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UTILIZATION OF *Ziziphus spina-christi* LEAVES AS A NATURAL GROWTH PROMOTER IN RABBIT'S RATIONS.

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Ninety weaned New Zealand White (NZW) male rabbits at 6 weeks of age (mean initial body weight, (762.60g) were used to evaluate the potential of ziziphus spina-christi leaves (sidr) as natural growth promoters of growing rabbits. Rabbits were randomly assigned to three experimental groups (n=30 in each group) in a simple randomized design experiment and fed individually during experimental period (8 weeks). The control group (diet 1) was fed a diet without Sider leaves (SL); the experimental groups were fed the same diet with 10 (diet 2), and 20g SL/kg diet (diet 3). This was followed by 5 days of feeding as a collection period to determine nutrients digestibility of the tested diets.

Final live weight, total weight gains and average daily gain (ADG) were significantly higher for diet 3 (20 g SL/kg diet) than for others. Rabbits fed control diet showed almost the lowest values (P<0.05) of the digestibility of various feed components. It was observed that rabbits taking diet 3 had significantly higher (P<0.05) TDN and DCP compared with those taking control diet. The best nitrogen balance (P<0.05) recorded with rabbits fed diet 3, which followed by those fed diet 2 and control diet (0 g SL/Kg diet), respectively. The NH_3-N value of diet1 group was significantly (P<0.05) higher compared with others. The total anaerobic bacteria count in control group was higher (P<0.05) than others. However, rabbits of group 2 and 3 recorded the highest total anaerobic cellulolytic bacteria count values. Whereas, total protein levels in blood serum of rabbits fed diet 3 were significantly lower (P<0.05) than that in the control group by 15.65%, respectively. However, urea nitrogen, uric acid and creatinine values were also significantly (P<0.05) higher in the control group than in group 3. Dressing

percentages of slaughter rabbits improved significantly (P<0.05) in diet 3 compared to the control group.

Conclusively, *the results of this study could have provided scientific validity for the use of low ziziphus spina-christi leaves levels (20g SL/kg diet) in the growing rabbit diets as natural growth promoters without any adverse effects on rabbit performance.*

Key words: *ziziphus,* rabbits, digestibility, growth promoter.

No doubt, that the veterinary medicine prices have become very expensive, especially antibiotics, growth promoters and vitamins, the price of fodder especially imported from abroad in Egypt Also, rabbit production is limited due to the high mortality and increased use of antibiotics has led to high incidence of resistant bacterial strains infections and associated with increased side effects. Rabbit meat is of high quality and safety; it is suitable to be raised for meat production due to its high feed conversion efficiency (De Blas and Garvey, 1975).

Gastrointestinal illnesses can cause death in 30-50% of the stock, and the animal's performance can also significantly be reduced (Lelkes and Chang, 1987). For resolve these problems, it is necessary to use the growth promoters of natural origin, which are able to provide the comparable efficacy and will not contribute to the cumulative contamination of the environment (Bomba *et al*., 2006). Finally, control of the micro-biota could limit digestive disorders around weaning via its barrier effect and its role as an immune stimulator (Combes *et al.,* 2013). *ziziphus spina-christi* is a subtropical plant known in Egypt as 'Nabq' or 'Sidr' (Taeckholm, 1974) which is used for various medicinal purposes. The leaves provide valuable animal forage and fodder under open grazing conditions, but the nutritional value is apparently not high for most domestic livestock. The leaves contain various alcaloids, including ziziphine, jubanine and amphibine, alpha terpinol, linalol and diverse saponins. ziziphusspina-christi L. ziziphusspina - christi has been shown to have activity against bacteria and fungi (Abdel-Galil and El-Jissry.,1991).

Therefore, the objective of the present work was to study the effect of addition different levels of *ziziphusspina-christi L.* leaves as natural growth promoter to rabbit's diets, on growth performance, carcass traits, digestibility coefficients of nutrients, cecal content and blood biochemical characteristics of growing rabbits.

