^{a}	63.98^{c}	68.26^{b}	70.06^{a}
CP	64.98	69.91	72.15	60.03^{b}	67.36^{a}	68.03^{a}
CF	54.19^{b}	58.91^{a}	62.87^{a}	54.59	54.33	54.13
EE	63.39^{b}	77.77^{a}	81.70^{a}	76.30^{b}	86.74^{a}	85.98^{a}
NFE	73.32	74.90	77.16	67.02^{b}	70.99^{a}	73.69^{a}
Nutritive values (%):						
TDN	62.59^{c}	68.45^{b}	71.99^{a}	59.23^{c}	66.30^{b}	68.86^{a}
DCP	9.90	10.38	10.63	8.18^{b}	8.92^{a}	8.86^{a}

a, b and c: Means within the same row with different superscripts for each feeding system are significantly different at (P<0.05).

El-Sanafawy (2008) found that inclusion of SFS at levels of 5 or 10% did not affect digestibility coefficients of nutrients, except that of EE, which significantly (P<0.05) improved with rations containing both SFS levels during winter or summer feeding as compared to the control ration. The present results herein indicated beneficial effects of increasing dietary level of SFS more than 10% on digestibility coefficients, whereas increasing level of SFS to 15 or 20% significantly (P<0.05) increased most nutrients in particular during summer feeding. However, Aboul-Fotouh *et al.* (1999) concluded that when SFS was used to replace 30% of CFM (representing 12% of total DM), digestibility coefficients of nutrients and nutritive values (TDN and DCP) were not significantly affected by oil seeds inclusion, which may suggest that increasing dietary level of SFS up to 30% may have adverse effects on digestion within the rumen. However, Park *et al.* (1983) found that increasing whole SFS (0, 10, 20 and 30%) in rations improved digestibility of dietary components fed to Holstein heifers.

On the other hand, no differences in digestion of DM or CP were found between growing calves fed SFM or SBM (Richardson *et al.*, 1981).

Also, Anderson *et al.* (1984) reported that DM digestibility was not significantly differed among cows fed rations contained 10% whole cotton seeds, 5% extruded soybean or 12% whole sunflower seeds. Moreover, Drackley *et al.* (1985) found that digestibility coefficients of DM, OM, CP and EE did not significantly differ for steers fed diet contained soybean meal + sunflower seeds plus calcium hydroxide compared to those fed soybean meal + sunflower seeds plus limestone.

In accordance with the present results on goats, Zhang *et al.* (2007) reported that oilseed supplementation had no effect on total tract fiber digestibility of lactating ewes. Ewes fed SFS had a higher ($P<0.05$) DM digestibility than those fed canola seed (CS) or control. El-Bedawy *et al.* (1994) found that feeding full fat sunflower or sunflower oil plus sunflower meal rations increased ($P<0.05$) cow digestibility of EE but had no significant effect on the other nutrient digestibility's. Aboul-Fotouh (1995) reported that oil seed supplemented diets tended to be higher in EE digestibility than other diets. The observed improve in digestibility coefficients of SFS rations as compared to the control may suggest that oilseeds are potential feed ingredients to control protozoa populations in ruminants and to increase the efficiency of dietary protein utilization (Ivan *et al.,* 2001).

Rumen liquor parameters:

Data in Table (3) show that inclusion of SFS at both levels (15 and 20%) in rations of goats during winter feeding significantly ($P<0.05$) increased pH value and decreased concentration of VFAs, but did not affect ammonia concentration in ruminal liquor (RL) sampled before or post-feeding. On the other hand, only inclusion of SFS at a level of 20% in rations of goats during summer feeding significantly ($P<0.05$) decreased pH value and concentration of VFAs but increased ammonia concentration in RL sampled before or post-feeding.

Table (3):Effect of feeding experimental rations on rumen liquor parameters at each of sampling time.

