

EVALUATION OF DRIED SUGAR BEET PULP IN FEEDING SHEEP

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ABSTRACT

Six metabolism trials were carried out using 3 Barki rams (in each) with average body weight of 55 ± 0.58 kg and aged 3 years to evaluate the digestibility coefficients and nutritive values of the mixtures of dried sugar beet pulp with different roughages as follows:-

I- 75% dried sugar beet pulp + 25 % berseem hay.

II- 75% dried sugar beet pulp + 25 % wheat straw.

III- 75% dried sugar beet pulp + 25 % rice straw.

V- 50% dried sugar beet pulp + 50 % berseem hay.

IV- 50% dried sugar beet pulp + 50 % wheat straw.

VI- 50% dried sugar beet pulp + 50 % rice straw.

The obtained results showed that dried sugar beet pulp is high in CF (24.50%) and NFE (57.10%), while it is low in CP (10.40%). The digestibility of all nutrients, nutritive values and nitrogen balance were significantly ($P < 0.05$) higher with berseem hay compared to wheat and rice straws.

Ruminal pH value increased with increasing the level of roughages and decreasing the level of dried sugar beet pulp. Ration contained rice straw showed the higher pH value, while those contained berseem hay had the lower values. The highest concentrations of TVFA's and ammonia-N were recorded with berseem hay compared with wheat and rice straws. These values decreased with increasing the level of roughage and decreasing the level of dried sugar beet pulp ($P < 0.05$). There were significant differences in the total count of erythrocytes and leukocytes as well as in hemoglobin and globulin concentrations and ALT activity among the different treatments.

Keywords: Rams, Dried sugar beet pulp, Nutritive values, Ruminal activity and Blood constituents.

INTRODUCTION

The increase of high population rate in Egypt has led to an increase in demand for animal products, on the other hand the limited cultivated area made it difficult to provide the animals with their proper nutritional requirements to minimize this gap. Many attempts were made to find new feed sources especially from the industrial by products (Abou-Ward *et al.*, 1998). In Egypt, the area cultivated with sugar beet increased annually reaching about 168 thousand feddan in year 2005 and there are five factories (Kafar El-sheikh, Dakahlia, Abokorkas, Fayuom and west Noparia) produce large quantities of sugar beet pulp as by-product of sugar beet industry. However, beet pulp can be used for ruminant feeding in different forms (Abdelhamid, 1992). Sugar beet pulp is a good remainder because it is always available with suitable quantities in specified regions, which can be

easily collected and transported to the end users. Also, beet pulp contains suitable amount of digestible feeding materials and can be manufactured. In addition, beet pulp has high fiber content; it is an excellent digestible energy source for ruminants because of type of carbohydrate associated with the cell wall fraction. The high pectin content of beet pulp provides a readily available source of energy for microbial protein activity in the rumen. So, beet pulp is an excellent feed ingredient for ruminant diets because of its high fiber content, readily fermentable energy and potential value as a high by-pass protein (Metwally and Stern, 1989). Finally, sugar beet pulp is a palatable feedstuff for feeding animals (EL-Badawi and Abou Ward, 1996). The objective of the present work was to evaluate the mixtures of dried sugar beet pulp with some roughage in the rations of sheep and its effects on the digestibility and nutritive values as well as rumen fermentation parameters, nitrogen balance and blood profile.

MATERIALS AND METHODS

The current work was carried out at Sakha Animal Production Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture in co-operation with Department of Animal Production, Faculty of Agriculture, Kafr El-Sheikh University. Six digestibility and metabolism trials were carried out using 3 Barki rams (in each) with average body weight of 55 ± 0.58 kg and aged 3 years to evaluate the digestibility coefficients and nutritive values of the mixtures of dried sugar beet pulp with different roughages as follows:-

- I- 75% dried sugar beet pulp + 25 % berseem hay.
- II- 75% dried sugar beet pulp + 25 % wheat straw.
- III- 75% dried sugar beet pulp + 25 % rice straw.
- V- 50% dried sugar beet pulp + 50 % berseem hay.
- IV- 50% dried sugar beet pulp + 50 % wheat straw.
- VI- 50% dried sugar beet pulp + 50 % rice straw.