MATERIALS AND METHODS

Experimental design:

This study was carried out at Borg El-Arab research station, Agricultural Research Center, Alexandria. Total 90 weaned New Zealand White (NZW) male rabbits at 6 weeks of age (mean initial body weight, 762.60g) were randomly assigned to three experimental groups (n = 30 in each group) in a simple randomized design experiment. The control group was fed a diet without Sider leaves (SL) (diet 1); the experimental groups were fed the same diet with 10, and 20g SL/kg (diet 2 and diet 3, respectively). The experimental period lasted for 8 weeks (from 6 to 14 weeks of age).

Experimental animals, housing and diets:

Rabbits were individually housed in galvanized wire cages (dimensions: 30 × 20 × 35 cm) under a 12:12 h light–dark cycle until marketing at 14 weeks of age. All rabbits were fed pelleted diet *ad libitum*. The experimental diets were formulated to meet the recommended nutrient requirements of growing rabbits according to Lebas (2004). The SL supplementation levels (10 and 20 g) were pre-mixed with 1 kg of each diet and successively mixed into the remaining diet to obtain the homogenous inclusion level. All rabbits were kept under the same management, hygienic and environmental conditions. Rabbits were reared in a well-ventilated building; fresh water was automatically available all the time by stainless steel nipples fixed in each cage. Throughout the experimental period, body weight was determined every 2 weeks (at 6, 8, 10, 12 and 14 weeks of age) and average body weight gain was calculated. During the whole experimental period, the feed intake was determined precisely and is given as grams per rabbit per week. From each cage, feed residuals were collected daily, weighed and taken into consideration for the calculation of feed intake and feed conversion ratio. Feed ingredients and chemical composition of the experimental diet are shown in Tables 1 and 3.

Analysis of diets and sidr leaf were performed as recommended by AOAC (2000) for determining moisture, crude protein (CP), crude fiber (CF), ether extract (EE), ash. The condensed tannins were determined according to Makkar (2003), phenolic compounds were determined using the high-performance liquid chromatographic using the procedure of Meier *et al.*

(1988). The contents of phenolic contents in the sidr (*ziziphusspina-christi*) leaves used in the present study are presented in Table 2.

Table 1. The proximate chemical composition of *ziziphus spina- Christi*.

Chemical composition	Moisture %	CP %	EE %	CF %	Ash %	ADF %	Lignin %	Cellulose %
% DM basis)	8.30	8.76	3.39	17.71	8.90	44.19	31.41	24.21

Table 2. Phenolic contents of sidr *(ziziphus spina-christi.)* leaves.

Items	Sidr (*ziziphusspina-christi.*) leaves
Total phenols (ppm)	717.00
Condensed tannin (% on DM basis)	3.17

Digestibility trials:

At the end of the growth experiment (14 weeks of age) digestibility trials were carried out to determine the nutrients digestibility, feeding values and nitrogen balance of experimental diets. A total number of 15 male rabbits were taken randomly (3 with in each treatment) and allotted in different treatment. Animals were housed individually in cages that allowed the separation of feces and urine. All rabbits were kept under the same management, hygienic and environmental conditions. The experimental diets were offered twice daily at 9 a.m. and 15 p.m. and fresh water was provided *ad libitum*. Survey of daily feed consumption was recorded. Any possible feed contamination was removed from the feces. Samples of daily feces of each rabbit were taken and oven dried at 60º C for 48h, then was ground and stored for proximate chemical analysis. Samples of feed and feces were analyzed for DM, CP, EE, CF, and ash according to the classical A.O.A.C (2000) methods. The nutritive values of the experimental diets as total *digestible nutrients* (TDN) value were calculated according to Cheeke (1987). Digestible energy (DE) was calculated according to Fekete and Gippert (1986) using the following equation: DE (kcal/ kg DM) = 4253-32.6 (CF %)-144.4 (total ash). The urine of each animal was collected in a glass recipient, containing 10 ml of a 1:1 HCl: H2O solution, to avoid bacterial production and possible losses by volatilization. The values of nitrogen intake (NI), nitrogen excreted in feces (NF) and

Table 3: Feed ingredients and chemical composition of experimental diets (% DM basis).

