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EFFECT OF SUGAR BEET PULP AND MOLASSES ON GROWTH PERFORMANCE OF RABBITS

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ABSTRACT: **This work was carried out to study the effect of sugar beet pulp (SBP) and SBP + molasses in growing rabbit diet. Sixty growing Newzeland male rabbits (650 g average body weight) were randomly distributed into three groups (20 rabbits/group). Rabbits in the 1st group were fed pelleted diet alone (control), the 2nd group was fed diet consisted of 75% control diet + 25% sugar beet pulp (SBP), while rabbits of the 3rd group were fed diet consisted of 75% control diet + 25% SBP then sprayed with 3.0% molasses. Chemical composition of SBP showed that organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE), nitrogen free extract (NFE) and ash were 94.06, 8.72, 20.60, 1.06, 63.68 and 5.94%, respectively. Diets containing SBP with or without molasses had lower CP, EE and ash contents but higher CF and NFE than the control. Feeding diets containing SBP with or without molasses significantly (P<0.05) increased but the digestibilities were not significantly affected. Growth rate, dressing percentage, internal organs weights and feed conversion did not differ among the three groups. Mortality rate was 25, 20 and 25% of rabbits which fed control diet, diets contain SBP and SBP + molasses, respectively. The economical efficiency was high with rabbits fed diet containing SBP, control then those fed diets containing SBP + molasses.**

Conclusion, growing rabbits can be fed on 75% basal diet + 25% SBP without any deleterious effects on its performance (feed intake, digestibility, growth rate and mortality rate) and increase of the economical efficiency. Addition of molasses to diet containing SBP had not beneficial effect on the rabbit performance in this study.

Key Words: Sugar beet pulp, rabbits, molasses

INTRODUCTION

The shortage of feed resources and its high cost consider the main problem in increasing of animal production in Egypt. Therefore, the researches on non traditional feed resources must be increase to produce additional feed resources. Sugar beet pulp (SBP) is a residue after sugar extraction from sugar beet tubers (Talha *et al.,* 2002). The SBP is mainly used as an energy source for rabbits, because of its high digestible fiber, pectins and sugars. It has a low starch concentration (De Blas and Carabano, 1996). Replacing starch with SBP leads to an increase of the fermentative activity in the hindgut where 40% of the dry matter content of SBP is digested in the caecum (Merino and Carabano, 1992). When the diet contain greater than 30% SBP, a correction factor should be envisaged to take in account the increase of energy losses associated to caecal digestion (De Blas and Carabano, 1996). Many attempts were carried out to improve utilization of high levels of SBP like addition of inulin sugar in rabbit diets (Volek *et al.*, 2004) or molasses for horses (Karlsson *et al.*, 2002).

In the recent years, cultivation of sugar beet in Egypt increased because its water requirement is less than sugar cane. Therefore, the quantity of sugar beet pulp also increased now and in the future. Agriculture Economics, (2000) reported that the quantity of SBP in Egypt was 173326 ton, could supply 155993 ton of dry matter, 113150 ton of TDN and 6708 tons of DCP.

This work was carried out to study the effect of replacement of 25% of basal diet by SBP without or with molasses on performance of growing rabbits.

MATERIALS AND METHODS

The experiment was carried out in of Animal Production Dept., Faculty of Agriculture, Zagazig University, Egypt. Sixty growing (average body weight 650 g) Newzeland (NZW) male rabbits were randomly distributed into three groups (each of 20 rabbits).

Rabbits in the 1st group were fed pelleted diet alone (control), the 2nd group was fed diet consisted of 75% control diet + 25% SBP, while the 3rd group were fed diet consisted of 75% control diet + 25% SBP sprayed with 3.0% molasses for 9 weeks experimental period.

