EFFECT OF REPLACING HAY BY SUGAR BEET PULP IN GROWING RABBIT DIETS ON SOME PRODUCTIVE, METABOLIC RESPONSES AND ECONOMICAL EFFICIENCY

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SUMMARY

A total number of 30 unsexed, 6 weeks old growing New Zealand white rabbits were randomly distributed into to five dietary treatments to study the effect of using the replacement of sugar beet pulp (SBP) by hay at levels of 0, 25, 50, 75 and 100% on some productive, metabolic responses and the economical efficiency. The data revealed that, feed intake increased (P<0.05) by increasing SBP level more than 25% up to 100% during the entire experimental period (6 to 16 weeks of age). However, rabbits fed dietary 25% SBP recorded the best feed conversion compared with other dietary treatments. The best (P<0.05) carcass % was recorded for rabbits fed 25 and 50% SBP diet compared with control diet. The digestibility of CF increased by increasing SBP level in rabbit diet up to 75%. Rabbits fed dietary 100% SBP recorded the greatest (P<0.05) values of blood total protein, globulin and calcium compared with other dietary treatments. The greatest economical efficiency and relative economical efficiency values were calculated for rabbits fed 25% however, all SBP diets economically surpassed the control one.

Keywords: Rabbits, sugar beet pulp, hay, productive performance

INTRODUCTION

In developing countries, there is a shortage of both energy sources and feedstuffs with acceptable protein content for animal production. In view of the worldwide demand for additional feed sources, the exploitation of traditional crops, which often are grown with low inputs, and are largely adapted to the climatic conditions of the developing countries, would be a step towards better resource utilization (Kebede, *et al.,* 2008; Mirzaei-Aghsaghali and Maheri-Sis., 2008).

The soluble fiber (SF) may be considered as a functional nutrient in rabbit diets as it promotes changes in intestinal macrobiotic and gut barrier and it decreases mortality (Carabaño *et al*., 2008; Xiccato *et al*., 2011). Sugar beet pulp (SBP) have a substantial potential value as animal feedstuffs (Mirzaei - Aghsaghali and Maheri-Sis, 2008). In Egypt, the beet pulp produced in 2000 was 24 million ton with an average of 1.288 tons of beet pulp/Fadden (Ministry of Agriculture 2007). Dried beet pulp, a carbohydrate rich by-product of the sugar industry, has been used as a partial source of energy in the rations of dairy cattle, growing calves; (El-Badawi and El-Kady., 2006) and rabbits diets (Cobos *et al*., 1995; Volek *et al*., 2002 and Zaza, 2005).

Regarding to the chemical analyses of sugar beet pulp, Abedo*.,* (2006) concluded that protein content of SBP ranged from 6.6 to 13.3% with an average of 9.9% compared with the requirements of most ruminants and mono gastric animals which are even higher. Sugar beet pulp contains high crude fiber from 14.6 to 24.8% with an averaged 19.7%, the fibrous carbohydrates of SBP are easily digested because of the amorphous structure of its cellulose and low content of its lignin.

Practically, Garcia *et al*., (1993) reported that inclusion of 15% SBP in finishing rabbit diets decreased dietary energy and CP digestibility by 6% (P<0.001), but non-significant effects were found on growth performance, empty body composition, and DE and digestible CP efficiency for growth. Higher levels of SBP (35 and 50%) led to leaner animals and did not affect DE intake but greatly impaired (P<.001) DE and nitrogen efficiency, NEg intake, growth rate, and dressing percentage in relation to the control diet. Inclusion of SBP increased the weight of gut contents (P<.001) and decreased cecal pH (P<.001), with no significant effect on mortality.

This study was conducted to evaluate the replacement of sugar beet pulp by hay in growing rabbit diets at levels of 0, 25, 50,75 and100% on some productive, metabolic responses and the economical efficiency.

MATERIALS AND METHODS

Experimental animals:

A total number of 30 New Zealand White growing rabbits 6 weeks of age were used in this study. Rabbits were randomly distributed into 5 treatments each containing 6 rabbits in three replicates (2 rabbits, each). Rabbits were kept in an open system house in cleaned and fumigated cages of wire floor batteries. Feed and water were offered to the rabbits *ad-libitum* under a total of 14-16 hours light/day during the experimental periods (6-16 weeks of age).

