ASSESSMENT OF THE NUTRITIVE VALUE OF SUGAR BEET TOPS HAY AS A PROSPECTIVE FEEDSTUFF FOR GROWING NZW RABBITS

Adel E. Abou - Zeid
Animal Production Dep., Faculty of Agriculture, Tanta University, Egypt.

ABSTRACT:

The current study aimed to shed more light on the beneficial effects of using sugar beet tops as a feedstuff for growing NZW rabbits on growth performance, digestion, caecotrophy, carcass traits and economic efficiency. Sixty unsexed 5-weeks-old New Zealand White rabbit (NZW) were divided into three equal experimental groups, 20 rabbits each. The basal diet was parctially replaced by sugar beet tops (SBT) at the level of 16, and 32% to formulate the experimental diets. The results revealed that the substitution of SBT in the rabbit diets significantly increased the daily weight gain and growth rate of rabbits fed diet contained 32% SBT, while performance index was increased in rabbits fed diet with 16% SBT. Feed intake was increased in rabbit fed diet with 32% SBT, as compared with these fed control diet, but feed conversion ratio was significantly improved in rabbits fed diet contained 16% SBT. The feeding SBT diets significantly increased all digestibility coefficients except ether extract. The incorporation of SBT in the rabbits diets significantly affected daily soft feces excretion, the highest value was noticed with rabbits fed 32% SBT. The CP contribution of soft faces to total CP intake was higher with 32% SBT compared with the control. The plasma total protein and albumin were significantly increased in the rabbits fed 32% SBT compared with those fed the control diet. The transaminases activities (GOT and GPT) did not show any significant differences compared with the control. Plasma glucose, cholesterol and triglycerides were significantly decreased, as the level of SBT increased from 0 up to 32% in the diets. Dressing percentage of the rabbits fed 32% SBT was significantly increased compared with the control. The cost of the total feed intake was decreased by 9.4% as the level of SBT increased from 0 up to 32% in the diets. It may be concluded that the SBT can be introduced to the growing NZW rabbits diets as well as improved performance and economical efficiency.

Key words: Sugar beat tops, growth performance, nutritive value, New Zealand White rabbits.

INTRODUCTION

The increasing demand of animal protein resources for human consumption can be partly met through rabbits production. However, for intensified rabbits as poultry production, it is necessary to develop low cost feed in developing countries. The main problem was to find economical sources of feed ingredient, because of great shortage in the dry and green fodders, especially in summer seasons, the agriculture by products can provide a considerable part of animal feed demands. In developing countries, the sugar beet tops hay is increasingly used and frequently introduced with Egyptian clover hay (BH).The agriculture by products were introduced to the rabbits diets in several types; carrot tops hay **(El-Kerdawy *et al.*, 1992)**, sweet potato tops hay **(Solaiman, 1995)**, potato top **(Awad,1997)** and peanut hay **(El-Adawy *and Borhami*, 2001)**. Sugar beet tops (*Beta vulgaris altissima*) (SBT) produced at large amounts as crop residues without economical usage **(El-Bendary *et al.*, 1992[a]). El-Shenawy (1990)** showed that Egypt annually produce more than 13.75 million tons of agriculture by products available for animal feeding. **El-Bendary (1991)** reported that more than 557.312 tons of fresh sugar beet tops are annually produced in Egypt. The TDN and DCP values of sugar beet tops (BH) produced were calculated to be 31544 and 4626 tons, respectively. It is will known that sugar beet tops fermented quickly causing flying breeding which may cause plant disease and water pollution problems. Some problems appeared when fresh sugar beet tops was used because its high moisture, potassium and oxalic acid contents, which lead to diarrhea and this must be taken into consideration when used in animal feeding **(El-Bendary *et al.* 1992[b]**). So, the drying of SBT using a proper method for conservation may contribute in solving some of the feed shortage problems as resources of animal feeding shortage and reducing pollution especially at highly needed in time. **Jahn, *et al.*, (1981)** reported that SBT can cover about 40% of dry matter requirements of the Holstein lactating cows without any adverse effect on the milk production. Little information and review of literatures are available about the inclusion of SBT hay in the diets of growing rabbits. **Tag El-Din *et al.* (2000)** found that using of SBT in growing rabbits diets up to 10% instead of Egyptian clover hay did not induce health troubles or negative effects on rabbits growth performance .Therefore, the objective of the current study was to investigate the effects of substitution of SBT hay instead of complete pelleted rabbits diets on growth performance, nutrient digestibility, nutritive values, caecotrophy, some plasma parameters, carcass traits as well as the economical efficiency of growing rabbits.

