

EFFECT OF PARTIAL SUBSTITUTION OF CORN GRAINS BY DRIED SUGAR BEET PULP IN GROWING LAMBS' RATIONS ON THEIR PRODUCTIVE PERFORMANCE

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ABSTRACT

Twenty one growing Balady lambs with an average live body weight of 25.8 kg and about 6 months old were used to study the effect of partial substitution of corn grains by dried sugar beet pulp on their growth performance. Dried beet pulp was integrated into lambs' rations at levels of 50% and 75% of corn grains on DM basis. Lambs received one of the following experimental diets: 1) concentrate mixture 1 (CM 1) + berseem hay (BH), 2) CM 2 + BH, and 3) CM 3 + BH. Concentrate mixture was fed at 60% of DM required while BH *ad. Lib* in all treatments. Three digestibility trials using three lambs of each group were carried out to determine nutrients digestibility and nutritive values of the experimental rations. Data obtained showed that dried sugar beet pulp (DSBP) was higher in CF content than corn grains (19.88 vs. 4.59%) and ash content (4.16 vs. 1.95%). While NFE and CP content of corn grains were higher than that of DSBP (79.36 and 9.51 vs. 64.43 and 9.37% respectively). Apart from CP and EE digestibilities, the highest nutrients digestibility was recorded with lambs fed ration 2 followed by those fed rations 1 and 3. Crude protein digestibility of ration 1 was the highest compared by those of rations 2 and 3. However, the differences among rations were not significant ($P>0.05$). The TDN of ration 3 was significantly ($P<0.05$) lower than ration 2. There is no significant difference among experimental ration regarding DCP%. DMI by lambs fed control ration was similar to those fed ration 2 (1120 vs. 1127 g/day respectively), while it was slightly higher than that intake by lambs fed ration 3 (1120 vs. 1087 g/day). Average daily gain was 153.57, 160.71 and 164.23 g/day for lambs fed rations 1, 2 and 3, respectively. The results showed that integration of DSBP into lambs' rations at 50 or 75% of corn grain improved feed conversion expressed as kg DM, TDN or DCP per kg gain. Feeding costs were 4.92, 4.49 and 4.15 LE/ kg gain for lambs fed rations 1, 2 and 3, respectively.

From the data obtained here it can be concluded that dried sugar beet pulp can be used as a good source of energy for growing lambs. It can be also used successfully as a substitution of corn grains at replacement rates of 50 or 75% of corn grains dry matter

Keywords: Corn grains, sugar beet pulp, growth performance, lambs, digestibility.

INTRODUCTION

Sugar beet pulp is the remaining residue after extraction of sugar from sugar beet tubers. A high proportion of beet pulp is dried and frequently beet molasses is added to it before drying (pelting). It is characterized by high crude fiber content (17 - 22%) and low protein content (8.00 - 11.00%) (Bhattacharya and Sleiman 1971, NRC, 1989, Abdelhamid, 1992; Eweedah *et al.* 1999, Bistanji *et al.*, 2000 and Ali *et al.*, 2000). The crude fiber is quite digestible, may be because its lignin content is low (El-Ashry *et al.*, 2000, and Eweedah 2001 and Saleh *et al.*, 2001). On the other hand, some workers

treated sugar beet pulp with urea to raise its CP content before integration into sheep rations (Abdelhamid, 1992 Eweedah *et al.* 1999 and El-Badawi *et al.*, 2001). Previous studies indicated that sugar beet pulp provides as much energy as corn grains when fed in amounts up to 75% of total ration DM Bhattacharya and Sleiman (1971), Bhattacharya and Lubbadah (1971) and with dairy cows, Bhattacharya *et al.*, (1975), Saleh *et al.*, (2001) and Eweedah (2001) with sheep.

This work was designed to study the effect of partial replacement of corn grains by dried sugar beet pulp on growing lambs' growth performance, nutrients digestibility and economic impact.

MATERIALS AND METHODS

This work was started at the beginning of May 2001 till the end of August 2001. Twenty one growing Balady lambs of an average weight of 25.8 kg and about 6 months old were divided into three similar experimental groups (7 lambs each) to study the effect of partial substitution of corn grains by dried sugar beet pulp on their growth performance. Dried beet pulp was integrated into lambs' rations at 50% and 75% of corn grains on DM basis. Lambs were group fed according to their average live body weight one of the following experimental diets: -

- 1) CM 1 + BH. (Control ration).
- 2) CM 2 + BH.
- 3) CM 3 + BH.