Experimental diets:

Rabbits were distributed in to five dietary treatments according to substitute berseem hay with graded (0, 25, 50, 75, 100%) levels of sugar beet pulp (SBP) as a source of energy and fiber. All experimental diets were formulated to contain adequate levels of nutrients for growing New Zealand White rabbits as recommended by the (NRC, 1994) and were prepared to be iso-nitrogenous and iso-caloric. The composition and analysis of dietary treatments are shown in Table (1), the composition of tested materials are show in Table (2) and the experimental design are show in Table (3).

Productive performance and metabolic parameters:

The live body weight and feed intake of each replicate were recorded each two week through the experimental period from 6 to 16 weeks of age. Body weight gain / rabbit / period was calculated for each period. Feed conversion was calculated by dividing the amount of feed consumption at each period on the weight gain during the same period.

At the end of the experimental period (16 weeks of age) three rabbits were randomly chosen from each treatment. All rabbits were individually weighted and slaughtered after approximately 12 hours of fasting, when complete bleeding was chivied, slaughter weight was recorded. After skinning the carcass was opened dawn and all entails were removed and empty carcass, heart, liver, kidneys and lungs were separated and weighed, moreover, each of them was proportionated to the live pre slaughtering weight. Also skin and head were weighted and expressed as percentage of pre slaughter weight.

For the digestion experiment, three rabbits from each treatment were housed individually and fed the tested diets for three days (at the end of the experiment). The collection period lasted for three days. Feed intake was measured and feces output was collected daily. Hair and scattered feed were separated or taken out of the feces. The collected feces of each treatment were pooled together, and then dried at 60º C till constant weight. The dried feces for the successive three days were left few hours to be equilibrium with the surrounding atmosphere and then, ground, well mixed and stored in a screw-top glass jars for analysis. Proximate chemical composition was determined according to A.O.A.C. methods (2006). Duplicate representative samples were analyzed for dry matter, crude protein, ether extract, crude fiber, and ash.

Blood samples were collected from three rabbits within each treatment, during slaughtering rabbits at the end of experimental period (16 weeks of age) in unheparinized tube. Blood samples from each rabbit were centerifugated at 3000 rpm / min to obtain blood serum. The serum was stored at -20 º C till chemical analysis. Serum samples were assigned for determination total protein (Gornal *et al.,* 1949), albumin (Doumas *et al.,* 1971), globulin by difference (Doumas *et al.,* 1971), glucose (Trinder., (1969), total lipid (Zollner and kirsch., 1962), Calcium (Gindler., 1972), and phosphorus (El-Merzabani., *et al.,* 1977) using commercial kits purchased from biodiagonstic chemical company (Egypt). The economic efficiency of dietary treatments were estimated according to the prices of 2009 in Egyptian pound (LE).

Statistical analyses:

Data of the experiments were statistically analyzed using SAS program (1998). The following statistical model was used for each age and trait:

$$Y_{ij} = \mu + D_i + E_{ij}$$

Where:

Yij = The observation value of the concerned trait.

μ = Overall mean for the concerned traits

Di = The fixed effect due to the diet.

Eij = A random error.

The differences among the means of individual treatment were tested with Duncan (1955) multiple range test (at level 5%) only when F-value were significant different at level 5%.

RESULT AND DISCUSSION

Growth performance:

Body weight and body gain:

Averages of live body weight and body gain of New Zealand White rabbits are presented in Tables (4 and 5). These results showed that, the effect of replacement of barseem hay by SBP on body weight of rabbits was significant ($P<0.01$), at 8, 10, 12, 14 and 16 weeks of age. In general, rabbits fed diets containing 25, 50, 75 and 100% SBP showed heavier body weight at most studied ages compared with control. Moreover, rabbits at marketing age (16 weeks) fed diets containing 25 and 100% SBP recorded significant ($P<0.05$) heavier body weight than those fed control diet.

No significant difference was detected in body gain during the period from 10-12 and

14-16 week of age. In general, body gain for rabbits fed diets containing 25, 50, 75 and 100% SBP showed significantly an enhancement at most studied ages compared to the control diet. Moreover, during the entire period (6-16 weeks of age), rabbits fed 25%SBP recorded the best (P<0.05) body gain followed by rabbits fed 100%SBP compared with other dietary treatments.