MATERIALS AND METHODS

Experimental procedure:

The current experiment was carried out at the Rabbit Research Laboratory, Department of Poultry Production, Faculty of Agriculture, Kafr El-Sheikh University.

Sixty unsexed 5-week-old New Zealand White rabbit (NZW) were weighed, housed individually in wire batteries and randomly divided into three equal experimental groups, each of 20 rabbits. Standard management techniques and environmental conditions were applied. Classical performance traits were recorded weekly. Performance index (PI) was calculated according to **North (1981)** as the following equation:

PI = [Live body weight (kg) / Feed conversion] x 100.

The experiments lasted till 13 weeks of age (marketing weight).

Diets:

A conventional Egyptian clover hay based diet was formulated to meet or exceed the essential nutrient requirements for growing rabbits according to the tables prepared by **De-Blas (1986)**.Because of the difference between crude fiber content (CF) of SBT and (CF) content of Egyptian clover hay (BH) and since the content of SBT is nearly similar to that of the basal diet, the basal diet Table 1. was partially replaced by sun dried sugar beet tops hay (SBT) at the level of 16, and 32 to formulate the experimental diets. The basal and experimental diets were manufactured under high pressure of steam evaporate in Kafr El-Sheikh company. The composition and chemical analysis of the basal diet, and sugar beet tops are presented in Tables 1and 2.

Table (1): Formulation and chemical analysis of the basal diet.

Ingredients	%
Yellow corn	16.0
Wheat bran	17.o
Barley	14.o
Soybean meal (44%)	18.0
Berseem hay	32.o
Common salt	0.3
Limestone	2.1
Premix*	0.3
DL- Methionine	0.3
Total	100

*Vitamins and mineral premix per kilogram contained : Vit. A 2,000,000 Iμ, Vit. D_3 150,000 Iμ, Vit. K 0.33 mg, Vit. B_1 0.33 g, Vit B_2 1.0 g, Vit B_6 0.33 g, Vit. B12 1.7 mg, Pantothenic acid 3.33 g, Biotin 33 mg, Folic acid 0.83 g, Choline chloride 100 mg, Zn 11.7 g, Mn 5.0 g, Fe 12.5 g, Mg 66.7 mg, Se 16.6 mg, Co 1.33 mg, Cu 0.5 g, I 16.6 mg and antioxidant 10.0 g.

Digestibility trial

A digestibility trial was carried out to determine the nutrient digestibility coefficients and nutritive values of Egyptian clover hay and sugar beet tops. For each treatment, six male rabbits were housed individually in metabolic cages that allow collecting feces and urine separately.

Feces and urine were separately collected daily over 5 consecutive days according to the European Reference Method for rabbit digestion trials **(Perez *et al.* 1995).**

Samples of daily feces (20%) of each rabbit were collected every day, dried at 60-70^{0}C, finally ground and kept for chemical analysis. Nutritive values in terms of total digestible nutrients (TDN%) and the digestible crude protein (DCP%) were calculated according to formula of **(Cheeke *et al.*, (1982).**

Caecotrophy trial:

At the end of the experiment (13 weeks), excretion soft feces (SF) and hard feces (HF) were determined using six rabbits per treatment. Plastic neck collars were used to prevent coprophagy. Soft and hard feces were collected according to the method described by **Carabaño *et al.,* (1989)**. The daily feed intake was recorded after deducing the scattered amounts.

Daily soft and hard feces of each rabbit were collected every day for three days and the samples of daily feces (20%) of each rabbit were taken for chemical analysis. The daily feces samples collected were sprayed with 1% boric acid solution to prevent ammonia losses during drying. Feces samples were dried at 60-70C for 48h. The dried feces observed from each rabbit during the collection period was weighed, mixed, ground and kept until chemical analysis.