Time (h)	Winter feeding			Summer feeding		
	G_1	G_2	G_3	G_1	G_2	G_3
Ruminal pH value:						
0 h	7.25	7.35	7.26	7.19	7.34	7.32
3 h	6.18^{b}	6.69^{a}	6.65^{ab}	6.76^{a}	6.31^{ab}	6.08^{b}
6 h	6.34^{b}	7.79^{a}	6.51^{ab}	6.89^{ab}	6.93^{a}	6.83^{b}
Concentration of VFAs (meq/100 ml):						
0 h	14.50^{a}	11.40^{b}	10.82^{b}	11.64^{a}	9.41^{b}	9.27^{b}
3 h	18.15^{a}	16.56^{b}	14.86^{c}	16.53^{a}	13.77^{b}	13.55^{b}
6 h	16.40^{a}	14.71^{b}	12.67^{c}	14.51^{a}	10.95^{b}	10.57^{b}
Ruminal NH_3-N concentration (mg/100 ml):						
0 h	21.09	21.48	22.40	19.13	19.41	21.09
3 h	25.57	26.02	27.06	22.12^{b}	23.80^{a}	24.59^{a}
6 h	20.80	21.40	21.65	19.88^{b}	21.18^{a}	21.46^{a}

a, b and c: Means within the same row with different superscripts for each feeding system are significantly different at ($P<0.05$).

Generally, all rumen parameters studied showed similar trend of change in all groups with sampling times. Considering the trend for some

rumen parameters at 0, 4 and 7 h post-feeding, it can be noticed that acetate and propionate were increased in rumen fluid at 4 and 7 h after feeding, while pH and ammonia tended to decrease by 4 h after feeding (Badamana and Sutton, 1992). Based on these results, inclusion of SFS by both levels adversely affected pH and VFAs production in rations containing FB or BH. However, dietary inclusion of 20% SFS significantly ($P<0.05$) increased ammonia concentration with diets contained BH.

In this respect, Jenkins (1993) reported that vegetable oil often depress animal fiber digestion. Also, the present results showed insignificant effect of SFS diets on CF digestibility coefficients during winter and summer feeding. In accordance with the present results, El-Sanafawy (2008) on zaraibi goats, revealed that diets contained sunflower seed at 5 or 10% reduced pH value of rumen liquor (RL) to 6.59 and 6.41 as compared to 7.10 in the control, respectively. However, concentration of ammonia-N increased to 23.42 and 24.32 mg/100 ml RL as compared to 22.31 mg/100 ml RL in the control, respectively. Yet, concentration of VFA decreased to 14.68 and 13.86 meq/100 ml RL as compared to 16.60 meq/100 ml RL in the control. Such findings may indicate marked effect of SFS as a source of protein and energy rather than their levels on rumen fermentation. These findings could be explained by the negative effect of free fatty acids on fermentation, which might be attributed to defaundation that could increase duodenal bacterial-N flow by decreasing protozoal predation of ruminal bacteria and competition for substrates between these microorganisms (Jopuany and Ushida, 1999 and Khattab *et al.*, 2001). Fierez *et al.* (2003) and Boeckaert *et al.* (2004) found that the reduction in TVFA's concentration might be due to lower cellulose digestibility. Also, Kitessa *et al.* (2001) and Jones *et al.* (2003) reported that a reduction in TVFA's could also be related to the reduced feed intake. Kucuk *et al.* (2004) reported that total ruminal VFA concentrations changed (cubic, $P=0.01$) with increased dietary soybean oil by decreasing by 7.4% when soybean oil was increased from 0 to 3.2%, then increasing by 20.5% when soybean oil was increased to 6.3%, and finally decreasing by 32.2% when dietary soybean oil was increased to 9.4%. The most pronounced effects on VFA concentration occurred with the 6.3% soybean oil diet.