Feed Ingredients (%)	Experimental diets, SL/kg		
	Diet1 (0.0g)	**Diet2 (10.0g)**	**Diet3 (20.0g)**
Soybean meal (44%CP)	20.9	20.9	20.9
Barley	32	32	32
Wheat bran	9.2	9.2	9.2
berseem hay	31	30	29
Molasses	3	3	3
Limestone	0.7	0.7	0.7
Di- Ca- phosphate	2.2	2.2	2.2
DL-Methionine	0.4	0.4	0.4
NaCl	0.3	0.3	0.3
Vit.-Min. premix*	0.3	0.3	0.3
Ziziphus spina-christi L. leaves	0.0	1.0	2.0
Total	**100**	**100**	**100**
Chemical composition (%DM basis)			
DM	92.88	92.78	91.98
OM	90.88	90.68	90.59
CP	17.56	17.37	17.35
CF	13.46	13.45	13.46
EE	2.3	2.29	2.35
NFE	57.65	57.57	57.43
Ash	9.120	9.320	9.410
NDF	37.767	37.761	37.767
Digestible energy (Kcal/Kg DM)**	2497.27	2468.72	2455.4

*__Mineral and vitamin mixture supplied per kg of diet__: Vitamin A 10,000 IU, Vitamin D3,1,800 UI; Vitamin E, 15 mg; Vitamin K3, 4.5 mg; Vitamin B1, 0.5 mg; Vitamin B2, 4 mg; Vitamin B12, 0.001 mg; Folic acid, 0.1 mg; Pantothenic acid, 7 mg; Nicotinic acid, 20 mg; I, 1 mg; Mn, 60 mg; Cu, 5.5 mg, Zn, 75 mg; Fe, 40 mg; Co, 0.3 mg; Se, 0.08 mg; Robenidine, 52.8 mg, Antioxidant, 0.250 mg.

**__Digestible energy (DE)__ was calculated according to Fekete and Gippert (1986) using the following equation: DE (kcal/ kg DM) = 4253-32.6 (CF %)-144.4 (total ash).

nitrogen excreted in urine (NU) were obtained by the amounts of feed ingested and excreted nitrogen of feces and urine, respectively, retained nitrogen was calculated as RN = NI – (NF + NU).

Slaughtering and carcass traits:

At the end of period of growth experiment, five male rabbits from each group (aged 14 weeks) were randomly taken, fasted for 12 h, individually weighed and immediately slaughtered. After complete bleeding, pelt, viscera and tail were removed, and then the carcass and its components were weighed as edible parts. The non-edible parts including lung, spleen, stomach, large intestine, small intestine and kidney fat were also weighed as percentage of pre-slaughter weight. Dressing percentage was calculated by dividing the hot dressed carcass weight by pre-slaughter weight and expressed as a percentage. Gastrointestinal tracts were individually removed from three slaughtered rabbits from each group, the cecum was weighted and the pH of the caecal content was measured using digital pH meter (Orion Research Digital pH meter, model 201). Then the caecal content was collected and divided into two samples, one of them was taken to estimate the cecum microflora (Total anaerobic bacteria count and anaearobic cellulolytic bacteria count) determined by Standard method according to Kim and Goepfert (1971). Using nutrient agar medium (Difco Manual, 1984), another sample was filtered through four folds of gauze for determination of total volatile fatty acids (VFA) and ammonia nitrogen by steam distillation (UDK 139- Semi-Automatic Distillation Unit) according to Warner (1964).

Blood samples and determination of biochemical parameters:

For determining blood biochemical components, five blood samples (5 ml from each rabbit) were taken during slaughter from five animals per treatment. Plasma was separated from blood by centrifugation at 1000 g for 20 min and stored at −20°C till assayed. Plasma total protein, albumin, glucose, urea nitrogen, uric acid and creatinine were measured calorimetrically using commercial kits (purchased from Bio-diagnostic, Cairo, Egypt) according to the manufacturers' instructions. Total protein was determined according to Orsonneau *et al.* (1989). Albumin was determined according to the method of Doumas *et al.* (1971). Plasma globulin concentration was calculated by the difference between total protein and albumin. Plasma glucose, urea nitrogen and creatinine were determined according to Fawcett and Soctt (1960). Uric acid was determined calorimetrically.