Table 2: Formulation and chemical composition of the experimental diets and SBT.

Ingredients	SBT	Experimental diets		
		C	S1	S2
- Basal diet	-	100	84	68
- SBT	-	-	16	32
Total		100	100	100
Chemical analysis (%)				
Dry matter (DM)	89.4	92.01	90.97	91.18
DM basis (%) :				
Organic matter (OM)	84.39	88.87	88.16	87.25
Crude protein (CP)	14.54	15:76	15.52	15.29
Ether extract (EE)	1.96	2.11	2.06	2.09
Crude fiber (CF)	14.61	13.16	13.38	13.62
Nitrogen free extract (NFE)	53.28	57.84	57.01	56.17
Ash	15.61	11.12	11.84	12.75
Calcium	0.70	1.01	0.98	0.89
T.Phosphorus	0.21	0.74	0.71	0.67
DE (kcal / kg)*	2577	2402	2389	2366

*DE (Kcal/kg feed DM) was calculated according to De-Blas 1986).

Analytical methods:

Chemical composition of the SBT, experimental diets and soft and hard feces were analyzed according to **A.O.A.C. (1995).**

- Relative contribution of soft feces to dry matter and crude protein intake were calculated according to **Fraga *et al.*, (1991)** as follows:
- Relative contribution of SF to dry matter intake = (SF excretion, g DM/day)÷(feed intake, g DM / day + SF excretion, g DM /day)×100.
- Relative contribution of SF to crude protein intake = (CP excreted in soft feces, g / day) ÷ (CP ingested in feed, g / day + CP excreted in soft feces, g /day) × 100.
- Caecal turnover rate was calculated according to **Garcia *et al.*, (1995).**

Caecal turnover rate =

[SF production (g DM / d) ÷ caecal contents (g DM)] ×100.

Slaughter test:

Six rabbits from each treatment were randomly slaughtered at the end of 13th week of age (marketing age). Rabbits were weighed and slaughtered after fasting for 12 hours **(Lukefahr *et al.,* 1992).** After slaughtering and complete bleeding (within 30 minutes), carcass traits were evaluated according to **Blasco *et al.*, (1992).**

Hot carcass weight (HCW) was obtained 15 – 30 minutes after slaughter including liver, kidneys, head, lungs, esophagus, trachea, thymus and heart. Dressing percentage was estimated as hot carcass weight (HCW) relatively to pre-slaughter body weight. Cold carcass weight (CCW) was obtained after refrigerating the hot carcass between 0 and 4^0C for 24 hours. Giblets weight (liver, kidneys, heart and spleen), and carcass measurements were recorded and their proportion to the live body weight was calculated.

Drip loss % was calculated as (HCW– CCW / HCW) × 100.

The chemical composition of rabbit s meat was carried out according to **A.O.A.C. (1995).**

Energy values (EV) of rabbit's meat (cal/100g) were calculated according to **Winton and Winton (1958)** as follows:

EV (cal/100g) = 4.1(% protein+% Carbohydrates) +9.3 (% Fat).

***Plasma biochemical analysis*:**

Plasma was obtained by centrifugation of heparinized blood for 10 min. at 3000 rpm and kept in ependorf tubes until chemical analysis. Plasma total protein and albumin were measured according to **Armstrong and Carr (1964)**. Plasma globulin was calculated as the difference between plasma total protein and albumin. Glucose, cholesterol and triglycerides were determined. All samples were analyzed by using specific diagnostic kits (Bio Merieux, France) as recommended by **Bogin and Keller (1987).**

Economical efficiency

The economical efficiency % was calculated using the selling price of weight gain and the feeding cost of this gain prevailing in the market, assuming that other costs were constant.

Economical efficiency % = [(A-B)/B] x100

Where: A= selling cost B= feeding cost

Statistical analysis

Data of the present study were statistically analyzed as reported measures using invariant analysis of variance with the GLM SAS procedure (Der and Everitt, 2001). The linear model used for each parameter was as follows:

$Y_{ij} = M + T_i + e_{ij}$

Where,

Y_{ij} = An observation on j^{th} individual; M = The overall mean;

T_i = fixed effect of j^{th} treatment i; e_{ij} = Random error.