Diets were offered to rabbits *ad libitum* and water was supplied all

time by using automatic nipple. Animals were housed in individual cages under the same managerial, hygienic and environmental conditions. Composition of the experimental diets is shown in Table (1). Rabbits weight and feed intake were weekly recorded. During the last week, digestibility trial was carried out using 4 rabbits from each group. At the end of the trial, 4 rabbits from each group were slaughtered. Carcass traits and weight of internal organs were recorded.

Proximate analysis of feed and feces were determined according to A.O.A.C. (1980).

Data were statistically analyzed according to Snedecor and Cochran (1982). Significant differences among treatment means were tested according to Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical Composition of Sugar Beet Pulp (SBP) and Experimental Diets

Incorporation of SBP without or with molasses decreased CP, EE and ash but increased OM, CF and NFE (Table 2). These results are due to chemical composition of SBP.

Feed Intake

Sugar beet pulp with or without molasses ($P<0.05$) increase feed intake by growing rabbits during the first 6 weeks and as an average of total period (Table 3). These results may be due to decrease of crude protein and increase of CF in diets containing SPB (Table 2), therefore the feed intake of rabbits increased to cover their requirements. These results agree with those found by Mahmoud *et al.*, (1998) that SBP increased dry matter intake by sheep from 1.34 to 1.43 and 1.64 kg/h/d by feeding diets containing 0.0, 17 and 34% SBP, respectively. On the other hand Volek *et al.*,(2004) found that replacement wheat bran with SBP had no significant effect on feed intake of weanling rabbits.

Digestibility Trial

Nutrient digestibilites were not significantly different among the groups (Table 4). Graham *et al.* (1986) found that substitution of a basal pigs diet by 33% SBP reduced the digestibilities of CP and fat. Also, Lindberg and Karlsson (2001) reported that horses fed the unmolassed sugar beet pulp showed lower apparent digestibility of CP. However, Karlsson *et al.* (2002) reported that molassed SBP can replace oats in a hay based diet of horses without impairing nutrient utilization and

Table 1. Composition (%) of experimental diets

Items	Diets		
	Control	Control + sugar beet pulp	Control + sugar beet pulp + molasses
Concentrate mixture*	100	75.0	72.8
Dried sugar beet pulp**	0.0	25.0	24.3
Molasses	0.0	0.0	2.9

*Concentrate mixture is composed of 20% yellow corn, 35% clover hay, 20% wheat bran, 11% barley, 10% soybean meal, 2.0% molasses, 0.10% sodium chloride, 0.30% methionine, 0.30% vitamins and mineral premix, 1.0% bone meal and 0.30% limestone.

**Dried sugar beet pulp contained 94.06, 8.72, 20.60, 1.06, 63.68 and 5.94% organic matter, crude protein, crude fiber, ether extract, nitrogen free extract and ash, respectively.

Table 2. Chemical composition (%) of experimental diets

Items	Diets		
	Control	Control + sugar beet pulp	Control + sugar beet pulp + molasses
DM	90.30	90.21	90.40
OM	89.50	90.64	90.60
CP	16.60	14.63	14.35
CF	15.80	17.00	16.10
EE	3.18	2.65	2.50
NFE	53.92	56.36	57.65
Ash	10.50	9.36	9.40

metabolic response in exercising horses. Total digestible nutrients (TDN%) did not significantly differ among treatments because of the absence of treatment effects on nutrient digestibilities.

Growth Rate

No significant differences in the average daily gain (ADG) were found among the experimental groups (Table 3). Decreasing of CP in diets of SBP with or without molasses (Table 2) and decreasing of its digestibility (Table 4) not effect on growth rate due to that increase of feed intake of rabbits which fed these diets (Table 3) and feed units intake (Table 4). Similar results were reported by Volek *et al.* (2004) who reported that inclusion of 20% SBP substitute of wheat bran with or without 4% inulin in diets of early weaned rabbits did not affect the average body weight gain. Talha *et al.* (2002) reported that growth performance of lambs fed ration contained SBP was higher than fed corn grains.