Statistical analysis:

Data were statistically analyzed using One-Way Layout with Means Comparisons Procedure SAS (2003). Differences among means were tested by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Productive performance

Data presented in Table (4) showed that rabbits fed on diets 3 had significant differences (P<0.05) in final live weight, total weight gain, av. daily feed intake (ADFI) and feed conversion ratio (FCR) in comparison with control group. It was also observed that initial live weight and average daily weight gain had no significant difference (P>0.05) among all treatments.

Table (4): Effect of different levels of Sidr (*ziziphus spina-christi L.*) on some of growth performance during the experimental period (6 to 14. weeks of age).

Parameters	Experimental diets, SL/kg				Sig. test
	Diet1 (0.0g)	Diet2 (10.0g)	Diet3 (20.0g)	± SE	
Av. Initial live weight (g)	753.81	765.00	769.00	8.66	NS
Final live weight (g)	2366.25c	2555.01b	2629.26a	21.91	
Total weight gain (g)	1612.44c	1790.01b	1860.26a	18.36	
Av. Daily weight gain (g)	28.79	31.96	33.22	1.12	NS
Av. Daily feed intake(g)	85.34b	86.94a	87.13a	0.15	
Feed conversion ratio	2.96a	2.72b	2.62b	0.08	

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

These results are similar to those of Abdu *et al.,* 2012 who reported that inclusion of ziziphus leaf meal in concentrate diet at 10-20% levels gave best performance than when the leaf meal is included at higher levels to ram lambs. Also, Al-Mamary *et al.* (2001) showed that addition of low-tannin (1.4 % catechin equivalent) in the diets of rabbits did not significantly change growth rate, feed intake or feed conversion ratio. Also, Struklec *et al*. (2001) did not observe palatability problems or anti-nutritional effects even at a dosage of 5% condensed tannin. The present results are in disagreement with those of Douglas *et al.* (1993), reported that increasing the tanning level in

the diet linearly depressed weight gains and feed conversion efficiencies of turkeys. However, McNabb *et al* (1998) and Barry and Duncan (1984) showed that the effect of tannins depends on the type and level of tannins, and dietary nutrients involved.

Digestibility, feeding values and nitrogen balance

Results of Table (5) showed that rabbits fed on diet 3 which contained 20 g Sidr (*ziziphus spina-christi* L.) leaves /Kg diet recorded the highest DM, OM, CP, EE and NFE digestibility ($P<0.05$) than others, while rabbits fed control diet showed almost the lowest values ($P<0.05$) of the digestibility of various feed components. Results of nutritive values as TDN and DCP as affected by SL supplementation are illustrated in (Table 5). It was observed that rabbits fed on diet 3 had significantly higher ($P<0.05$) of TDN and DCP compared with those fed on control diet. In contrary, Abdu *et al.* (2012) showed that there was a significant ($P<0.05$) depression on dry matter (DM), organic matter (OM), neutral detergent fiber (NDF) and acid detergent fiber (ADF) digestibility, as the *ziziphus spina christi* leaf meal inclusion in the supplementary Yan kasa lambs diet.

Different hypotheses explained the positive effect of low to moderate concentration of tannins as secondary metabolites identified in the *ziziphus spina-christi* could be responsible for antimicrobial and antifungal pathogens activity (Mohammed *et al*., 2012 and Mohammed *et al*., 2011). One of these, Tannins in low to moderate concentration bind cell walls protein of ruminal bacteria, preventing growth and protease activity [Asquith *et al*,1986] and making nutritional proteins unavailable for them (Junior and Zanil 2000), (Asquith *et al*.,1986). That increase flow of non-ammonia nitrogen and essential amino acid from the rumen (Egan and Ulyatt, 1980; Barry and Manley, 1984; Waghrn *et al.,* 1987) and cecum in rabbits. It is known that rabbits eat their faeces and hence drive substantial amounts of microbial proteins from such diets (Al-Mamary *et al.,* 2001). However, that could lead to further digestibility of the re-ingested tannin-complexes formed along the digestive tract, but this is not well known and may require further investigation. Also, Tannins partially cover the mucus membrane of the gut and thereby a barrier against toxins (Chung *et al.,* 1998) is used for the treatment of stomach discomfort and urinary infections (Adzu *et al.,* 2003) that could lead to improve the health status of the rabbits.