Tests of significance for the differences among treatments were done according to **Duncan (1955).**

RESULTS AND DISCUSSION

Chemical composition of ingredients:

The chemical compositions of dried SBT compared with Egyptian clover hay (BH) and basal diet are presented in Table 3. The results showed that SBT as compared with BH was slightly higher in CP, EE, NFE and ash content by 4.6, 90.3, 4.9 and 35.7%, respectively, but it was lower in the DM and OM and extremely lower in CF contents by 0.78, 4.6 and 35.9%, respectively, At the same time crude protein of SBT was similar to that found in basal diet ,the difference was not more than 1.0 % (14.5 vs. 15.7%). The same observation was detected in crude fiber content (14.61 vs. 13.16%). The chemical composition of SBT in the present study was within the range reported by **El-Bendary *et al.*, (1999), Tag El-Din *et al.*, (2000) and Ali and El-Saidy (2003).**

Table (3): Chemical composition (%) of Egyptian clover hay (BH), sugar beet tops (SBT) and basal diet.

Ingredients	Chemical composition (%)		
	SBT	BH	Basal diet
Dry matter (DM)	89.4	90.1	92.01
Organic matter (OM)	84.39	88.5	88.87
Crude protein (CP)	14.54	13.9	15.76
Crude fiber (CF)	14.61	22.8	13.16
Ether extract (EE)	1.96	1.03	2.11
Nitrogen free extract (NFE)	53.28	50.8	57.84
Ash	15.61	11.5	11.12

Growth performance:

The effect of sugar beat tops hay-containing diets on growth performance of growing NZW rabbits is presented in Table 4.Rabbits fed the experimental diets (S1, 16 and S2, 32%) possessed significantly higher final body weight than those fed the control diet by 6.43 and 6.18%, respectively. Similar trend was noticed with daily weight gain, the increments were higher by 8.6 and 9.6% compared with the control. No significant differences were detected in final body weight and daily weight gain between rabbits fed 16% and 32% SBT. Performance index was significantly improved by 9.2% in rabbits fed diet containing 16% SBT compared to those fed the control diet. These results are in harmony with the results observed by **Tag El –Din *et al.*, (2000)** who pointed out that growth performance improved by increasing sugar beat tops hay in the rabbits diets. In the current investigation, one rabbit of each treatment died. The highest daily feed intake was observed in rabbits fed 32% SBT followed by those fed 16% SBT compared with control. In the rabbits fed diet containing 32% SBT, the feed intake increased by 9.34% compared to those fed the control diet. The increase in daily feed intake in the reported herein may be attributed to higher passage rate of the digesta due to SBT hay inclusion. **Garcia *et al.*, (1999)** attributed the increase of feed intake to the passage rate of digesta and the retention time. **Tag El–Din *et al.* (2000)** found that daily feed intake was gradually increased with elevating the level of SBT from o to 30% in the rabbits diets. Feed conversion ratio significantly improved by 2.54% in the rabbits fed diet containing 16% SBT compared with those fed the control diet, while feed conversion ratio was not statistically affected by 32% SBT. The improvement in feed conversion ratio in the rabbits fed 16% SBT could be attributed to the adaptability of rabbits to SBT in diets. The same conclusion was mentioned by **Tag El-Din *et al.*, (2000).** The study of **Tag El-Din (1996)** and **Awad (1997)** showed that feed conversion ratio significantly affected by feeding rabbits with sugar beet pulp and potato tops up to 30%.

Table (4): Effect of SBT on growth performance of growing NZW rabbits.