Rams were housed individually and offered the experimental mixtures in metabolism carts for 15 days as preliminary period followed by 7 days as collection period. The metabolism carts permitted total collection and separation of feces and urine. Tested feed was offered for rams in two equal meals daily at 8 a.m. and 4 p.m. While, the water was available all the day round in plastic buckets

Samples of the tested feeds were taken at the beginning, middle and end of the collection period, composted and dried in a forced air oven at 60 °C for 48 hours and then ground. Fresh feces for each ram was weighed daily during the collection period and representative sample (10% by weight) of each daily collection was taken and dried at 60 °C for 48 hours. The daily feces samples for each animal were thoroughly mixed and ground. Urine was collected for each ram during the collection period in plastic bucket containing sulfuric acid (10%) to prevent losses of ammonia-N. Daily urine volume was measured and samples (10% of volume) were taken in glass bottles and stored in a refrigerator for nitrogen determination. Representative samples of

feedstuffs and feces were chemically analyzed to determine DM, CP, CF, EE and ash as well as nitrogen in urine according to the methods of AOAC (1990).

The samples of rumen liquor were collected from each ram by using a stomach tube after 3 hours from the morning feeding on the seventh day of the collection period. The samples were filtered through a double layer of cheese cloth. The pH was determined directly using Orian 680 digital pH meter. The concentration of TVFA's was determined in rumen liquor by the steam distillation method (Warner, 1964) using markham microdistillation apparatus. The concentration of NH₃-N was determined using saturated solution of magnesium oxide distillation according to the method of AOAC (1990).

Blood samples were taken during the collection period at 3 hours post morning feeding from the jugular vein of rams by clean sterile needle in clean dry glass tubes using heparin as an anticoagulant. Each sample was divided into two parts; the first one was used for hemoglobin concentration as well as for counting red and white blood cells using a haemocytometer. The other part was centrifuged for 15 minutes at 4000 rotation per minute to obtain plasma. Blood plasma concentrations of total protein, albumin and urea as well as activity of AST and ALT were determined calorimetrically using commercial diagnostic kits (test-combination- Pasteur lap.). The obtained results were statistically analyzed using general linear models procedure adopted by SPSS for windows (1999) for one-way ANOVA. Also, Duncan test within program of SPSS was done to determine the degree of significance between the means.

RESULTS AND DISCUSSION

Chemical composition:-

The chemical composition of the tested feedstuffs and experimental diets is shown in Table (1). Dried sugar beet pulp is slightly higher in CF (24.50%) and NFE (57.10%), while it is low in CP (10.40%) and ash (6.45%) comparing with berseem hay. From the chemical composition of the dried sugar beet pulp, it could partially replace hay in the rations of ruminants. The OM contents of the experimental rations decreased with increasing the level of roughage and the low content was recorded with treatment VI containing 50% rice straw (85.11%). The contents of CP increased from 11.83 to 12.60% with increasing the level of berseem hay from 25 to 50%, while it decreased from 8.40 to 6.45% and from 8.27 to 6.25% with increasing the levels of wheat and rice straws from 25 to 50 % respectively. The content of CF is higher with rice straw (26.71 and 27.99%) compared with berseem hay (23.54 and 23.24 %) and wheat straw (24.63 and 24.88 %). The higher NFE content was recorded with wheat straw (55.62 and 55.69%) and the lower content was showed with rice straw (51.42 and 49.45 %), while with berseem hay had intermediate value (54.39 and 52.81 %).