The improvement in live body weight and weight gain as a result of feeding rabbits grade levels of SBP may be due to that, the soluble fiber (SF) of SBP may be considered as a functional nutrient in rabbit diets as it promotes changes in intestinal micro biota and gut barrier (Carabaño *et al*., 2008 and Xiccato *et al*., 2011). Also, dried beet pulp as a carbohydrate rich by-product of the sugar industry, has been used as a partial source of energy in the rations of rabbit (Cobos *et al*., 1995 , Volek *et al*., 2002)

The present results are in agreement with the results obtained by Tag-El-Din.,(1996) who reported that, live body weight were significantly higher in rabbits given 30% sugar beet pulp as fiber source. Similar results were observed by Amber *et al.,* (2002) they found that, rabbits fed diet containing sugar beet pulp (SBP) had the highest body weight.

Feed intake and feed conversion:

Averages of feed intake and feed conversion of New Zealand White rabbits during the experimental periods from 6 - 8, 8 - 10, 10 - 12, 12 - 14, 14 – 16 and 6 - 16 weeks of age are presented in Tables (6 and 7). Results revealed general positive relationship between the addition levels of SBP and the values of feed intake. Increasing SBP levels up to100% resulted in a significant increase (p<0.05) in feed consumption which was evident over the entire experimental period (6-16 weeks old) in comparison to the control group. This effect was sustained till the end of the experimental period 16 weeks old. Exception was seen at 10-12 and 14-16 weeks, in this respect feed consumption was not significantly affected.

Inclusion levels of SBP in the diets affect significantly feed conversion. Exceptions was seen at the periods from 14-16 weeks of age which showed insignificant effect in this parameter. However, rabbits fed diets containing different experimental levels of SBP showed an improvement in feed conversion at most studied ages. During the whole experimental period from (6 -16 weeks of age), rabbits feed on diet contained 25% SBP significantly improved feed conversion than those fed the control diet and other SBP levels.

These increments in the amount of feed consumption could be due the relatively higher content of crude fiber as the result of increasing levels of SBP in the diets. Consequently the rabbits have to increase their feed consumption to meet energy requirements. Moreover, The enhancing in feed conversion as result of using grade levels of SBP in rabbit diets may due to the enhancing in body weight gain in table (5)

In this connection, Garcia *et al*., (1993) reported that, although rabbits were able to maintain digestible energy DE intake with increasing dietary levels of SBP, impairment of net energy efficiency led to a decrease of NE, intake (198, 201, 171, and 107 kcal/diet for dietary 0, 15, 35, and 50 % SBP , respectively). As a consequence, growth rate was also impaired, but the decrease was not parallel to NEg intake because of the simultaneous increase in the proportion of digestive tract and decrease of the energy content of live weight gain (approximately25% between extreme diets).

Volek *et al.,* (2003) fed Hyplus1 rabbits, on three granulated diets containing potato pulp, sugar beet pulp or wheat bran at 350g/ kg. they found that feed intake was significantly lower in rabbits fed diet with potato pulp (131g/day) than in rabbits receiving diet with sugar beet pulp or wheat bran (149 and 156 g/day, respectively). Moreover, Zaza, (2005) reported that no significant differences were found in feed intake among the treatment groups as a result of feeding rabbits rations contained 0, 50 and 75 % biological treated SBP.

Carcass traits:

The effects of dietary treatments on weights of some carcass traits and their proportions are presented in Tables (8 and 9). The data revealed that using SBP as a replacement of hay in rabbit diets recorded significant (P<0.05) differences in carcass, skin and head weights. However, no significant difference were detected among all dietary treatments in fasting weight, edible organs liver, kidney, lung, and heart. Substitution of SBP in rabbit diets improved (P<0.05) carcass weights at 25% and skin at 25 and 100% replacement of SBP compared with the control diet. In the present study, it could be revealed that using SBP as a replacement of hay in rabbit diets recorded significant (P<0.05) differences in the proportions of all organs studied except the carcass, the edible organs the liver and lung percent. Better (P<0.05) dressing percentage (carcass %) was recorded for rabbits fed 25, 75, and 100% SBP diet compared with either dietary 50% SBP or control diet. Rabbits fed the control diet recorded the highest ($p<0.05$) value of head%.

The improvement in carcass weight or dressing percentage as effect of using SBP may be due to the enhancement of body weight and body gain of rabbits fed SBP diets at all replacement levels (Tables 13).