Items	Experimental diets			SE	Sig.
	C	S1(16)	S2(32)		
Initial body weight (g)	657	662	639	36.9	NS
Final body weight (g)	2348[b]	2499[a]	2493[a]	54.6	*
Daily weight gain (g)	30.2[b]	32.8[a]	33.1[a]	0.46	**
Daily feed intake (g/d)	107[c]	113[b]	117[a]	2.96	***
Feed conversion ratio	3.54[b]	3.45[a]	3.53[b]	0.04	**
Growth rate (%)	112.5[c]	116.2[b]	118.4[a]	1.49	***
Performance index (%)	66.3[c]	72.4[a]	70.6[b]	1.34	**

Means within row for each item having different superscript differ significantly.
NS = Not significant * $P \leq 0.05$ ** $P \leq 0.01$ *** $P \leq 0.001$

***Digestibility and nutritive values*:**

Partial substitution of rabbit diets with SBT had significant effects on the nutrients apparent digestibility of all nutrients except ether extract Table 5.The digestibility coefficients of DM, CP, CF and NFE, indicated that the rabbits fed 32% SBT had the highest values numerically in almost nutrients followed by those received the diet containing 16% SBT. The diet containing 32% SBT significantly increased the digestibility coefficients of DM, CP, CF and NFE by 5.46, 4.33, 31.54 and 2.78%, respectively, than those of the control group. These results are in accordance with the results reported by **Tag El-Din *et al.* (2000)** who noticed that digestibility of DM, OM, CP, CF and NFE were significantly increased except EE as the level of SBT increased from 0 to 30% in rabbit diets. **El-Bendary *et al.* (1999)** reported that digestion coefficients of CP and CF were higher ($p \leq 0.05$) in growing calves fed diets contained sugar beet tops hay or silage compared with those contained rice straw and berseem hay.

The nutritive values of the experimental diets affected by feeding different levels of SBT in the rabbits diets expressed as TDN, DCP and DE are tabulated in Table 5. The TDN and DCP increased significantly by 9.80 and 5.56%, respectively, while DE decreased ($p \leq 0.01$) by 5.4% in the rabbits fed diet with 32% SBT compared with those fed the control diet. These results are compatible with those observed by **Tag El-Din *et al.* (2000)** who reported that TDN, DCP and DE were significantly higher in the rabbits fed diet containing 30% SBT than those fed control diet. However, **El-Adawy and Borhami (2001)** reported that increasing the dietary substitution of 50% berseem hay by SBT insignificantly affected the nutritive values.

Table (5): Effect of SBT on nutrients apparent digestibility coefficients and nutritive values in growing NZW rabbit diets.

Nutrient	Experimental diets			SE	Sig
	C	S1	S2		
Digestibility coefficients (%):					
DM	69.6^{b}	72.8^{a}	73.4^{a}	0.64	*
CP	71.5^{c}	73.2^{b}	74.6^{a}	0.67	***
CF	29.8^{c}	36.7^{b}	39.2^{a}	1.29	**
EE	84.9	85.2	84.8	1.24	NS
NFE	75.5^{b}	76.3^{ab}	77.6^{a}	0.74	**
Nutritive values:					
TDN %	65.3^{c}	69.4^{b}	71.7^{a}	0.32	**
DCP %	12.58^{c}	12.96^{b}	13.28^{a}	0.16	***
DE (kcal / kg)	2402^{a}	2389^{a}	2366^{b}	12.7	**

Means within row for each item having different superscript differ significantly
NS = Not significant * $P \leq 0.05$ ** $P \leq 0.01$ *** $P \leq 0.001$

***Caecotrophy trials*:**

The incorporation of SBT up to 32% rabbit diets caused a significant increase in DM intake and soft faces (SF) excretion, by 10.08 and 43.6% respectively, compared with the control diet (Table, 6). The same trend was noticed in the DM of caecal contents, which was higher numercally in the rabbits fed SBT diet than those kept on control diet. These results are in line with those observed by **Merino and Carabano, (1992)** who reported higher SF excretion in the fistualted rabbits fed sugar beet pulp diet than those fed alfa alfa hay. The increase of the SF excretion and caecal content in the current investigation may be attributed to indigestible fiber content of SBT that leads in turn to offer the suitable environment to fibrolitic bacteria to grow and increase their activity **(Gidenne *et al.*, 1998).**