The results revealed that no significant differences in nitrogen intake were detected between rabbits fed experimental diets (Table 5) on three

Table (5): Effect of different levels of Sidr (*ziziphus spina-christi L.*) on digestion coefficients (%), nutritive values (%) and nitrogen balance of experimental diets.

Items	Experimental diets, SL/kg			± SE	Sig. test
	Diet1 (0.0g)	Diet2 (10.0g)	Diet3 (20.0g)		
Digestion coefficients (%)					
DM	67.56c	69.26b	70.46a	0.33	
OM	67.67c	69.67b	71.20a	0.44	
CP	73.46c	76.19b	77.76a	0.51	
CF	58.30b	59.81a	60.51a	0.28	
EE	70.34c	73.78b	76.41a	0.68	
NFE	67.96b	68.62b	70.70a	0.36	
Nutritive value (%)					
TDN	63.57c	64.57b	66.27a	0.32	
DCP	12.90b	13.23ab	13.49a	0.11	
Nitrogen balance					
Nitrogen intake (g day-1)	2.44	2.51	2.54	0.05	NS
Excreted nitrogen through faeces (g day-1)	0.95a	0.91a	0.83b	0.02	
Excreted nitrogen through urine (g day-1)	0.44a	0.37b	0.27c	0.02	
Total excreted nitrogen (g day-1)	1.39a	1.28b	1.10c	0.04	
Nitrogen balance	1.05c	1.23b	1.44a	0.05	

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

formulated diets containing 0, 10 and 20 g SL/Kg diet. Rabbits fed the diet 3 excreted the lowest amount (P<0.05) of nitrogen through feces and urine.

Rabbits fed the diet 3 recorded the best nitrogen balance (P<0.05) than others, which followed by those fed diet 2 and control diet, respectively. Similar trends have been observed by Al-Mamary *et al* (2001) who found that addition of low-tannin sorghum grains to the rabbit diet did not significantly have any effect on faecal nitrogen excretion and nitrogen retention with respect to the control diet. However, in their experiment, they also observed that the addition of high tannin sorghum grains significantly increased faecal nitrogen output and reduced nitrogen retention. In disagreement with our results Abdu *et al.* (2012) found that feeding different levels (0, 10, 20, 30, and 40%) *ziziphus spina christi* leaf meal containing diets significantly (P<0.05) influenced nitrogen utilization. The positive effects of tannins on protein utilization have practical importance because problems associate with

extensive proteolysis and /or de-amination in the rumen will be avoided by binding of tannins with proteins (Beever *et al.*,1989).

Cecum activity

The caecum activity and micro flora count of the rabbits in experimental trial are presented in Table 6. There were no differences ($P>0.05$) between treatments in caecum weigh, caecum length and TVFA. Ammonia concentrations were found within the range 22.71-27.88 mg/ dl, the NH_3-N value of group 1 was significantly ($P<0.05$) higher than others.

The pH value of the caecum is usually about 6.0- 7.0 around growing rabbits depending on microbial activity and feeding pattern (Cheeke, 1987 and Fekete, 1990). Increasing sidr leaves level resulted in more fermentation in the cecum, thus reduced cecum pH as a result of increasing ($P>0.05$) VFA production. Caecal pH varies inversely to the increase in VFA concentration. These values are in general agreement with those obtained by García *et al*. (2002). However, decreasing NH3–N concentration and pH and the increasing of VFA in the cecum may be attributed to increasing digestion of all nutrients (Table 5) accordingly, that leads to decrease the proteolytic capacity of caecal microorganisms, as occurs in the rumen (Waghorn *et al*., 1987). Also, decreasing NH3–N concentration may be attributed to the conversion of ammonia-N into microbial protein for the benefit of rabbits which characterized by the pseudo-rumination.