Concentrate mixture was fed at 60% of DM required and BH was offered *ad. Lib* in all treatments. CM 1 consists of 80% corn grains, 10% soybean meal and 10% linseed meal; CM 2 consists of 40% corn grains, 40% DSBP, 10% soybean meal and 10% linseed meal; and CM 3 consists of 20% corn grains, 60% DSBP, 10% soybean meal and 10% linseed meal. Water and mineral blocks were available in free amounts. Lambs were housed in open-sheds with free access to water, mineral blocks and feed. Feed was offered near to the theoretical requirements of the lambs calculated from expected gain (200g/ day) according to NRC (1985). Lambs were treated against internal parasites then weighed at the beginning of the trial and at biweekly interval thereafter. The amount of CM was adjusted biweekly according to body weight changes for each group.

By the end of experimental period, three digestibility trials using three lambs of each group were carried out to determine nutrients digestibility and nutritive values of the experimental rations. Each digestibility trial lasted 17 days: the first 10 days were for adaptation with the metabolic cages followed by 7 days for faeces collection. Total faeces were collected and weighed. Representative samples of faeces (about 10% of fresh faeces), feed ingredients and concentrate mixtures were prepared for chemical analysis according to A. O. A. C. (1990) procedures.

Data were statistically analyzed according to Steel and Torrie (1980). Differences among means were tested for significance by Duncan's multiple range test (1955).

RESULTS AND DISCUSSION

Chemical composition of feed ingredients is presented in Table (1). Results recorded in this study are in agreement with those reported by Eweedah *et al.*, (1999), Ali *et al.*, (2000), El-Ashry *et al.*, (2000); Saleh *et al.*, (2001), (Talha 2001) and Talha *et al.*, (2001). Data showed that, DSBP is higher in CF content than corn grains (19.88 vs. 4.59%) and ash content (4.16 vs. 1.95%). On the other hand NFE and CP content of corn grain is higher than that of DSBP (79.36 and 9.51 vs. 64.43 and 9.37% respectively).

As a result of chemical composition of feed ingredients CF and ash content of concentrate mixtures increased and NFE decreased while CP content was similar by increasing DSBP proportion in the mixture (Table 2). Calculated chemical composition of the tested rations followed the same trend of concentrate mixtures.

Table (1): Chemical composition of feed ingredients

Item	DM %	Composition of DM (%)					
		OM	CP	EE	CF	NFE	Ash
Corn grains	89.57	98.05	9.51	4.59	4.59	79.36	1.95
Sugar beet pulp	92.06	95.84	9.37	2.16	19.88	64.43	4.16
Soybean meal	89.73	96.94	47.28	5.27	7.35	37.04	3.06
Linseed meal	92.75	83.29	31.70	7.55	9.95	34.09	16.71
Berseem hay	88.10	87.68	14.30	2.63	30.86	39.89	12.32

Table (2): Chemical composition of concentrates mixtures and calculated composition of the tested rations.

Item	DM %	Composition of DM (%)					
		OM	CP	EE	CF	NFE	Ash
CM 1	88.40	97.46	16.75	1.26	3.85	75.6	2.54
CM 2	90.09	96.59	16.75	1.51	9.77	68.56	3.41
CM 3	90.88	96.02	16.84	1.80	12.33	65.05	3.98
Rations*		Calculated chemical composition of tested rations (%)					
Ration 1	88.28	93.56	15.51	1.81	14.63	61.61	6.44
Ration 2	89.29	93.08	15.78	1.95	18.09	57.26	6.92
Ration 3	89.77	92.75	15.84	2.13	19.61	55.17	7.25

* Rations were fed during the feeding and digestibility trials.

Data regarding nutrients digestibility are recorded in Table (3). Apart from CP and EE digestibilities, highest nutrients digestibility was recorded with lambs fed ration 2 followed by those fed rations 1 and 3, respectively. Crude protein digestibility of ration 1 was the highest compared by those of rations 2 and 3. However, the differences among the three experimental rations were not significant ($P>0.05$). These results could be attributed to the similarity of crude protein content of the three experimental rations and consequently CP intake. Similar results have been reported when DSBP replaced corn grains (Saleh *et al.*, 2001) or commercial concentrate mixture (El-Badawi *et al.*, 2001) in lambs' rations at 50% replacement rate. While the differences were significance at 100% replacement rate. Crude fiber digestibility increased by the addition of DSBP in the rations. Highest CF

digestibility was recorded with lambs fed ration 2 followed by those fed ration 3 however differences were insignificant ($P>0.05$) while both of them were significantly ($P<0.05$) higher than ration 1. Similar results have been reported by Mahmoud et al. (1998), Mohsen et al. (1999), El-Badawi et al. (2001) and Saleh et al. (2001). These results might be due to the high CF digestibility of sugar beet pulp (El-Badawi et al., 2001) and/ or low lignin content (El-Ashry et al., 2000 and Saleh et al., 2001).