Rations contained rice straw recorded the highest ash content (12.15 and 14.89 %), followed by wheat straw (9.81 and 11.46 %), while berseem

hay showed the least values (8.74 and 9.87 %). The values of chemical composition of dried beet pulp are within the values obtained by O'mara *et al.* (1997), Eweedah *et al.* (1999) and Abdelhamid (1992). They found that the chemical composition of dried beet pulp was 88.20-96.71 % DM, 93.30-95.02 % OM, 7.59-10.70 % CP, 0.80-1.80 % EE, and 4.98-6.70 % ash.

Table 1: Chemical composition of the tested feedstuffs and experimental rations.

Items	DM %	Composition of DM %					Ash
		OM	CP	CF	EE	NFE	
Tested feedstuffs:							
Dried sugar beet pulp	91.60	93.55	10.40	24.50	1.55	57.10	6.45
Berseem hay	90.45	89.10	13.45	23.95	1.45	50.52	10.90
Wheat straw	91.75	85.85	2.65	25.70	1.60	55.90	14.15
Rice straw	89.30	82.50	2.20	29.50	1.40	49.40	17.50
Experimental diets:							
I	91.00	91.26	11.83	23.54	1.50	54.86	8.74
II	92.18	90.20	8.40	24.63	1.55	56.65	9.81
III	90.42	87.85	8.27	26.71	1.45	51.91	12.15
IV	90.71	90.13	12.60	23.24	1.48	53.02	9.87
V	92.48	88.54	6.45	24.88	1.52	656.70	11.46
VI	89.84	85.11	6.25	27.99	1.42	49.60	14.89

I- 75% dried sugar beet+25% berseem hay. IV- 50% dried sugar beet + 50% berseem hay.
 II- 75% dried sugar beet + 25% wheat straw. V- 50% dried sugar beet p + 50% wheat straw.
 III- 75% dried sugar beet + 25% rice straw. VI- 50% dried sugar beet + 50% rice straw.

Feed intake:-

Average daily DM feed intake by rams (Table 2) differed significantly ($P<0.05$) among the different experimental treatments. The highest feed intake was recorded by berseem hay rations (1432.73 and 1372.10 g/day), followed by wheat straw (1299.73 and 1277.07 g/day), while rice straw showed the least values (1191.73 and 1106.97 g/day). The differences in feed intake may be attributed to the differences in palatability of the different supplemented roughages.

Digestibility coefficients:-

As shown in Table (2), the digestion of all nutrients were significantly ($P<0.05$) higher with berseem hay rations compared to wheat and rice straws. Mixture (I) contained 25% berseem hay recorded significantly ($P<0.05$) the highest digestion coefficients of DM, OM and NFE being 69.04, 71.03 and 75.24 %, respectively, while ration (IV) contained 50% berseem hay showed significantly ($P<0.05$) the highest digestion coefficients of CP, CF and EE being 66.50, 65.36 and 75.18 %, respectively. However, ration (VI) contained 50 % rice straw revealed significantly ($P<0.05$) the least digestion coefficients of DM, OM, CP, EE and NFE, which were 58.37, 61.16, 59.24, 67.45 and 66.31%, respectively while ration (III) contented 25% rice straw had significantly ($P<0.05$) the least CF digestibility (51.65 %). These results agreed with those obtained by Flachowsky *et al.* (1993) who fed weathers on diets with wheat straw: concentrate ratios of

100:0, 75:25, 50:50 and 0:100, using ground barley, ground maize and dried sugar beet pulp (DSBP) as concentrate source and found that high level of DSBP increased nutrients digestibility. However, Abdelhamid (1992) fed Rahmani rams on DSBP (250 g) plus BH (350 g) comparing with BH only (600 g/h/d) and found lower digestibility coefficients of OM and CF but better coefficients for CP.