No significant differences in DM% of SF or caecal contents were noticed among the experimental groups and the control (0, 16 and 32% SBT). Meanwhile, CP% was significantly ($P<0.01$) increased by increasing the level of SBT in the diets. The dietary SBT levels induced a significant effect on DM contribution of SF to total DM intake, this is mainly due to higher DM intake in the rabbits fed higher SBT level. The highest value of CP contribution of SF to total CP intake was found in the diet contained 32% SBT by (31.6%) compared to the control, as a result of increasing SF excretion. These results confirmed those found by **Valerani (1980)** who reported that the increase of cecum microorganisms population improved crude fiber digestibility and increased the percentage of crude protein in soft feces. However, **El-Adawy and Borhami (2001)** reported that the complete substitution of berseem hay by SBT hay decreased significantly the crude protein content in the soft feces and increased the crude protein content in the hard feces. A significant increase in the caecal turnover rate was observed as the level of SBT in the diets increased. This increase means that caecal content of the rabbits fed SBT rich diet tended to remain shorter time in the caecum consequently the rabbits produce and consume a greater quantity of SF to compensate the higher losses of endogenous protein **(Carabaño *et al.*, 1989).**

Table (6): Effect of SBT on soft faces excretion and caecal content of NZW rabbits.

Items	Experimental diets			SE	Sig
	C	S1	S2		
DM intake (g / d)	119 c	126 b	131 a	2.72	**
Soft faces excretion: (g DM / d)	18.6 c	24.8 b	26.7 a	0.54	***
Chemical composition:					
DM %	34.9	35.4	35.2	0.86	NS
CP %	29.3 c	30.6 b	32.5 a	0.43	**
Relative contribution of soft feces					
DM intake	13.5 c	16.4 b	16.9 a	0.22	***
CP intake	20.6 c	25.4 b	27.1 a	0.36	***
Caecal content (g D M)	29.4 c	34.7 b	36.5 a	0.97	**
Chemical composition of caecal content					
DM %	24.7	24.9	25.2	0.89	NS
CP %	25.3 c	26.6 b	29.1 a	0.36	***
Caecal turnover rate (%)	63.3 c	71.5 b	73.2 a	0.57	**

Means within row for each item having different superscript differ significantly
NS = Not significant * $P \leq 0.05$ ** $P \leq 0.01$ *** $P \leq 0.001$

Plasma constituents:

Summarized in Table (7) are some of the plasma constituents of differents. The plasma total protein and albumin were significantly increased by 20.7 and 21.9%, respectively; in the rabbits fed 32% SBT compared with those fed the control diet. This may be due to the higher CP digestibility observed in rabbits fed 32% SBT. Globulin and urea-N,or the transaminases activities (GOT and GPT) did not show any significant differences compared with the control. These results may indicate that rabbits could tolerate and adapt to these levels of SBT used.

However, **Abd-El-Hady *et al.* (1999)** pointed out that the inclusion of SBT in rabbits diets significantly affected serum GOT and GPT, while total protein, urea-N and creatinine were not significantly affected by feeding diets containing silage, hay of SBT and berseem hay.

Plasma glucose, cholesterol and triglycerides were significantly decreased by 13.13, 32.9 and 12.6%, respectively, as the level of SBT increased from 0 to 32% in the diets. This decrease may be due to the changing in the source of starch in the diets **(Lerer *et al.*, 1996)**.

Table (7): Effect of SBT on some blood parameters of growing NZW rabbits.

Items	Experimental diets			SE	Sig.
	C	S1	S2		
Total protein (g / dl)	5.18[c]	5.86[b]	6.25[a]	0.26	**
Albumin (g / dl)	3.24[c]	3.78[b]	3.95[a]	0.14	*
Globulin (g / dl)	1.94	2.08	2.30	0.47	NS
Glucose (mg / dl)	137[a]	129[b]	119[c]	5.15	**
GPT (U / L)	17.9	16.8	18.2	3.11	NS
GOT (U / L)	50.1	48.6	49.9	4.25	NS
Cholesterol (mg / dl)	86.3[a]	69.5[b]	57.9[c]	8.32	***
Triglycerides(mg/ dl)	126.7[a]	116.4[b]	110.8[b]	6.49	**
Urea – N (mg / dl)	19.1	18.9	19.4	2.24	NS