In this concern, El-Badawi, *et al*. (2007) fed growing rabbits untreated sugar beet pulp (USBP) or fungal treated sugar beet pulp (TSBP) with *Trichoderma reesei* at levels of 25 and 50 %. Results showed that the dressing percentage for rabbits fed dietary 25 and 50% TSBP were (75.15 and 73.96%) but not varied from the control (72.14%), but it was significantly ($p<0.05$) higher than for rabbits fed 25 and 50% USBP (69.15 and 64.05%). Edible giblets percentage, especially liver, kidneys and heart were higher for rabbits fed TSBP diets, especially at 50% compared with rabbits fed control and 25% USBP diets. Also, the rabbits fed 50% USBP recorded higher kidneys and heart percentages.

Digestibility of nutrients:

The effects of dietary treatments on the digestibility of some nutrients of growing rabbits are presented in Table (10). The data revealed that using SBP as a replacement of hay in rabbit diets recorded significant ($P<0.05$) differences in the digestibility of crude protein (CP) and crude fiber (CF). However, using SBP as a replacement of hay in rabbit diets recorded no significant ($P>0.05$) differences in the digestibility of dry matter (DM), organic matter (OM), ether extract (EE) and (NFE) among all dietary treatments. Increasing SBP level in rabbit diets from 25 up to 50 or 75% improved the digestibility of CP. However, rabbits fed dietary 100% SBP recorded the lowest value of CP digestibility compared with other dietary treatments. The digestibility of CF increased by increasing SBP level in rabbit diet up to50 and 75% while, rabbits fed dietary 25and 100% SBP showed no difference in CF digestibility compared with control diet. Perez *et al,*. (1991) reported that digestibility coefficient of DM, OM,CP and energy were significant higher in the sugar beet pulp and citrus pulp diets than the diets contained alfalfa hay, rice hulls and grape marc. In this respect, Amber *et al,*. (2002) observed that, apparent digestibility of DM, OM, NFE, EE, and CP were significantly increased in the SBP and SPT diets than the other diets. Volek *et al,*. (2003) found that, the digestibility of crude protein was significantly lower and digestibility of N-free extract significantly higher in rabbits fed potato pulp and sugar beet pulp than others fed wheat bran. The rabbits fed potato pulp digested ADF more efficiently than other rabbits ($P < 0.05$) as a result of feeding weanling Hyplus1 rabbits, 34 days of age, on three granulated diets containing potato pulp, sugar beet pulp (SBP group) or wheat bran at 350 g/ kg live weight.

Blood parameters:

The effects of dietary treatments on some blood parameters of growing rabbits are presented in Table (11). The data revealed that, using SBP as a replacement of hay in rabbit diets recorded significant ($P<0.05$) differences on total protein (g/dl), albumin (g/dl), globulin (g/dl)**,** calcium (mg/dl) and phosphorus (mg/dl). However, using SBP as a replacement of hay in rabbit diets recorded no significant ($P>0.05$) differences in total Lipids (g/dl) and glucose (mg/dl). Rabbits fed dietary 100% SBP recorded the highest ($P<0.05$) values of total protein, globulin, glucose, calcium and phosphorus compared with other dietary treatments.The highest values of phosphorus was recorded for rabbits fed dietary 75 and 100% SBP compared with other dietary treatments. The lowest value of phosphorous was noticed when rabbits fed dietary 25 % SBP. These results are agree with the finding reported by El-Badawi *et al.,* (2007),who fed growing rabbits on either untreated sugar beet pulp (USBP) or fungal treated sugar beet pulp (TSBP) with *Trichoderma reesei* were at levels of 25 and 50 %. They found that, blood constituents included; total protein, albumin, urea, creatinine, AST and ALT were within the normal range. However, rabbits fed USBP recorded lower albumin and urea values than the other groups. Zaza (2005) reported that no significant differences were found among the rabbits fed biological treated SBP and control in total protein, albumin, globulin, A/G ratio, GPT and GOT however, rabbits fed 50 % TSBP ration was showed ($p<0.05$) higher blood urea concentration compared with those fed either the 75 % TSBA or the control ration.

Economical efficiency:

The effects of dietary treatments on the economical efficiency of experimental diets (L.E, 2009) are presented in Table (12). The data revealed that using SBP as a replacement of hay in rabbit diets improved net revenue (16.75, 15.36, 15.29, and 15.75), economical efficiency (3.19, 2.32, 2.28, and 2.53) and relative economical efficiency (151.76, 110.05, 108.36, and 120.29%) at 25, 50, 75, and 100% levels of SBP respectively compared with the control diet. The greatest economical efficiency and relative economical efficiency values were calculated for rabbits fed 25% followed by those on 100 % SBP. The enhancement in the economic efficiency represented as relative economical efficiency could be related to the lowest price of SBP compared with hay also, related to the improvement in the feed conversion as a result of increasing SBP in rabbit diets (Table 7).