Nutritive values:-

Nutritive values as shown in Table (2) expressed as TDN, DE and DCP differed significantly ($p < 0.05$) among the different experimental treatments. The high nutritive values were noticed with berseem hay rations, followed by wheat straw, while rice straw had the lowest values ($P < 0.05$). Moreover, on DM basis, the highest TDN (66.18%) and DE (2.92 M cal/ kg) were recorded with ration I, while ration IV had the highest DCP value (8.37%). However, ration VI had the lowest TDN (53.20%), DE (2.35M cal/kg) and DCP (3.70%). These results might be due to the higher digestion coefficient with berseem hay and the lower digestion with rice straw (Table 2). These results are in accordance with those obtained by Khalafalla (1999) and Mohsen *et al* (1999) they found that TDN value increased with increasing the level of DSBP in rations of sheep and Angora bucks, while DCP value were nearly similar.

Table 2: Average daily feed intake and nutrients digestibility coefficients of the experimental rations by rams.

Item	Experimental diets						MSE
	I	II	III	IV	V	VI	
Average feed intake (g/ day):							
As feed	1574.43 ^a	1409.99 ^b	1318.00 ^{bc}	1512.62 ^a	1380.91 ^b	1232.15 ^c	7.03
As DM	1432.73 ^a	1299.73 ^{bc}	1191.73 ^{de}	1372.10 ^{ab}	1277.07 ^{cd}	1106.97 ^e	6.60
Nutrients digestibility coefficients (% DM basis):							
DM	69.04 ^a	63.09 ^b	59.60 ^{bc}	68.06 ^a	62.11 ^{bc}	58.37 ^c	0.25
OM	71.03 ^a	64.95 ^b	63.30 ^b	70.15 ^a	63.00 ^b	61.16 ^b	0.23
CP	64.86 ^a	61.64 ^b	61.51 ^b	66.50 ^a	60.44 ^{bc}	59.24 ^c	0.15
CF	64.32 ^a	52.46 ^b	51.65 ^b	65.36 ^a	52.18 ^b	52.18 ^b	0.36
EE	72.47 ^b	71.99 ^b	68.55 ^c	75.18 ^a	70.96 ^b	67.45 ^c	0.16
NFE	75.24 ^a	70.79 ^{bc}	69.19 ^c	72.99 ^b	67.90 ^c	66.31 ^c	0.21
Nutritive values (DM basis):							
TDN %	66.18 ^a	59.68 ^b	56.85 ^b	64.62 ^a	57.12 ^b	53.20 ^c	0.27
DE Mcal / kg	2.92 ^a	2.63 ^b	2.51 ^b	2.85 ^a	2.52 ^b	2.35 ^c	0.03
DCP %	7.67 ^b	5.18 ^c	3.86 ^d	8.37 ^a	3.90 ^d	3.70 ^e	0.11

a, b, and c: Means in the same row with different superscripts differ significantly ($P < 0.05$).
 I- 75% dried sugar beet+25% berseem hay. IV- 50% dried sugar beet + 50% berseem hay.
 II- 75% dried sugar beet + 25% wheat straw. V- 50% dried sugar beet p + 50% wheat straw.
 III- 75% dried sugar beet + 25% rice straw. VI- 50% dried sugar beet + 50% rice straw.

Nitrogen balance:-

Data of nitrogen balance by rams are shown in Table (3). Rams fed ration contained 50% dried sugar beet pulp and 50% berseem hay recorded significantly ($P < 0.05$) the highest values of nitrogen intake, excretion in urine and feces and absorption (27.65, 12.14, 9.26 and 18.39 g/ day, respectively). However, rams fed 50% DSBP and 50% RS showed significantly ($P < 0.05$)

the least values (11.06, 3.25, 4.51 and 6.55 g/day, respectively). While, those fed 75% DSBP and 25% BH had significantly ($P<0.05$) the highest N-balance (6.64 g/day). However, those fed 75% DSBP and 25% RS had the least value (3.23 g/ day).