The total anaerobic bacteria count in control group was higher ($P<0.05$) than others. However, rabbits of groups 3 and 2 recorded the highest ($P<0.05$) total anaerobic cellulolytic bacteria count values than group 1. This may be due to the decreasing of the cecum pH with increasing sidr leaf level when compared to the control diet. Also, these results may be due to that tannins have general antimicrobial and have been reported to prevent the development of bacteria by precipitating microbial protein (Asquith and Butlur1986). whereas, Korji, (2012) and Al-Mutairi *et al.* (2016) who found that the aqueous extract of *ziziphus spina-christi* leaves has shown significant antibacterial activity against *Salmonella typhi, Proteus mirabilis, Shigella dysenteriae, E. coli, K. pneumonia, B. melitensis, Bordetella bronchiseptica* and *P. aeruginosa* in comparison with eight antibiotics. Bennegadi *et al.* (2003) found that cellulolytic bacteria represented <7% of total bacteria, with a predominance of *R. flavefaciens* and *R.albus*, respectively, for conventional and specific pathogen free rabbits. It is clear to notice that incorporating sider

Table 6: Caecum activity and micro flora count as affected by feeding different levels of sidr (*ziziphus spina-christi*) for growing rabbits.

Items	Experimental diets, SL/kg			± SE	Sig. test
	Diet1 (0.0g)	Diet2 (10.0g)	Diet3 (20.0g)		
Caecum weight, g	169.77a	169.43a	169.73a	0.0.75	
Caecum length, cm	11.78a	11.46a	11.90a	0.17	NS
TVFA (meq. / dL cecal juice)	6.01a	6.18a	6.23a	0.10	NS
NH3-N (mg\ dL cecal juice)	27.88a	22.88b	22.71b	0.72	
Caecum pH	5.80a	5.71b	5.69b	0.02	
Total anaerobic bacteria count (log^{-1} cfu/ml)	7.76a	6.42b	6.12c	0.21	
Total Anaerobic cellulolytic bacteria count (log^{-1} cfu/ml)	6.19[b]	6.73a	6.80a	0.09	

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

leaves in rabbit diets stimulating the maturation of cecal flora especially cellulolytic bacteria, which secretes enzymes capable of hydrolyzing the cellulose as the main components of dietary fiber.

Blood parameters

It was interest to note that as sidr leaves level increases total protein albumin, globulin and glucose levels in blood plasma of rabbits within normal range according to (Steven (1974) significantly (P<0.05) decreases (Table 7). The obtained results of this study were comparable to the report of Mitruka and Rawwnssely (1977) who reported a range of glucose was 43.02 – 99.9 mg/dl and Jackson and Cockcroft (2002) (43.2-72 mg/dl). Plasma glucose is an indication of carbohydrate metabolism in high energy diets **(**Coles 1980). The current results are in harmony with those obtained by Glombitza *et al.* (1994) who demonstrated that the butanol extract (saponin fraction) of *ziziphus spina-christi* leaves or its main saponin glycoside improved glucose utilization in diabetic rats. Also, Michel *et al.* (2011) reported that Oral administration of 200 mg/kg B.W of *ziziphus spina-christi* leaf extract diet-diabetic rats for 28 days resulted in significant reduction in blood glucose level together with significant rise in plasma insulin. Vessal *et al.* (2003) suggested that quercetin has proven to be beneficial in decreasing blood glucose concentration, promoting regeneration of the pancreatic islets, as shown by increased number of islet cells, and increasing insulin release in diabetic rats.