In this respect, Zaza. (2005) reported that the highest economic efficiency was achieved with the group that fed 50% TSBP followed by the group that fed 75 % TSBP and then by the control group which recorded as a result of feeding rabbits rations contained 0, 50 and 75 % biological treated SBP.

In conclusion, t could be replacing SBP in rabbit diets by hay up to 100% replacement without any adverse effect on growth performance or blood aspects. The greatest economic efficiency and relative economic efficiency values were calculated for rabbits fed dietary 25% followed by 100 % SBP.

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Table 1. The composition and calculated analysis of dietary treatments.

Ingredients%	Experimental diet				
	T1	T2	T3	T4	T5
	Sugar beet pulp levels %				
	0	25	50	75	100
Ground yellow corn	36.95	35.59	33.45	31.50	29.30
Soya bean meal (44%)	16.50	18.75	20.80	22.75	24.20
Berseem hay	25.00	18.75	12.50	6.25	0.00
Sugar beet pulp	0.00	6.25	12.50	18.75	25.00
Wheat bran	19.75	18.86	18.95	18.95	19.70
Lime stone	1.00	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50
Premix*	0.30	0.30	0.30	0.30	0.30
Total	100	100	100	100	100
Calculated analyses%					
ME (kcal/ kg)	2336.76	2394.59	2431.66	2471.91	2500.02
Crude protein,	18.04	18.13	18.19	18.20	18.05
Crude fiber,	9.46	9.42	9.50	9.57	9.73
Calcium,	0.87	0.90	0.92	0.96	0.99
Available phosphorus,	0.47	0.48	0.49	0.50	0.51
Methionine,	0.79	0.80	0.81	0.82	0.81
Lysine,	0.37	0.36	0.33	0.31	0.29

*Each2.5 kg of vitamins and minerals mixture contains:12000.000 IU vitamin A acetate; 2000.000 IU vitamin D_3; 10.000 mg vitamin E acetate; 2000 mg vitamin K_3; 100 mg vitamin B_1; 4000 mg vitamin B_2; 1500 mg vitamin B_6; 10 mg vitamin B_{12}; 10.000 mg pantothenic acid; 20.000 mg Nicotinic acid; 1000 mg Folic acid; 50 mg Biotin; 500.000 mg chorine; 10.000 mg Copper; 1000 mg Iodine; 300.00 mg Iron; 55.000 mg Manganese; 55.000 mg Zinc, and 100 mg Selenium.

Table 2. Chemical composition of tested materials used in the experimental diets (as fed)

Item	DM %	Ash %	O M %	CP %	CF %	EE %	NFE %
Sugar beet pulp	90.50	3.90	86.60	8.96	19.72	0.52	75.40
Berseem hay	87.82	14.07	85.94	13.40	26.25	2.25	44.04

Table 3. The experimental design

No of treatments	Treatments
T 1	Rabbits were received control diet contain 0% (SBP)
T 2	Rabbits were received diet contain 25% (SBP) of diet hay
T 3	Rabbits were received diet contain 50% (SBP) of diet hay.
T 4	Rabbits were received diet contain 75% (SBP) of diet hay
T 5	Rabbits were received diet contain 100% (SBP) of diet hay.

Table 4. Effect of dietary sugar beet pulp (SBP) on body weight (gm) of growing rabbits

Age/ wks	Treatments sugar beet pulp replacement levels %					±SE	Sig.
	0	25	50	75	100		
6	750.00	733.33	741.66	733.33	750.00	6.45	N.S
8	1291.66^{b}	1368.00^{a}	1380.00^{a}	1295.00^{b}	1391.60^{a}	19.95	**
10	1501.60^{c}	1701.60^{a}	1605.00^{b}	1766.66^{a}	1705.00^{a}	21.83	**
12	1655.00^{c}	1941.66^{a}	1791.66^{b}	1943.33^{a}	1926.66^{a}	30.23	**
14	1810.00^{b}	2291.66^{a}	2263.33^{a}	2166.66^{a}	2220.00^{a}	58.53	**
16	2051.66^{d}	2601.66^{a}	2363.33^{c}	2393.33^{bc}	2525.00^{ab}	46.157	**

Values within rows with no common superscripts are significantly different (P<0.05).
±SE = Stander Error of means
Ns= Not significant **= (P<0.05)

Table 5. Effect of dietary sugar beet pulp (SBP) on body weight gain (g) of growing rabbits.