Rams fed ration VI (50% DSBP + 50% RS) showed significantly ($P<0.05$) the highest N- balance as a percentage of N- intake (29.86%) and those fed ration IV (50% DSBP + 50% BH) had the least value (22.62%). However, when N-balance expressed as % of N-absorbed, treatment IV had significantly ($P<0.05$) the highest value (66.50%) and treatment VI showed the least value (59.24%). These results are in agreement with those obtained by Salam (2000) who reported that N-excretion and balance (g/day) by lambs increased with increasing N-intake. Yet, Abdelhamid (1992) gave higher N-balance (10.3 g/ day) by Rahmani rams fed DSBP + BH than that reported herein.

Table 3: Nitrogen balance of the experimental rations by rams.

Item	Experimental diets						MSE
	I	II	III	IV	V	VI	
N-intake (g / day)	27.12 ^a	17.47 ^b	11.95 ^d	27.65 ^a	13.18 ^c	11.06 ^d	0.39
Feces- N (g / day)	9.53 ^a	6.70 ^b	4.60 ^d	9.26 ^a	5.21 ^c	4.51 ^d	0.12
Urine- N (g / day)	10.95 ^b	6.26 ^c	4.12 ^d	12.14 ^a	4.15 ^d	3.25 ^e	0.20
Absorbed- N (g / day)	17.59 ^b	10.77 ^c	7.35 ^d	18.39 ^a	7.96 ^d	6.55 ^e	0.27
N-balance (g / day)	6.64 ^a	4.48 ^b	3.23 ^d	6.25 ^a	3.81 ^c	3.30 ^d	0.08
N-balance % of N intake	24.49 ^c	25.66 ^{bc}	27.03 ^d	22.62 ^d	28.92 ^a	29.86 ^a	0.15
N-balance % of N absorbed	64.86 ^a	61.64 ^b	61.51 ^d	66.50 ^a	60.44 ^b	59.24 ^c	0.15

a, b, c, d and e: Means in the same row with different superscripts differ significantly ($P<0.05$).

I- 75% dried sugar beet+25% berseem hay. IV- 50% dried sugar beet + 50% berseem hay.
 II- 75% dried sugar beet + 25% wheat straw. V- 50% dried sugar beet p + 50% wheat straw.
 III- 75% dried sugar beet + 25% rice straw. VI- 50% dried sugar beet + 50% rice straw.

Rumen activity:-

Results of rumen activity of rams fed the diets contained dried sugar beet pulp with different roughages are shown in Table (4). Ruminal pH value increased with increasing the level of roughages and decreasing the level of DSBP. Also, rations contained rice straw showed the higher pH values, while those contained berseem hay had the lower values. Ration contained 50% DSBP and 50% RS recorded significantly ($P<0.05$) the highest ruminal pH value (6.97), while ration contained 75% DSBP and 25% BH had the least value (5.43).

The highest ruminal NH_3-N concentration was recorded with berseem hay (23.05 and 22.91 mg/100ml) followed by wheat straw (17.25 and 14.89 mg/100ml), while rice straw showed the least concentration (15.47 and 12.87 mg/100ml) and the differences were significant ($P<0.05$). Moreover, ruminal NH_3-N concentration tended to decrease with decreasing the level of dried sugar beet pulp and increasing the level of roughages. These results agreed with those obtained by Rouzbehan *et al* (1996) who found that ruminal NH_3-N concentration increased with increasing the level of sugar beet pulp in the ration of lambs.

Table 4: Rumen activity of rams fed the experimental rations.

Item	Experimental diets						MSE
	I	II	III	IV	V	VI	
pH	5.43 ^d	5.93 ^c	6.03 ^c	6.57 ^o	6.83 ^{ab}	6.97 ^a	0.03
NH ₃ -N (mg / 100 ml)	23.05 ^a	17.25 ^b	15.47 ^{bc}	22.91 ^a	14.89 ^{bc}	12.87 ^c	0.24
TVFA's (meq / 100 ml)	13.26 ^a	11.04 ^{ab}	11.60 ^{ab}	10.27 ^{bc}	8.73 ^{cd}	7.87 ^d	0.12

a, b, c and d: Means in the same row with different superscripts differ significantly (P<0.05).