Feed Conversion

Feeding SBP with or without molasses decreased feed conversion (Table 3). The feed conversion (feed/gain) of total period was 3.99, 4.39 and 4.56 for rabbits fed control diets, SBP without or with molasses, respectively. These results agree with those reported by Garcia *et al.* (1993) that substitution of barley grains (50% of diets) by 0.0, 30, 70 and 100% SBP reduced feed conversion (g body weight gain/g dry matter intake) which was 100, 96, 87.4 and 72%, respectively. Also, Saleh *et al.* (2001) reported that feed conversion ratio (FCR) decreased as the level of SBP increased above 50% in the ration of growing lambs. On the other hand, Zaza (2005) reported that using of SBP treated by *Trichoderma viride* instead of 50 and 75% of yellow corn in growing rabbit diet improved the FCR which was 3.87 and 4.49, respectively in comparison with 5.63 of control. Addition of molasses did not improve the FCR. Volek *et al.* (2004) reported that addition of 4% chicory inulin sugar to growing rabbit diet containing 20% SBP improve FCR which was 3.23 in comparison with 3.57 for diet containing SBP without inulin and control (3.84). Our results take opposite trend where the diets containing SBP had worst FCR in comparison with control. These differences may be due to: substitution level of SBP, substitution material or chemical composition of diet.

Table 3. Performance of rabbits fed experimental diets

Parameters	Week	Diets		
		Control	Control + sugar beet pulp	Control + sugar beet pulp + molasses
Daily feed intake (g)	1	b 57.48 ± 3.17	a 70.76 ± 2.78	b 60.95 ± 2.90
	2	b 76.89 ± 1.48	a 102.80 ± 3.19	a 103.97 ± 6.32
	3	b 104.37 ± 3.92	a 108.74 ± 2.66	a 111.00 ± 3.86
	4	b 89.00 ± 5.45	a 108.56 ± 4.51	a 117.13 ± 6.11
	5	c 109.78 ± 5.79	a 134.78 ± 5.99	b 121.83 ± 6.41
	6	b 123.63 ± 5.39	a 153.00 ± 3.57	a 149.67 ± 6.95
	7	128.50 ± 4.97	131.33 ± 5.64	129.33 ± 5.87
	8	117.14 ± 3.43	109.78 ± 4.64	108.17 ± 6.95
	9	105.06 ± 3.82	104.78 ± 2.74	107.00 ± 4.38
	Average	b 101.32 ± 8.90	a 113.84 ± 10.20	a 112.12 ± 9.60
Daily body gain (g)	1	21.43 ± 1.63	23.57 ± 0.65	22.14 ± 1.47
	2	29.29 ± 1.20	31.43 ± 2.11	29.29 ± 0.93
	3	b 32.14 ± 1.78	a 36.43 ± 1.30	b 32.14 ± 1.83
	4	30.71 ± 1.84	32.14 ± 1.71	30.00 ± 2.25
	5	a 30.40 ± 1.30	b 27.14 ± 1.30	c 23.57 ± 1.80
	6	27.86 ± 1.18	26.43 ± 2.01	25.00 ± 1.45
	7	24.29 ± 1.24	24.29 ± 1.41	23.57 ± 0.79
	8	21.43 ± 1.11	20.00 ± 1.65	18.57 ± 1.85
	9	18.57 ± 1.50	20.00 ± 1.35	20.71 ± 1.70
	Average	26.24 ± 1.11	26.83 ± 1.71	25.00 ± 1.71