Means within row for each item having different superscript differ significantly
NS = Not significant * $P \leq 0.05$ ** $P \leq 0.01$ *** $P \leq 0.01$

Carcass traits:

The results presented in Table (8) showed that dressing % of the rabbits fed 32% SBT significantly increased by 7.78 % compared with the control. These results are in harmony with those observed by **Tag El–Din (1996) and Amber and Gad (2001)** who reported that dressing and relative carcass weight increased by increasing the SBT levels (30-32%) .The gastrointestinal tract (GIT) was significantly decreased by 9.18% in rabbits fed 32% SBT. The cecum length was higher ($P \leq 0.01$) by 9.72 % in rabbits fed diet with 32% SBT compared with those fed the control diet while he length of small intestine was not statistically affected. These results are compatible with those reported by **Carabano *et al.* (1997).**

Meat composition analysis revealed that CP and ash content increased by increasing SBT levels. On the other hand, meat composition of DM and EE were significantly reduced by 4.96 and 15.6%, respectively, in rabbits fed diet 32% SBT compared with those fed the control diet. The lower plasma cholesterol and triglyceride observed in the current investigation confirmed those observed by slaughter test where EE in the rabbits meat was reduced due to dietary 32% SBT.

Relative revenue:

The results of growth performance (weight gain and feed intake) were subjected to economical study (Table 9). The results of the economical efficiency showed that the cost of the total feed intake was decreased by 9.4% as the level of SBT increased from 0 to 32% in the diets. This decrease was mainly due to the lower price of 1 kg of S2 (32% SBT) diet by 19.6% as compared with the control diet. The highest value of net revenue was obtained in the rabbits fed diet with 32% SBT, while the least value was obtained in rabbits fed the control diet. These results disagreed with those **Tag El-Din *et al.* (2000)** who found that the highest economical efficiency values were recorded in the rabbits fed the control diet, while, the least values were obtained in the rabbit fed diet with 30% SBT. **El-Adawy and Borhami (2001)** reported that the inclusion of SBT in growing rabbit diets slightly increased the economical efficiency values than those fed the control diet.

Table (8): Effect of SBT on carcass traits and meat composition of growing rabbits.

Items	Experimental diets			SE	Sig.
	C	S1	S2		
Dressing % (with head)	52.8^{c}	54.7^{b}	56.9^{a}	0.45	**
Gastrointestinal tract(GIT)	19.6^{a}	18.2^{b}	17.8^{b}	0.64	**
Small intestine:					
Weight (%)	4.04^{a}	3.67^{b}	3.14^{c}	0.26	*
Length (cm)	306	309	312	12.5	NS
Cecum content:					
Weight (%)	5.72^{a}	5.56^{a}	4.87^{b}	0.39	*
Length (cm)	49.4^{c}	52.3^{b}	54.2^{a}	1.16	*
Meat composition on DM% basis					
DM	26.2^{a}	25.6^{ab}	24.9^{b}	0.56	*
EE	17.9^{a}	16.4^{b}	15.1^{c}	0.29	**
CP	68.3^{c}	70.8^{b}	72.5^{a}	0.57	**
Ash	6.62^{c}	7.24^{b}	8.19^{a}	0.35	***

Means within row for each item having different superscript differ significantly
NS = Not significant * $P \leq 0.05$ ** $P \leq 0.01$ *** $P \leq 0.001$

Table (9): Effect of diet inclusion SBT on economical efficiency of growing NZW rabbits.

Items	Experimental diets		
	C	S1	S2
Number of survival rabbits	19	19	19
Total feed intake (kg)	113.8	120.2	124.5
Price / kg diet (L.E).	0.92	0.82	0.74
Total feed cost (L.E.)	104.70	98.56	92.13
Total meat yield (kg)	32.13	34.89	35.22
Selling price* (L.E).	257.04	279.1	281.76
Net revenue** (L.E).	152.34	180.6	189.63
Relative economical efficiency***	100	118.5	124.4

*Selling price of 1 kg = 8.0 L.E. × total yield.
**Net revenue = selling price of meat yield – feed cost.
***Assuming that relative economical efficiency of control diet equal to 100.