I- 75% dried sugar beet+25% berseem hay. IV- 50% dried sugar beet + 50% berseem hay.
 II- 75% dried sugar beet + 25% wheat straw. V- 50% dried sugar beet p + 50% wheat straw.
 III- 75% dried sugar beet + 25% rice straw. VI- 50% dried sugar beet + 50% rice straw.

Blood Parameters:-

Average values of total erythrocytes count, total leukocytes count and hemoglobin (Hb) concentration for different dietary treatments are presented in table (5). Results revealed that there were no significantly differences (P<0.05) in the total count of erythrocytes among the different dietary treatments and ranged from 6.17 to 7.46 x 10⁶/ml. These results agree with the values obtained by Eweedah (1986).

There were significant (P<0.05) differences in the total count of leukocyte among the different treatments. Treatment I (25% berseem hay) recorded significantly (P<0.05) the highest leukocyte count (12.90 x10³/ ml). These results tended to be higher than the values obtained by Eweedah (1986) who found that the total leukocyte count in blood of buffalo calves fed rations contained sugar beet pulp ranged from 9.55 to 10.25 x 10³/ml.

Table 5: Blood parameters of rams fed the different rations.

Item	Experimental diets						MSE
	I	II	III	IV	V	VI	
RBC (X 10 ⁹ / ml)	7.23	7.46	7.38	6.94	6.17	6.67	0.19
WBC (X 10 ⁶ / ml)	12.90 ^a	11.67 ^{ab}	12.03 ^{ab}	12.23 ^{ab}	11.73 ^{ab}	11.30 ^b	0.20
Hemoglobin (g/ dl)	14.67 ^a	12.00 ^{ab}	12.67 ^{ab}	14.00 ^{ab}	11.00 ^b	12.33 ^{ab}	0.43
Total protein (g/ dl)	6.23	6.27	6.33	6.23	6.37	6.53	0.05
Albumin (g/ dl)	2.97	3.17	3.17	3.07	3.07	2.93	0.03
Globulin (g/ dl)	3.27 ^{ab}	3.10 ^b	3.13 ^{ab}	3.17 ^{ab}	3.30 ^{ab}	3.60 ^a	0.06
Urea (mg/ dl)	25.67	25.67	28.33	33.67	36.00	36.00	1.62
AST (IU/ l)	54.67 ^a	42.33 ^b	44.33 ^b	54.33 ^a	41.36 ^b	39.33 ^b	2.27
ALT (IU/ l)	14.00 ^{ab}	9.00 ^b	13.00 ^{ab}	19.00 ^a	17.67 ^{ab}	13.67 ^{ab}	1.05

a and b.: Means in the same row with different superscripts differ significantly (P<0.05).

I- 75% dried sugar beet+25% berseem hay. IV- 50% dried sugar beet + 50% berseem hay.
 II- 75% dried sugar beet + 25% wheat straw. V- 50% dried sugar beet p + 50% wheat straw.
 III- 75% dried sugar beet + 25% rice straw. VI- 50% dried sugar beet + 50% rice straw.

The differences in hemoglobin concentration among the different treatments were significant (P<0.05). Ration I (25% berseem hay) showed significantly (P<0.05) the highest Hb concentration (14.67 g/100 ml), while ration V (50% wheat straw) revealed the least concentration (11.00 g/100 ml). There were no significant (P>0.05) differences in the concentrations of total protein, albumin and urea-N in blood plasma of rams fed the different rations. However, there were significant differences (P<0.05) in the concentration of

globulin and the activities of AST and ALT. These results were within the values obtained by Eweedah (1986).

From this results it could be concluded that the suitable percentages of dried sugar beet pulp in the ration of sheep were 50% with using berseem hay (ration IV); or 75% with using wheat straw (ration II), but the nutritive values were lower with using rice straw.