Table 3. Continue

Daily body gain (g)	1	b 2.68 ± 0.16	a 3.00 ± 0.14	a 2.75 ± 0.15
	2	b 2.63 ± 0.12	a 3.27 ± 0.13	a 3.21 ± 0.20
	3	b 3.25 ± 0.10	c 2.98 ± 0.10	a 3.45 ± 0.14
	4	c 2.90 ± 0.20	b 3.38 ± 0.13	a 3.90 ± 0.13
	5	b 3.57 ± 0.13	a 4.97 ± 0.23	a 5.17 ± 0.17
	6	b 4.44 ± 0.16	a 5.79 ± 0.14	a 5.99 ± 0.11
	7	5.29 ± 0.22	5.41 ± 0.18	5.49 ± 0.16
	8	5.47 ± 0.26	5.49 ± 0.23	5.82 ± 0.23
	9	a 5.66 ± 0.14	b 5.24 ± 0.12	b 5.17 ± 0.15
	Average	b 3.99 ± 0.19	a 4.39 ± 0.22	a 4.55 ± 0.18

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

Table 4. Digestion coefficient, nutritive values and intake of nutritive values of rabbits fed experimental diets

Parameters	Diets		
	Control	Control + sugar beet pulp	Control + sugar beet pulp + molasses
Digestion coefficient, %			
DM	74.21 ± 1.60	76.68 ± 1.40	76.07 ± 1.33
OM	75.20 ± 1.45	77.60 ± 1.75	77.15 ± 1.26
CP	84.60 ± 1.12	84.20 ± 1.67	83.90 ± 1.45
CF	30.60 ± 0.65	33.12 ± 1.11	32.90 ± 1.57
EE	90.11 ± 1.97	90.70 ± 2.15	90.90 ± 1.85
NFE	80.00 ± 3.12	80.60 ± 2.68	80.10 ± 2.60
Nutritive values (%), TDN	68.46 ± 2.45	69.02 ± 2.56	68.63 ± 2.11
DCP	a 14.04 ± 0.30	b 12.32 ± 0.25	b 12.04 ± 0.17
Nutritive values intake (g)	b	a	a
TDN	69.36 ± 3.00	78.57 ± 3.40	76.36 ± 2.46
DCP	14.23 ± 0.43	14.03 ± 0.45	13.50 ± 0.49

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

Carcass Traits and Organ Weights

The results in Table (5) showed no significant differences in dressing percentage and internal organ weights among the experimental groups. Zaza (2005) reported that substitution of 50 and 75% of yellow corn by SBP treated by *Trichoderma viride* had no significant effect on dressing %, heart, kidneys and lungs weight as % of live body weight.

Mortality Rate and Economical Efficiency

Mortality rate (Table 6) was 25, 20 and 25% for rabbits in control, SBP and SBP with molasses groups, respectively. These results similar to that obtained by Volek *et al.*, (2004) who reported that the mortality rate did not differ significantly between rabbits fed diet contained SBP and those fed control diet (contained wheat bran).

The economical efficiency (Table 6) was high in rabbits fed diet containing SBP without molasses addition (11.71 Egyptian pounds, LE) followed by control (11.29 LE) and the lowest in diets containing SBP plus molasses (10.19 LE). Also, the lowest mortality rate was in diets 2, 1 and 3.

It could be concluded that, growing rabbits can be fed on 75% basal diet + 25% SBP without adverse effect on the performance (feed intake, digestibility, growth rate, mortality rate) and increase of the economical efficiency.

Table 5. Carcass traits of rabbits fed experimental diets

Organs %	Diets		
	Control	Control + sugar beet pulp	Control + sugar beet pulp +molasses
Dressing	53.43 ± 1.50	52.89 ± 1.76	54.27 ± 1.76
Liver	3.73 ± 0.13	3.15 ± 0.12	3.31 ± 0.12
Heart	0.36 ± 0.02	0.45 ± 0.03	0.35 ± 0.03
Kidneys	0.71 ± 0.03	0.73 ± 0.04	0.65 ± 0.04
Lungs	0.53 ± 0.02	0.52 ± 0.03	0.50 ± 0.03
Ceacum	5.13 ± 0.05	5.17 ± 0.03	5.29 ± 0.03
Excreta	17.16 ± 0.13	17.15 ± 0.13	17.64 ± 0.13
Skin	17.41 ± 0.02	18.30 ± 0.02	16.53 ± 0.02