Nutritive values of the experimental rations expressed as TDN and DCP are presented in Table (3). Data showed that TDN values of ration 3 was significantly ($P<0.05$) lower than ration 2. The higher TDN values of ration 2 and 1 might be due to high DM, CP, EE and NFE digestibilities of these rations than those of ration 3. Similar trend has been reported by Eweedah et al., (1999). On the other hand there are no significant differences among experimental rations with regard to DCP%. The values followed the same trend of CP digestibility in the three rations.

Table (3): Mean values of nutrients digestibility and feeding values of the experimental rations.

Item	Treatments	Ration 1	Ration 2	Ration 3	SE
No. of animals		3	3	3	
DMI g/ head/ day					
BH		440	440	440	
CM		660	680	680	
Total		1100	1120	1120	
% DMI of hay from total DMI		40.00	39.29	39.29	
Total DMI as % of LBW		2.50	2.49	2.49	
Nutrients digestibility, %					
DM		63.84a	64.71 a	62.21 b	0.41
OM		66.22 b	67.48 a	65.56 b	0.32
CP		71.06	69.02	68.74	0.62
EE		58.40	52.21	48.32	2.15
NFE		68.32 b	70.54 a	68.26 b	0.41
CF		53.19 b	58.10 a	57.25 a	0.90
Nutritive values, %					
TDN		63.27 ab	64.09 a	62.41 b	0.28
DCP		11.02	10.89	10.89	0.01

a, b, Means at the same row with different superscripts are significantly different at ($P<0.05$).

Data in Table (4) showed that daily DMI by lambs fed the control ration was similar to the intake by those fed ration 2 (1120 vs. 1127 g/ day, respectively), but it was slightly higher than the intake by lambs fed ration 3 (1120 vs. 1087 g/day). Many studies reported that feeding DSBP as a substitution of corn or commercial concentrate mixture up to replacement rate of 75% did not significantly ($P>0.05$) affect DMI (Mahmoud et al., 1998; Saleh et al., 2001 and El-Badawi et al., 2001).

Average daily gain (ADG) was 153.57, 160.71 and 164.23 g/ day for lambs fed the experimental rations 1, 2 and 3, respectively. Lambs fed rations containing either 50 or 75% DSBP grew faster than those fed the control ration without significant differences ($P>0.05$) among the three groups. These

results might be explained by the results obtained from DM, TDN and DCP intake (since intake was nearly similar among all groups) and partially nutrients digestibility.

The results showed that integration of DSBP into lambs' rations at 50 or 75% of corn grains improved feed conversion expressed as kg DM, TDN or DCP per kg gain (Table 4). A similar trend has been reported by Ali *et al.*, (2000) and Saleh *et al.*, (2001).

Table (4): Mean values of growth performance and the feeding cost per kg gain for local lambs fed the experimental rations during the entire experimental period*.

Items	Experimental rations*			SE
	I	II	III	
No. of animals	7	7	7	-
Entire period (days)	120	120	120	-
Initial LBW (kg)	25.86	25.86	25.71	1.19
Final LBW (kg)	44.29	45.14	45.43	1.71
Total gain (kg)	18.43	19.28	19.72	-
ADG (g)	153.57	160.71	164.23	8.04
Daily DMI/ head:				
BH (g)	425	419	373	-
CM (g)	695	708	714	-
Total (g)	1120	1127	1087	-
TDN (g)	708.6	722.3	687.4	-
DCP (g)	123.4	122.7	118.4	-
% DMI of hay from total DMI	37.9	37.2	34.31	-
Feed conversion Kg/ kg gain:				
DM	7.29	7.01	6.62	-
TDN	4.61	4.49	4.19	-
DCP	0.80	0.76	0.72	-
Economical evaluation				
Daily feeding cost, LE/ head	0.76	0.72	0.68	
Feed cost, LE/ kg gain	4.92	4.49	4.15	

* Lambs were group fed.

Economic evaluation: Calculation of feeding cost based on the following prices of feed ingredients (LE/ kg): YC 0.60, DSBP 0.50, SBM 1.15, LSM 0.90, BH 0.45. Feeding costs were 4.92, 4.49 and 4.15 LE/ kg gain for lambs fed experimental rations 1, 2 and 3, respectively. Feeding cost of kg gain was lower for lambs fed rations 2 and 3 by 8.74% and 15.65% compared with lambs fed the control ration, respectively.