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تقييم تفل بنجر السكر الجاف في تغذية الأغنام

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أجريت ٦ تجارب ميتابوليزم لتقدير معاملات الهضم والقيم الغذائية وميزن الأزوت، وكذلك درست تخمرات الكرش وبعض مكونات الدم على الكباش البرقي (٣ في كل تجربة) متوسط وزنها ٥٥ كجم وعمر ٣ سنوات غذيت على مخاليط تفل بنجر السكر الجاف مع بعض مواد العلف المألوفة مثل قش الأرز وتبن القمح ودريس البرسيم كما يلي:-

- ١- ٧٥% تفل بنجر السكر الجاف + ٢٥% دريس برسيم .
- ٢- ٧٥% تفل بنجر السكر الجاف + ٢٥% تبن قمح .
- ٣- ٧٥% تفل بنجر السكر الجاف + ٢٥% قش أرز .
- ٤- ٥٠% تفل بنجر السكر الجاف + ٥٠% دريس برسيم .
- ٥- ٥٠% تفل بنجر السكر الجاف + ٥٠% تبن قمح .
- ٦- ٥٠% تفل بنجر السكر الجاف + ٥٠% قش أرز .

أظهرت النتائج ارتفاع محتوى الألياف الخام (٢٤,٥٠%) والمستخلص الخالي من الأزوت (٥٧,١٠%) في تفل بنجر السكر الجاف، بينما ينخفض محتوى البروتين (١٠,٤٠%) والمستخلص الأثيري (١,٥٥%) والرماد (٦,٤٥%) . وقد ارتفع المأكول من العلف ومن مادته الجافة مع دريس البرسيم يليها مع إضافة تبن القمح بينما كان أقل مأكول مع قش الأرز . وكذلك اتضح ارتفاع معاملات هضم جميع العناصر الغذائية مع دريس البرسيم بالمقارنة مع كل من تبن القمح وقش الأرز . لوحظ ارتفاع القيم الغذائية مع إضافة دريس البرسيم، يليها مع تبن القمح، بينما كانت أقل القيم مع قش الأرز . كما أظهرت الكباش المغذاة على المعاملة المحتوية على ٥٠% تفل بنجر سكر + ٥٠% دريس برسيم أعلى قيم للأزوت المأكول والمفرز في الروث والبول والممتص، بينما حققت تلك المغذاة على ٧٥% تفل بنجر سكر + ٢٥% دريس برسيم أعلى قيم للأزوت المحتجز . لوحظت زيادة درجة حموضة (pH) سائل الكرش مع زيادة مستوى المواد المالئة ونقص مستوى تفل بنجر السكر، كذلك وجدت أعلى قيم لحموضة سائل الكرش مع العلائق المحتوية على قش الأرز، بينما كانت أقل القيم مع دريس البرسيم . وجد أعلى تركيز للأحماض الدهنية الطيارة الكلية وأزوت الأمونيا في سائل الكرش مع العلائق المحتوية على دريس البرسيم، تلاها تبن القمح، بينما كان أقل تركيز مع قش الأرز . كما لوحظ نقص تركيز الأحماض الدهنية الطيارة الكلية مع زيادة مستوى المواد المالئة . توجد اختلافات معنوية في العدد الكلي لخلايا الدم الحمراء والبيضاء وتركيز الهيموجلوبين والجلوبيولين ونشاط انزيم الأسبارتات ترانسمي أميناز بين المعاملات المختلفة حيث أظهرت المعاملة المحتوية على ٧٥% تفل بنجر سكر + ٢٥% دريس برسيم أعلى القيم . نستخلص من هذه الدراسة أن النسبة المناسبة من تفل بنجر السكر الجاف في عليقة الأغنام هي ٥٠% مع دريس البرسيم (عليقة IV) و ٧٥% مع تبن القمح (عليقة II) ولكن مع استخدام قش الأرز فكانت القيم الغذائية منخفضة .