CONCLUSION

It may be concluded that the SBT can be introduced to the growing rabbits diets up to 32% as a replacement of the complete basal diet to improved the performance and economical efficiency of NZWrabbits.

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التقييم الغذائي لعرش بنجر السكر كمادة غذائية غير تقليدية في أعلاف الأرانب النامية

عادل السيد أبو زيد
قسم الإنتاج الحيواني - كلية الزراعة - جامعة طنطا

أستخدم في تلك الدراسة ستون من ذكور الأرانب النامية عمر ٥ اسابيع وذلك لدراسة اثر الإحلال الجزئى لعرش بنجر السكر بنسب ١٦ ، ٣٢% محل العليقة المتكاملة للأرانب على كفاءة النمو، معاملات الهضم والقيم الغذائية، بعض قياسات الدم، قياسات الذبيحة، افراز الروث الرطب والكفاءة الإقتصادية. تم توزيع الأرانب بطريقة عشوائية على ثلاثة مجموعات تجريبية كلا منها يحتوى على ٢٠ ارنب. تم تقدير وزن الجسم الحى والغذاء المأكول بطريقة فردية لكل الأرانب تحت الدراسة اسبوعيا.أشارت نتائج البحث الى أن احلال عرش بنجر السكر فى علائق الأرانب أدى الى زيادة جوهرية فى معدل الزيادة اليوميه لوزن الجسم ومعدل النمو فى مجموعة الأرانب المغذاة على عليقة محتوية على ٣٢% عرش بنجر السكر فى حين أدى احتواء العليقة على ١٦% عرش بنجر سكر إلى زيادة قيمة دليل الكفاءة مقارنة بالقيم المتحصل عليها فى المجموعة المغذاة على عليقة المقارنة (الكنترول) والخالية من عرش بنجر السكر. أدت التغذية على العلائق المحتوية على عرش بنجر السكر إلى زيادة معنوية فى جميع معاملات الهضم عدا معامل هضم الدهن الخام فى حين اظهرت مجموعة المقارنة (الكنترول) أعلى قيمة لمعامل هضم الطاقة الكلية. إضافة عرش بنجر السكر لعلائق الأرانب أثر معنويا على إفراز الروث الرطب وأعطت المجموعة المغذاة على عليقة محتوية على ٣٢% عرش بنجر سكر أعلى قيمة لإفراز الروث الرطب. مدى مساهمة البروتين الخام للروث الرطب فى البروتين الخام المأكول أعطى اعلى قيمة معنويا فى مجموعة الأرانب المغذاة على عليقة محتوية على ٣٢% عرش بنجر سكر مقارن بمجموعة الأرانب المغذاة على عليقة المقارنة. أظهرت النتائج ان قيم الجلوكوز والكلوستيرول والدهون الثلاثية قد انخفضت وان قيم البروتين الكلى والألبيومين زادت معنويا في سيرم الدم بزيادة نسبة عرش البنجر بالعليقة. لم تظهر انزيمات وظائف الكبد أي اختلافات معنوية بينها وبين الكنترول. النسبة المئوية لتصافى الذبيحة زادت معنويا فى مجموعة الأرانب المغذاة على عليقة محتوية على ٣٢% عرش بنجر سكر مقارنة بالمجموعة المغذاة على عليقة المقارنة (الكنترول). أعلى قيمة للدخل النسبى تم الحصول عليها فى مجموعة الأرانب المغذاة على عليقة محتوية على ٣٢% عرش بنجر سكر فى حين كانت اقل المجموعات فى الدخل النسبى هى مجموعة المقارنة (الكنترول). ويمكن أن نستنتج من نتائج البحث أن عرش بنجر السكر يعتبر مصدر غذائى جيد لتغذية الأرانب النامية وأنة يمكن إضافتة بنسبة تصل الى ٣٢% من علائق الأرانب النامية دون أن يؤثر ذلك سلبيا على كفاءة النمو والقيم الغذائية كما أدت الإضافة إلى زيادة قيمة الكفاءة الإقتصادية للأرانب النامية.