Age/ wks	Treatments sugar beet pulp replacement levels %					±SE	Sig.
	0	25	50	75	100		
6-8	541.66^{b}	635.00^{a}	638.33^{a}	561.66^{b}	641.66^{a}	21.69	**
8-10	210.00^{c}	333.33^{b}	225.00^{c}	471.66^{a}	313.33^{a}	20.49	**
10-12	153.33	240.00	186.66	176.66	221.66	19.55	N.S
12-14	155.00^{c}	350.00^{ab}	471.66^{a}	223.33^{bc}	293.33^{bc}	51.29	*
14-16	241.66	310.00	290.00	226.66	305.00	40.55	N.S
6-16	1301.66^{c}	1868.33^{a}	1621.66^{b}	1660.00^{b}	1775.00^{ab}	47.78	**

Values within rows with no common superscripts are significantly different (p<0.05)
.±SE = Stander Error of mean
Ns= Not significant, *= (P<0.05) and **= (P*<0.01).*
*= (P<0.05) and **= (P<0.01)

Table 6. Effect of dietary sugar beet pulp (SBP) on feed intake (g/rabbit) of growing rabbits

Age/ Wks	Treatments sugar beet pulp replacement levels %					±SE	Sig.
	0	25	50	75	100		
6-8	908.33^{b}	973.33^{ab}	1086.66^{a}	1060.00^{a}	1001.66^{a}	34.3	*
8-10	996.66^{b}	1185.00^{ab}	1168.32^{ab}	1375.00^{a}	1388.32^{a}	37.95	*
10-12	1130.00	1005.00	1135.00	1448.42	1480.00	82.25	N.S
12-14	1178.32^{b}	1691.66^{ab}	1741.66^{ab}	1413.32^{ab}	1825.00^{a}	84.03	*
14-16	1561.66	1315.00	166.66^{a}	1855.00	1456.66	94.53	N.S
6-16	5775.00^{c}	6170.00^{bc}	6793.33^{b}	7151.74^{a}	7151.65^{a}	66.07	*

a-d Values within rows with no common superscripts are significantly different (p<0.0)
±SE = Stander Error of means
Ns= Not significant, *= (P<0.05) and **= (P<0.01)

Table 7. Effect of dietary sugar beet pulp (SBP) on feed conversion (Feed, g / Gain, g) of growing rabbits

Age/ Wks	Treatments sugar beet pulp replacement levels %					±SE	Sig.
	0	**25**	**50**	**75**	**100**		
6-8	1.68^{ab}	1.52^{b}	1.70^{a}	1.88^{a}	1.56^{b}	0.08	*
8-10	4.78^{a}	3.60^{bc}	5.20^{a}	2.92^{c}	4.42^{ab}	0.16	**
10-12	7.44^{ab}	4.20^{b}	6.42^{ab}	8.14^{a}	6.68^{ab}	0.51	*
12-14	7.87^{a}	4.83^{bc}	3.78^{c}	6.30^{ab}	6.20^{b}	0.39	*
14-16	6.46^{a}	٤.24^{a}	5.7٣^{a}	8.18^{a}	4.7٧^{a}	0.57	N.S
6-16	٤.٤٣^{a}	٣.30^{b}	4.20^{a}	4.30^{a}	4.02^{a}	0.16	*

a-d Values within rows with no common superscripts are significantly different (p<0.05).
±SE = Stander Error of means.
Ns= Not significant, *= (P<0.05) and **= (P<0.01).

