

NUTRITIONAL EVALUATION OF DRIED TOMATO (*LYCOPRISON ESCULINTUM*) HAULMS INSTEAD OF ALFALFA HAY IN FEEDING GROWING RABBITS UNDER NORTH SINAI CONDITIONS.

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SUMMARY

The study was conducted to evaluate the utilization of dried tomato (*Lycopersicon esculintum*) haulms as instead of alfalfa hay in feeding growing rabbits. Thirty weaned New Zealand white rabbits of both sexes aged 7 wk and weighted 970.80 were randomly divided into three groups (10 each). The first group (C) was fed the basal diet as control (0% DTH), while the other two treatment groups (L and H). Were fed diets containing 10 and 20% DTH, respectively replacing alfalfa hay in the basal diet. All the experimental diets contained nearly the same level of crude protein (CP) and digestible energy (DE). All the experimental diets formulated to cover the nutrients requirements of rabbits. The diets and fresh water were supplied *ad-libitum* during the experimental period (8 wk). At the end of experimental period, digestibility trials were carried out to determine the digestibility of feed nutrients and the feeding values of experimental diets. Three rabbits from each group were slaughtered to evaluate carcass traits and some blood parameters. Results indicated that the experimental diets with different levels of DTH (L and H) showed no significant differences ($P > 0.05$) among the dietary treatments in respect of live body weight, total weight gain and daily weight gain at different ages. Total feed intake and daily feed intake of DTH-diets were significant decreased compared to that of control diet during the first four weeks, while, were slightly decreased during the whole experimental period. Feed conversion did not affected significantly. All nutrients digestibility coefficients (DM, OM, CP, CF, EE and NFE) and Nutritive values as TDN did not effect by dietary treatment did not affected, while DCP was lower with H-diet than that of other diets (control diet and L-diet). Empty carcass as weight or percentage and total edible parts as weight were decreased significantly with H-diet compared with that of control diet, while the other traits of carcass were not affected by dietary treatments. There were no significant differences among dietary treatments in most blood constituents (Albumin, Glucose, Cholesterol, Urea-N, Creatinine, ALT and AST). Total protein (TP) and Globulin of rabbits fed on H-diet were lower ($P < 0.05$) than those fed C-diet. Economic efficiency (E.E) and Relative of DTH-diets were higher than C-diet.

Keywords: Rabbits, dried Tomato (*Lycopersicon esculintum*) haulms, productive performance, digestibility, carcass traits, blood parameters and economic efficiency.

INTRODUCTION

In Egypt, there is a wide nutritional gap between the available and that demand for meet to nutritional requirements of livestock. This gap is continuously increasing because of limited land and irrigation water and increasing human population. So, several searches have made to decrease this gap by using crop residues and agro-industrial by-products in animal feeding. There are annually about 38.28 million tons of field crop residues and using of them is estimated about 39% as animal feeds (Agricultural statistics, Economic affaire sectors, Ministry of Agriculture, 2011).

Vegetable crop residues are the plant parts that remained after harvesting of vegetable crops. Most of them used as organic fertilizers or burned causing environmental pollution and subsequent health hazard, but a little are dried and stored as forage sources for ruminants or left in the field as grazing for animals (Renard, 2001). Crop tomato (*lycopriscon esculintum*) is considered main vegetable crop in Egypt. Crop area of them is estimated about 537582 fedan produce about 1881537 tons of tomato haulms (Agricultural statistics, Economic affaire sectors, Ministry of Agriculture, 2011). Tomato (*lycopriscon esculintum*) haulms can be used in ruminant feeding as forage where it having 14.88% CP, 1.85% EE, 43.59% CF and 30.71% NFE (EL-sayed *et al.*, 2012).

Therefore, the present study aimed to study the effective inclusion of dried tomato (*lycopriscon esculintum*) haulms instead of alfalfa hay as untraditional feed ingredient in rabbit diets on growth performance, digestibility of nutrients, carcass traits and some blood constituents.

MATERIALS AND METHODS

This experiment was conducted in the rabbitry farm of the Department of Animal and Poultry Production, Faculty of Environmental Agriculture Sciences, Arish University, North Sinai, Egypt for 8 weeks starting 19-5 to 13-7-2021.