However, urea nitrogen, uric acid and creatinine values were also significantly (P < 0.05) higher in the control group than others. Lower blood urea indicates superior protein quality in group of rabbits received 10 and 20 g / Kg SL diet this had earlier been reported by Eggun, (1970), that high level of blood urea indicated poor protein quality, the high level of plasma urea might be attributed to excessive tissue protein catabolism associated with protein deficiency (Odunye and Adedevon 1976). These results are parallel with Wada *et al* (2014) who found that as *ziziphus mucronata* level increase (0 - 5%-10%-15%) in Yan kasa ram's diet urea and creatinine decreased. Creatinine values in this study were significantly (p<0.05) among the treatments, whereas diet 1 have the highest value of 0.65 mg/dl which is a slightly lower than (1.41-24.40 mmol/L) reported by (Özkan *et al.,* 2012). This observation suggested that there's no muscle waste and that the rabbits did not survive at the expense of their body reserves (Ologhobo, 1992). So, this is an indication that the dietary protein was well utilized by the rabbits in each treatment group as earlier reported elsewhere (Eggun 1970, Ross *et al.,* 1978).

Table (7): Effect of different levels of sidr (*Ziziphus spina-christi*) on blood biochemical (Within normal range, Steven of growing rabbits.

Items	Experimental diets, SL/kg			± SE	Sig. test
	Diet1 (0.0g)	Diet2 (10.0g)	Diet3 (20.0g)		
Total Protein, (g/dl)	6.39a	5.72ab	5.39b	0.16	
Albumin, (g/dl)	3.97a	3.03b	3.10b	0.14	
Globuline, (g)	2.42b	2.69a	2.29c	0.05	
Glucose, (mg/dl)	85.77a	81.66b	80.94b	0.63	
Urea nitrogen, (mg/dl)	26.22a	22.63b	21.01c	0.61	
Uric acid, (mg/dl)	0.48a	0.39b	0.37b	0.02	
Creatinine, (mg/dl)	0.65a	0.52b	0.50b	0.02	

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

Carcass traits:

Table (8) shows the carcass characteristics of rabbit groups fed the experimental diets. The results indicated that increase in sider leaves supplementation in the diet, significantly (P<0.05) improved the dressing percentages of slaughter rabbits.

Whereas, the rabbits fed diets containing 0, 10 and 20 g SL /Kg diet recorded the dressing percentages of 58.11, 60.89 and 63.03 %, respectively. The results indicated that head, heart, kidney fat, spleen, lung and cecum

Table (8): Carcass characteristics of rabbit groups fed the experimental diets.

Items	Experimental diets, SL/kg			± SE	Sig. test
	Diet1 (0.0g)	Diet2 (10.0g)	Diet3 (20.0g)		
Pre-slaughter weight (g)	2366.25b	2555.01a	2629.26a	33.60	
Hot carcass weight (g)	1374.55c	1555.23b	1657.22a	34.31	
Dressing (%)	58.11c	60.89b	63.03a	0.56	
Fur (%)	7.08b	7.43ab	7.65a	0.09	NS
Head (%)	4.51	4.68	4.74	0.07	NS
Liver (%)	2.12b	2.41a	2.50a	0.06	
Heart (%)	0.23	0.23	0.23	0.01	NS
Kidney (%)	0.52b	0.60a	0.61a	0.01	
Kidney fat (%)	0.23	0.28	0.29	0.01	NS
Spleen (%)	0.044	0.045	0.045	0.001	NS
Lung (%)	0.52	0.54	0.54	0.01	NS
Cecum [%]	6.68	6.77	6.88	0.07	NS
Edible giblets (%)	2.86b	3.24a	3.44a	0.08	
Total edible parts (%)	60.97c	64.13b	65.97a	0.56	
Total non-edible parts (%)	39.03a	35.87b	34.03c	0.56	

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

Weight of hot carcass including head as percentage of pre-slaughter weight, Edible giblets (%) = {Liver (g) + Kidney (g) + Heart (g)/Pre-slaughter weight (g)} x 100,

Total edible parts (%) = {Carcass weight (g) + Weight of edible giblets (g)/Pre-slaughter weight (g)} x 100.

percentages were unaffected significantly by treatments. However, it was noted that total edible parts (%) were improved significantly ($P<0.05$) with increasing dietary sider leaves level. Under normal physiological conditions, the condensed tannins are not absorbed into the blood streams, therefore, they are not likely to damage organs such as the liver, kidney, spleen, etc., as has been the case for hydrolysable tannins (McSweeney *et al.*, 2001).