Table 8. Effect of dietary sugar beet pulp (SBP) on some carcass traits of growing rabbits

Items	Treatments **sugar beet pulp replacement levels %**					±SE	Sig.
	0	**25**	**50**	**75**	**100**		
Live Body weight	2195.00	2633.00	2386.00	2343.00	2255.66	141.39	NS
Carcass	1053.00^{b}	1341.33^{a}	1268.33^{ab}	1105.66^{ab}	1093.66^{ab}	74.92	*
Edible organs	458.66	442.00	490.66	493.00	444.33	63.36	NS
Liver	66.66	81.33	69.00	68.33	79.00	5.92	NS
Kidney	13.10^{a}	15.33^{a}	8.40^{b}	8.83^{b}	12.33^{a}	0.93	*
Lung	11.63	15.93	11.33	13.83	19.66	3.23	NS
Heart	7.83^{a}	6.40^{ab}	2.66^{b}	3.50^{b}	3.66^{b}	1.15	*
Skin	352.00^{b}	449.00^{a}	371.33^{ab}	360.66^{ab}	430.66^{a}	26.37	*
Head	120.66	125.33	104.00	109.66	108.33	7.83	NS

a-d Values within rows with no common superscripts are significantly different (p<0.05).

Table 9. Effect of dietary sun sugar beet pulp (SBP) on some carcass traits proportions of growing rabbits

Items	Treatments sugar beet pulp replacement levels %					±SE	Sig.
	0	25	50	75	100		
Live Body weight (g)	2195.00	2633.00	2386.00	2343.00	2255.66	141.39	NS
Carcass %	48.11	50.97	53.94	47.22	48.37	3.34	NS
Edible organs %	20.73	16.74	20.19	21.04	19.70	1.86	NS
Liver %	3.04	3.08	2.91	2.92	3.54	0.27	NS
Kidney %	0.60[a]	0.58[a]	0.35[b]	0.37[b]	0.55[a]	0.05	*
Lung %	0.53	0.60	0.47	0.59	0.84	0.12	NS
Heart %	0.35[a]	0.24[ab]	0.11[b]	0.14[b]	0.15[b]	0.04	*
Skin %	16.02[ab]	17.05[ab]	15.52[b]	15.40[b]	19.34[a]	1.10	NS
Head %	5.49[a]	4.77[b]	4.35[b]	4.68[b]	4.79[b]	0.19	NS

a-d Values within rows with no common superscripts are significantly different (p<0.05).

Table 10. Effect of dietary sugar beet pulp (SBP) on digestibility of nutrients of the experimental diets

Items / Treatments	Digestibility of Nutrients (%) DM	OM	CP	EE	CF	NFE
Control	76.13	76.73	83.72[b]	83.21	46.99[b]	83.29[a]
25 % SBP	74.88	76.47	86.05[ab]	78.64	53.26[ab]	80.78[a]
50 % SBP	81.00	82.62	87.77[a]	84.22	72.52[a]	83.34[a]
75 % SBP	81.98	82.64	88.58[a]	84.64	73.22[a]	84.07[a]
100 % SBP	77.07	78.01	62.31[c]	82.94	53.45[ab]	81.30[a]
±SE	3.33	3.19	1.09	3.20	6.35	2.64
Sig.	N.S	N.S	*	N.S	*	N.S

a-d Values within columns with no common superscripts are significantly different (p<0.05)
±SE = Stander Error of means
Ns= Not significant, *= (P<0.05)

Table 11. Effect of dietary sugar beet pulp (SBP) on some blood parameters of growing rabbits

Treatments / Items	Sugar beet pulp replacement levels % 0	25	50	75	100	±SE	Sig.
Total protein(g/dl)	5.97[c]	5.11[c]	4.77[d]	7.11[b]	9.11[a]	0.31	**
Albumin (g/dl)	4.07[ab]	4.35[a]	3.62[b]	3.68[b]	3.67[b]	0.30	*
Globulin (g/dl)	1.90[c]	0.76[e]	1.15[d]	3.43[b]	5.44[a]	0.33	*
Total Lipids (g/dl)	8.50[a]	7.60[a]	6.90[a]	7.60[a]	7.20[a]	0.50	N.S
Glucose (mg/dl)	133.33[a]	126.66[a]	126.66[a]	126.66[a]	140.00[a]	5.96	N.S
Calcium (mg/dl)	5.45[c]	8.18[b]	8.78[b]	5.45[c]	11.21[a]	0.50	**
Phosphorus (mg/dl)	2.81[b]	2.22[c]	2.88[b]	3.33[a]	3.70[a]	0.13	**

a-d Values within rows with no common superscripts are significantly different (p<0.05)
. ±SE = Stander Error of means Ns= Not significant,
*=(P<0.05)and **=(P<0.01), ,

Table 12. Effect of dietary sugar beet pulp (SBP) on economic efficiency of experimental diets (L.E,2009)