Live body weight:

Data presented in Table (4) show that the differences in live body weight (LBW) among the experimental groups were not significant at late pregnancy (30 d pre-partum), during suckling period (0 – 90 d post-partum) and even during milking period (90-225 d). Also, there was a similar trend of changes in LBW of does within each group at different experimental periods. Does in all groups showed marked reduction in LBW between 30 d pre-partum and 15 d postpartum. The sharp decrease in LBW resulted from kidding and removal of fetus and its attachments (embryonic membranes and fluids). Similar to the present results, the negative correlation between milk production and body weight changes was reported on Zaraibi does fed diets supplemented with different types of calcium salt fatty acids (CSFA) (Hassan *et al.,* 2012) or fed diets contained 5 or 10% SFS.

Table (4): Effect of feeding experimental rations on live body weight (kg) of does during pre- and post-partum and milking periods (means ± SE) .

Period	Experimental group			P-value
	G_1	G_2	G_3	
Pre-kidding				
30 d pre-partum	47.2±1.71	48.0±1.63	48.8±1.20	0.481
Post-partum period (suckling period):				
15 days	36.0±1.55	37.8±2.13	38.0±2.70	0.127
30 days	35.8±1.37	37.5±1.86	37.7±1.07	0.916
45 days	34.5±1.15	36.9±1.47	36.3±1.66	0.927
60 days	35.4±0.66	37.0±1.53	37.7±1.10	0.369
75 days	35.3±1.12	37.5±1.87	38.4±0.69	0.530
90 d (weaning)	34.3±1.19	37.1±1.50	38.6±1.07	0.417
Milking period:				
120 days	35.0±1.05	37.4±1.44	38.2±1.03	0.561
135 days	34.0±1.22	36.0±1.36	38.4±0.92	0.339
150 days	34.9±1.29	36.1±1.47	38.2±0.90	0.274
165 days	34.2±1.24	36.3±1.07	37.3±0.91	0.997
180 days	33.7±1.15	35.4±1.77	38.3±0.93	0.577
195 days	34.8±1.20	36.0±1.55	38.7±0.75	0.679
210 days	35.8±1.48	36.8±1.38	38.7±0.90	0.564
225 days	37.6±1.32	38.1±1.43	39.7±0.95	0.803

Also, Zambom *et al.* (2003) revealed a 16.42 to 20.72% reduction in body weight of ewes had occurred after lambing. However, during suckling and milking periods, they severed from slight loss in LBW due to milk production. During the physiological stress of milk production particularly during the peak of lactation, goats tended to have no increase or may loss of body weight (Dapoza *et al.*, 1999 and Olsson *et al.*, 1999). They indicated that animals did not gain weight or may lose weight during lactation, especially up to peak of lactation. Morand-Fehr *et al.* (1992) had already analyzed variations in body reserves in goats during a cycle of reproductive and during the growth period, methods of assessing them, the relationships between body condition and goat performance and various uses of body conditions. A body condition score method based on body palpations is difficult to work out in goats because of a lack of subcutaneous adipose tissue in this species. Djibrillou *et al.* (1998) observed continued loss of body weight in goats throughout lactation in Red Sokoto goat in Niger Republic, and cotton seed supplementation did not prevent weight loss throughout eight-week long lactation. Recently, Otaru *et al*. (2011) found that the weight loss of goats was numerically more with higher levels of palm oil supplementation which might have been due to lower DM and hay intake.

In accordance with the present results in other species, Richardson *et al.* (1981) found no differences in growth performance between growing calves fed SFM or SBM. In ewes, El-Shahat and Abo-El Maaty (2010) identified that dietary supplementation of CSFA enhanced body growth as indicated by increased final body weight and body condition score. However, Purushothaman *et al*. (2008) found non-significant effect of feeding ration containing palm oil on average adjusted values for body weight gain/day. In cows, Schauff and Clark (1989) observed similar weight loss and attributed it

to decreased DM intake, while in ewes; it was associated with decreased forage intake (Casals *et al.,* 2006).

It could be concluded that replacing 20% of CFM by sunflower seeds has beneficial effects on digestibility coefficient and nutritive values without marked change in ruminal liquor parameters and goat performance in Zaraibi lactating goats.