Conclusively, these increments in live body weight and body weight gain may be attributed to increasing digestion of all nutrients, decreasing pH and count of pathogenic bacteria which have a role on decreasing diarrhea at sidr leaves levels 10 and 20 g/Kg SL diet. Also, decreasing NH3–N concentration and the increasing of VFA in the cecum, accordingly, improving the nutrients utilization may be attributed to the conversion of ammonia-N into microbial protein for the benefit of rabbits which

characterized by the pseudo-rumination. Therefore, the present results proved that *ziziphus spina-christi* leaves could be used in feeding of growing rabbits up to 20 g / SL / kg diets as natural growth promoters without any adverse effects on rabbit performance.

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الاستفادة من أوراق شجر السدر كمنشط نمو طبيعى فى علائق الأرانب

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أجريت هذة التجربة بهدف دراسة تأثير استخدام اوراق شجر السدر كأحد مصادر منشطات النمو الطبيعية فى علائق الأرانب حيث تم استخدام 90 من ذكور الارانب النيوزلاندى الابيض عمر 6 اسبوع بمتوسط وزن 759.45 جرام والتى تم توزيعها عشوائيا الى ثلاث مجاميع كل مجموعة تحتوى على 30 ارنب . استمرت التجربة لمد 8 اسابيع غذيت فيها الارانب فرديا على العلائق كالتالى:

١ - عليقة1 (عليقة المقارنة) بدون اضافة اوراق شجر السدر
٢ -عليقة 2 (عليقة المقارنة) + 10 جرام اوراق السدر الجاف / كجم عليقة
٣ - عليقة 3 (عليقة المقارنة) + 20 جرام اوراق السدر الجاف / كجم عليقة

وبانتهاء تجربة النمو تم اجراء تجربة هضم استخدم فيها 15 من ذكور الارانب (5 ارانب لكل معاملة) والتى استمرت لمدة 5 ايام لتقدير معاملات الهضم .

وبتحليل النتائج المتحصل عليها احصائيا أتضح الاتى:

ان المجموعة الثالثة (20 جرام ورق سدر / كجم عليقة مقارنة) زيادة معنوية فى كلا من الوزن النهائى الحى و واجمالى الزيادة فى الوزن ومعدل النمو اليومى للارانب مقارنة بباقى المعاملات. سجلت مجموعة المقارنة اقل معاملات هضم (معنويا) لمختلف العناصر الغذائية مقارنة بباقى المعاملات. كما اظهرت الارانب المغذاة على عليقة 3 افضل قيم معنوية لكلا من المركبات الكلية المهضومة والبروتين المهضوم عند المقارنة بعليقة المقارنة. سجلت الارانب بالمجموعة 3 افضل ميزان نيتروجين معنويا وتبعت بأرانب المجموعة 2 وأخيرا مجموعة المقارنة. فى حين أن المجموعة رقم 1 كان لها أعلى قيم لكلا من الأمونيا و العدد الكلى للبكتريا اللاهوائية معنويا مقارنة بالعليقة 2 و 3. فى حين سجلت المجموعة 3 أعلى قيم معنويا للعدد الكلى للبكتريا المحللة للسليلوز والتى تبعت بالمجموعة 2 و1.

كما اظهرت النتائج ان تحليل عينات الدم انخفاضا فى المجموعة 3 بمقدار 15.65% فى قيم البروتين الكلى بالدم مقارنة بعليقة 1، فى حين ان مجموعة المقارنة كان لها اعلى قيم بصورة معنوية فى مستوى كلا من اليوريا وحمض

اليوريك والكريتينين فى الدم مقارنة بعليقة الثالثة، كما تحسنت صفات الذبيحة فى العليقة 3 مقارنة بباقى المعاملات.

التوصية: ومن نتائج هذه الدراسة يتضح امكانية استخدام المستويات المنخفضة من اوراق شجر السدر (20 جرام من ورق السدر لكل كجم عليقة) كمنشط نمو طبيعى بدون ظهور أى تأثيرات سلبية على اداء الارانب النامية.