Items	Treatments sugar beet pulp replacement levels %				
	0	25	50	75	100
Cost of one kg SBP	0.85	0.85	0.85	0.85	0.85
Cost of one kg hay	1.2	1.2	1.2	1.2	1.2
Feed/gain ratio (a)	4.43	3.3	4.2	4.3	4.02
Price /kg Feed (b) L.E.	1.60	1.59	1.58	1.56	1.55
Feed cost of 1kg weight gain(a*b)	7.09	5.24	6.63	6.70	6.23
Market price /kg (c)LE	22.00	22.00	22.00	22.00	22.00
Net revenue{c-(a*b)}	14.91	16.75	15.36	15.29	15.77
Economic efficiency	2.10	3.19	2.32	2.28	2.53
Relative economical efficiency %	100.00	151.76	110.05	108.36	120.29

تأثير إحلال تفل البنجر محل الدريس فى علائق الأرانب النامية على بعض الصفات الإنتاجية والتمثيلية والكفاءة الاقتصادية

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أجريت هذه التجربة بهدف دراسة تأثير إستبدال دريس البرسيم بتفل بنجر السكربمستويات صفر و ٢٥ و ٥٠ و ٧٥و ١٠٠% كمصدر للالياف فى علائق ارانب النيوزيلاندى النامية. وتم استخدام عدد٣٠ أرنب ذكور وإناث من سلالة النيوزيلاندى عند عمر ٦ أسابيع وزعت عشوائيا فى ٥ معاملات بكل معاملة ٣ مكررات تحتوى كل مكررة على ٢ أرنب فى النظام المفتوح وذلك فى أقفاص معدنية وقدمت العليقة وماء الشرب لمستوى الشبع طوال فترة التجربة لمدة ١٠ وفى نهاية التجربة تم الإبقاء على بعض الأرانب لإجراء تجربة الهضم وكذلك أخذ عينات للدم ودراسة مواصفات الذبيحة .وشملت القياسات التى تم تقديرها خلال التجربة كل من وزن الجسم,الزيادة فى وزن الجسم,معدل التحويل الغذائى, بعض مواصفات الذبيحة,بعض قياسات الدم وكذلك دراسة الجدوى الإقتصادية. واوضحت النتائج ما يلى:-

- كانت النتائج لوزن الجسم عند٢٥%وحتى ١٠٠% أفضل مقارنة بمعاملة الكنترول(صفر%)
- إستبدال الدريس بتفل بنجر السكر حسن من المأكول عند جميع مستويات الإضافة خلال فترة التجربة بإستثناء الفترة عند عمرمن ١٠ -١٢,١٢-١٤ أسبوع
- أفضل نتائج معدل تحويل غذائى طوال فترة التجربة (٦-١٦ أسبوع) كانت عند مستوى ٢٥% من تفل بنجر السكر
- أفضل نسب مئوية للذبيحة كانت عند مستوى٥٠, ٧٥,١٠٠% من تفل بنجر السكر مقارنة بمستوى ٢٥% من تفل البنجروعليقة الكنترول
- تبين وجود زيادة فى معامل الهضم للألياف فى الأرانب التى غذيت على زيادة من تفل بنجر السكرحتى مستوى ٧٥% بينما الأرانب التى غذيت على ١٠٠% من تفل بنجر السكر لم تظهر تغيرا معنويا فى معامل هضم الالياف عند مقارنتها بعليقة بالكنترول
- الأرانب التى غذيت على عليقة بها ١٠٠% تفل بنجر السكر محل الدريس أظهرت أعلى القيم للبروتين الكلى ,الجلوبيولين والكالسيوم فى الدم مقارنة بالعلائق الأخرى
- كانت أعلى القيم للكفاءة الإقتصادية للأرانب التى غذيت على العلائق التى بها تفل بنجر السكر بنسب من ٢٥ وحتى ١٠٠% . كما تفوقت جميع المعاملات اقتصاديا على عليقة الكنترول
- نستخلص من النتائج السابقة أنه من الممكن إحلال تفل بنجر السكر محل دريس البرسيم المصرى حتى مستوى ١٠٠% إحلال دون أى تأثيرات ضارة على معدلات النمو وأيضا خصائص الدم. وأن أعلى قيم إقتصادية أظهرتها الدراسة وجدت عند تغذية الأرانب على ٢٥وحتى ١٠٠% إحلال لتفل بنجر السكرمحل.