Table 6. Mortality rate and economic efficiency of rabbits fed Experimental diets

Items	Diets		
	Control	Control + sugar beet pulp	Control + sugar beet pulp + molasses
Mortality rate (%)	25	20	30
Economic efficiency			
Initial weight	650	650	655
Final weight	2305	2340	2225
Rabbit price at initiating*	9.75	9.75	9.83
Consumed diet of total period (kg)	6.38	7.17	7.06
Diet price**	8.93	8.96	9.04
Selling price***	29.97	30.42	28.93
Profit****	11.29	11.71	10.06

*Price/kg rabbits = 15 LE. ** price of 1 kg diet was 1.40, 1.25, and 1.28 LE for treatments, respectively (cost of one kg sugar beet and molasses were 0.80 and 1.0 LE, respectively.
***Selling price of 1kg = 13 LE. ****Profit = selling price – (rabbit price + diet price).

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تأثير تفل بنجر السكر و المولاس على النمو فى الأرانب

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أجريت هذه الدراسة لمعرفة تأثير استبدال جزء من عليقة الأرانب النامية بتفل بنجر السكر أو تفل بنجر السكر + المولاس. تم استخدام ٦٠ ذكر أرنب نيوزيلندى نامى (متوسط الوزن ٦٥٠ جم) تم توزيعها عشوائيا على ٣ مجموعات (٢٠ أرنب/ للمجموعة). تم تغذية أرانب المجموعة الأولى على عليقة كنترول. تغذت أرانب المجموعة الثانية على عليقة مكونة من ٧٥% من عليقة الكنترول + ٢٥% تفل بنجر سكر (SBP) بينما تغذت المجموعة الثالثة على عليقة مكونة من ٧٥% من عليقة الكنترول + ٢٥% SBP و تم رشها ب ٣% مولاس.

أظهر التحليل الكيماوى أن المادة العضوية، البروتين الخام، الألياف الخام، مستخلص الأثير ، المستخلص الخالى من النيتروجين و الرماد SBP كان ٩٤,٠٦، ٨,٧٢، ٢٠,٦٠، ١,٠٦، ٦٣,٦٨ و ٥,٩٤% على التوالى. العلائق المحتوية SBP مع أو دون المولاس كانت منخفضة فى محتواها من البروتين الخام، مستخلص الأثير و الرماد بينما ارتفع محتواها من الألياف الخام و المستخلص الخالى من النيتروجين. زاد الغذاء المأكول معنويا للأرانب عند تغذيتها العلائق المحتوية SBP مع أو بدون المولاس بينما لم يختلف هضم المركبات الغذائية جميعها معنويا. كما لم يختلف معدل النمو، نسبة التصافى ووزن الأعضاء الداخلية معنويا بين الأرانب فى كل المجموعات. كفاءة التحويل الغذائى كانت غير جيدة فى الأرانب المغذاة علائق محتوية SBP مع أو بدون مولاس. كانت نسبة النفوق ٢٥، ٢٠ و ٢٥ % فى أرانب الكنترول، المغذاة عليقة بها SBP دون أو مع مولاس على التوالى. أعلى ربح تم الحصول عليه من الأرانب المغذاة العليقة المحتوية SBP ثم الكنترول ثم المغذاة SBP + مولاس حيث كان ١١,٧١، ١١,٢٩ و ١٠,١٩ على التوالى.

التوصية: تغذية الأرانب النامية على ٧٥% من العليقة الاساسية + ٢٥% تفل بنجر سكر لم يكن له تأثيرات ضارة على الأداء بل أدى إلى زيادة الكفاءة الاقتصادية. إضافة المولاس إلى العليقة المحتوية تفل بنجر السكر لم يكن لهم أى تأثير مفيد فى هذه التجربة.