CONCLUSION

From data obtained here it can be concluded that dried sugar beet pulp can be used as a good source of energy for growing lambs. It can be also used successfully as a substitution of corn grains at replacement rates of 50 or 75% of corn grains dry matter.

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تأثير الإحلال الجزئي لحبوب الذرة بتفل بنجر السكر الجاف في علائق الحملان النامية على أدائها الإنتاجي

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أجريت هذه التجربة لدراسة تأثير استخدام تفل بنجر السكر الجاف كمصدر للطاقة في علائق الحملان النامية وذلك عن طريق إحلاله جزئياً محل حبوب الذرة بنسبة ٥٠ أو ٧٥% من المادة الجافة لحبوب الذرة، وتأثير ذلك على الأداء الإنتاجي للحملان النامية. استخدم في هذه التجربة ٢١ حمل نامي بلدي متوسط أوزانها ٢٥,٨٠ كجم ومتوسط أعمارها حوالي ٦ شهور.

تم تقسيم الحملان تبعاً لأوزانها إلى ٣ مجموعات تجريبية بكل منها ٧ حملان، غنيت كل مجموعة على أحد العلائق التجريبية التالية:-

(١) مخلوط مركز (١) + دريس برسيم.

(٢) مخلوط مركز (٢) + دريس برسيم.

(٣) مخلوط مركز (٣) + دريس برسيم.

تمت تغذية المخلوط للمركز بمقدار ٦٠% من المادة الجافة المقررة لكل حيوان بينما تم تقديم دريس البرسيم للتعب وذلك للمجموعات التجريبية الثلاث. تتكون المخالط المركزة الثلاث كما يلي:-

• المخلوط المركز (١) ٨٠% حبوب ذرة، ١٠% كسب فول صويا، ١٠% كسب بذرة الكتان.

• المخلوط المركز (٢) ٤٠% حبوب ذرة، ٤٠% تفل بنجر سكر جاف، ١٠% كسب فول صويا، ١٠% كسب بذرة كتان.

• المخلوط المركز (٣) ٢٠% حبوب ذرة، ٦٠% تفل بنجر سكر جاف، ١٠% كسب فول صويا، ١٠% كسب بذرة كتان.

قوالب الأملاح المعدنية وماء الشرب كانت متاحة للحملان طوال الوقت، وقد حسبت كميات الغذاء المقدمة للحملان

لتعطي معدل النمو المتوقع (٢٠٠جم/يوم) وفقاً لمقررات الـ (NRC 1985).

بنهاية تجربة النمو أجريت ٣ تجارب هضم باستخدام ٣ حملان من كل مجموعة، وكانت أهم النتائج المتحصل عليها

كما يلي:-

• كان محتوى تفل بنجر السكر الجاف من البروتين الخام (٩,٣٧%) مشابه لمحتوى حبوب الذرة منه (٩,٥١%) بينما كان محتواه من الألياف الخام (١٩,٨٨%) أعلى بالمقارنة بحبوب الذرة (٤,٥٩%).

• قيم معاملات هضم المادة الجافة، والمضوية، والمستخلص الخالي من الفيتوجين المسجلة مع الحملان المغذاة على العليقة (٢) كانت أعلى من تلك المسجلة مع المغذاة على العليقة (١)، (٣). بينما كانت قيم معاملات هضم البروتين الخام متقاربة. معامل هضم الألياف الخام للعليقة (٣)، (٢) كان أعلى معنوياً بالمقارنة بالعليقة (١) وذلك عند مستوى معنوية ٥%.

• كانت قيم مجموع المركبات الكلية المهضومة ٦٣,٢٧، ٦٤,٠٩، ٦٢,٤١% للعلائق ١، ٢، ٣ على التوالي بينما كانت القيم المقابلة للبروتين المهضوم ١١,٠٢، ١٠,٨٩، ١٠,٨٩%.

• كانت معدلات النمو اليومي للحملان المغذاة على العلائق التجريبية الثلاث ١٥٣,٥٧، ١٦٠,٧١، ١٦٤,٢٣ جم/يوم للعلائق ١، ٢، ٣ على التوالي.

• كانت الحملان المغذاة على العليقة (٣) الأكل في تحويل الغذاء تلتها المغذاة على العليقة (٢) فالمغذاة على العليقة (١).

• كانت تكلفة التغذية بالحنيه لكل كجم تمر ٤,٩٢، ٤,٤٩، ٤,١٥ للحملان المغذاة على العلائق ١، ٢، ٣ على التوالي.

يستنتج من النتائج السابقة أنه يمكن استخدام تفل بنجر السكر الجاف كمصدر للطاقة في علائق الحملان النامية بنسبة إحلال ٥٠ أو ٧٥% من حبوب الذرة.