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تأثير التغذية على بذور دوار الشمس الكاملة للماعز الزرايبى الحلابة:
١- على معاملات الهضم، ووظائف الكرش والوزن الحي

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استخدم ٣٠ معزة زرايبى حلابة (متوسط وزن الجسم الحى ٤٢.٤٦ ± ٠.٨٦ كجم ، عمر ٤-٥ سنوات) فى هذه التجربة لدراسة تأثير إحلال جزء من العلف المركز المحتوى على بذور القطن في النظام الغذائي بمستويين من بذور دوار الشمس الكاملة [١٥ % (ج٢) و ٢٠ % (ج٣)] على التركيب الكيميائي، معاملات الهضم، وقياسات سائل الكرش ووزن الجسم الحى للماعز الزرايبى. اخذت الماعز في الشهر الأخير من الحمل وقُسّمت إلى ثلاث مجموعات متماثلة (١٠ ماعز لكل منها). غُذيت الماعز فى المجموعة الأولى (ج١ ،ضابطة) على ٢٥ % علف مركز و٧٥ % برسيم أخضر خلال فصل الشتاء أو ٥٠ % علف مركز و٥٠ % دريس برسيم أثناء فصل الصيف. خلال فترة التجربة بداية من ٣٠ يوماً قبل الولادة حتى بدء موسم التزاوج التالى تم وزن الماعز كل أسبوعين وأُجريت تجربتين هضم ، الأولى خلال فترة الرضاعة حوالى ٩٠ يوما (التغذية في فصل الشتاء) والأخرى فى منتصف فترة الحليب (التغذية في الصيف). أوضحت النتائج أن محتوى العلف من نسبتى المادة العضوية والمستخلص الإيثيرى كان أعلى، في حين أن نسب المادة الجافة والبروتين الخام والرماد كانت أقل في مجموعتي بذور دوار الشمس الكاملة عن تلك المجموعة الضابطة. بينما كانت نسب المستخلص الخالى من الآزوت والألياف الخام تقريبا متساوية فى مجموعتى بذور دوار الشمس الكاملة والمجموعة الضابطة. تميزت التغذية فى فصل الشتاء بإرتفاع البروتين الخام (١٥ مقابل ١٣%) وإنخفاض الألياف الخام (١٢ مقابل ١٦٪) عن تلك المغذاة فى فصل الصيف. وبزيادة مستوى إحلال بذور دوار الشمس الكاملة من ١٥ الى ٢٠% فإن معاملات هضم المادة الجافة والمادة العضوية والمستخلص الاثيرى قد زادت معنويا خلال التغذية فى فصل الشتاء ، بينما زادت معاملات الهضم (ما عدا للبروتين الخام) معنويا خلال التغذية فى فصل الصيف. خلال التغذية فى فصلى الشتاء والصيف زادت القيم الغذائية كمجموع مواد غذائية مهضومة وكبروتين خام مهضوم لكل من مستويى التغذية على بذور دوار الشمس الكاملة وكانت ٢٠% هى الأعلى. وكذا فإن إحلال مستويى التغذية على بذور دوار الشس الكاملة خلال فصل الشتاء زاد معنويا من قيمة الأس السالب لتركيز أيون الهيدروجين وانخفض تركيز الأحماض الدهنية الطيارة، ولم يكن لها أى تأثير على مستوى تركيز الأمونيا في سائل الكرش سواء قبل أو بعد التغذية. المجموعة (ج٣) انخفضت فيها قيم الأس السالب لتركيز أيون الهيدروجين معنويا وزاد تركيز الأحماض الدهنية الطيارة فى سائل الكرش سواء قبل أو بعد التغذية خلال التغذية فى فصل الصيف. لم يكن هناك اختلافات معنوية فى وزن الجسم بين المجموعات خلال فترات التجربة المختلفة. وتوصى الدراسة بأن إحلال بذور دوار الشمس الكاملة بنسبة ٢٠% من العليقة المركزة قد حسنت من معاملات الهضم والقيم الغذائية بدون التأثير على خصائص سائل الكرش وأداء الماعز الزرايبى الحلابة.

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