Preparation of dried tomato (lycopriscon esculintum) haulms (DTH)

Tomato (*lycopriscon esculintum*) haulms (TH) were collected from EL-Saleheya city, Sharqia governorate, Egypt. TH were air dried under shade until their moisture content reached almost 10%, then completely ground and stored in a well tight polyethylene bags at room temperature until they were used. Samples of dry Tomato haulms (DTH) were taken for chemical analysis. DTH was analyzed for crude protein (CP), crude fiber (CF), ether extract (EE) and ash according to A. O. A. C (2012).

Experimental design and management

Thirty newly weaned New Zealand White (NZW) rabbits of both sexes at 7 weeks ages were assigned to three similar groups, each of 10 animals according to their initial live body weight (970.80 ± 24.51 g). Rabbits of each group were sub-divided into three replicates of 3, 3 and 4 animals. The experimental period lasted 56 days (from 7 to 15 wks of age). The 1st treatment group (control, C%) was fed a pelleted control diet; the 2nd and 3rd treatment groups (L and H) were fed diets containing 10 and 20% DTH substituting 33.3% and 66.6% alfalfa hay respectively (Table 1). DTH was handily mixed with feed ingredients and the experimental diets were pelleted under a temperature of 70 °C and 0.3 cm diameter and 2 cm length. The experimental diets were formulated to be iso-nitrogenous ($\approx 17\%$ CP), iso-caloric (2500 kcal DE / Kg diet) and cover the recommended nutrients requirements of growing rabbits according to NRC (1996). Ingredient and calculated chemical composition of the experimental diets are showed in Table (1). Rabbits were housed in galvanized wire cages (3/cage) measured (40*40*30 cm) in a well-ventilated building (natural air and light throw the window). Cages were provided with feeders and automatic nipple drinkers. The experimental diets and fresh water were offered *ad-libitum* twice daily at 8.00 AM and 6.00 PM. All rabbits were observed daily, kept under the same managerial, hygienic and environmental conditions. All rabbits were individually weighed at the beginning of the experiment, then weekly before offering the morning meal until end of experiment. Feed intake was recorded weekly during the experimental period. Live body weight, weight gain, feed intake, feed conversion ratio (g feed/g gain) and economic efficiency were estimated.

Digestibility trials

At the end of the growth experimental period (15 wk of age), digestibility trials were conducted to evaluate the nutrient's digestibility and feeding values of the experimental diets. Three male rabbits were chosen randomly from each group and housed individually in metabolism cages facilitate the collection of feces. The same feeding regime used during the feeding trial was also used during the digestibility trial. A preliminary period of 10 days was followed by 5 days as a collection period for feces. The experimental diets were offered once a day at 8.00 AM *ad-libitum*. Feed intake was recorded daily and quantitative collection of feces was started 24 hours after offering the daily feed. The feces of each rabbit were collected daily in the morning for a collection period of 5 days. Any shaded hair or foreign materials were discarded. The feces were sprayed with 2% boric acid for trapping any ammonia released, then was dried at 60 °C for 36 hours. At the end of the collection period, all dried feces for each rabbit was mixed, grounded and stored until chemical analysis. Diets and feces were analyzed according to A. O. A. C (2012). The nutritive values of the experimental diets were estimated as digestible crude protein (DCP %), and total digestible nutrients (TDN) Values of total digestible nutrients (TDN) were calculated according to the equation described by Cheeke *et al.* (1982) as follows:

$$\text{TDN}\% = \% \text{DCP} + \% \text{DCF} + \% \text{DNFE} + 2.25 (\% \text{DEE}).$$

Carcass traits

At the end of experimental period (15 wk of age), three rabbits representing each dietary treatment were randomly chosen to estimate carcass traits. Rabbits were fasted for approximately 12 hours and

individually weighted to record the pre-slaughter weight. After complete bleeding and skinning, the empty carcass with head, liver, kidneys and heart were weighted separately according to Cheeke (1987).

Table (1): Ingredients and calculated chemical composition of the experimental diets (as fed).

Item	The experimental diets ¹		
	C	L	H
Alfalfa hay (15%)	30.00	20.00	10.00
Dried tomato haulm (DTH)	-	10.00	20.00
Yellow corn	21.00	21.14	23.69
Soybean meal (44%)	18.00	17.60	18.00
Wheat bran	24.19	24.40	21.00
Molasses	4.00	4.00	4.00
Di-Methionine	0.11	0.11	0.11
Vitamins and mineral mixture ²	0.30	0.30	0.30
Salt	0.50	0.50	0.50
Limestone	1.35	1.40	1.65
Di-Calcium phosphate	0.35	0.35	0.55
Anti-fungi	0.10	0.10	0.10
Anti-coccidian	0.10	0.10	0.10
Total	100	100	100
Calculated analysis ³ .			
Dry matter (DM)%	87.04	87.01	87.00
Organic matter (OM)%	81.09	81.15	81.36
Crude protein (CP)%	17.00	17.00	17.00
Ether extract (EE)%	2.67	2.63	2.56
Nitrogen free extract (NFE)%	47.96	47.15	46.82
Ash%	5.95	5.86	5.64
Digestible energy (DE) ⁴ , kcal/Kg	2500	2500	2500
Crude fiber (CF)%	13.46	14.36	14.98
NDF%	37.77	38.36	38.77
ADF%	21.71	22.53	23.10
Hemicellulose%	16.06	15.83	15.67
Calcium%	1.13	1.01	1.00
Total phosphorus%	0.535	0.510	0.500
Methionine%	0.38	0.36	0.34
Lysine	0.82	0.75	0.71
DE : CP	147.06	147.06	147.06

¹Experimental diets; C = control diet, containing no DTH; L = diet containing 10 % DTH; H = diet containing 20% DTH.

²Each 3 kg of premix contains: Vit. A 6000000 iu, Vit. D3 900000 iu, Vit. E 40000 mg, Vit k3 2000 mg, Vit. B1 2000 mg, Vit. B2 4000 mg, Vit. B6 2000 mg, Vit. B12 10mg, Biotin 50 mg, Pantothenic acid 10000 mg, Nicotinic acid 50000 mg, Folic acid 3000 mg, Choline chloride 250000 mg, Mg 8500 mg, Zinc 50000 mg, Iron 50000 mg, Copper 5000 mg, Iodine 200 mg, Selenium 100 mg and Cobalt 100 mg.

³ according to (MOA 2001).

⁴Calculated according to Cheeke (1987): DE (kcal/g) = 4.36 - 0.0491 (%NDF).
%NDF=28.924+0.657(%CF). %ADF= 9.432 + 0.912(%CF). Hemicellulose= %NDF %ADF

RESULTS AND DISCUSSION

Temperature- humidity index (THI)

In this study, overall averages of temperature and relative humidity were 29.76 ° C and 63.24%, respectively. The calculated mean THI was 28.01 indicated that the rabbits were reared under moderate heat stress (Marai *et al.*, 2001).

Productive performance:

As shown in table (2), No significant differences were observed among the three dietary treatments in respect of live body weight, total weight gain and daily weight gain at different ages (from 7 to 15 weeks). Slightly decreasing was observed due to inclusion of DTH in the mentioned traits. Decreasing daily weight gain of all rabbits in the present study than that obtained by (Bakr *et al* 2019 and Bakr, 2019) for the same of rabbit strain may be due to heat stress. Viability percentage of rabbits were 90, 100 and 90% for the three dietary treatments (control diet, C; L and H), respectively.

Table (2): Live body weight and daily gain of growing rabbits as influenced by dietary treatments.

Item	Treatments ¹			P-Value ²
	Control, C	L	H	
Live body weight (g):				
Initial (7 wk).	968.80±26.65	970.80±24.51	970.10±24.96	0.998
11 wks.	1578.22±53.16	1561.80±28.56	1518.22±29.61	0.536
15 wks.	1969.56±55.16	1970.40±38.41	1897.22±49.00	0.475
Total weight gain (g):				
7-11 wks.	613.44±37.46	591.00±24.87	534.44±33.14	0.224
11-15 wks.	391.33±28.70	408.60±23.04	379.00±32.17	0.751
7-15 wks.	1004.78±50.15	999.60±32.79	913.44±54.14	0.310
Daily weight gain (g):				
7-11 wks.	21.91±1.34	21.11±0.89	19.09±1.18	0.224
11-15 wks.	13.98±1.02	14.59±0.82	13.53±1.15	0.751
7-15 wks.	17.94±0.89	17.85±0.59	16.31±0.97	0.308
No. of animals:	10	10	10	-
No. of dead animals.	1	-	1	-
Viability %.	90	100	90	-

¹Treatments. C = Control, containing no DTH; L = Containing 10% DTH; H = Containing 20% DTH. ²Values are least-squares means.

Table (3): Feed intake and feed conversion ratio as influenced by dietary treatments.

Item	Treatments ¹			P-Value ²
	Control (C)	L	H	
Total feed intake (kg/head)				
7-11 wks.				
11-15 wks.	2.20 ^a ±0.03	2.11 ^b ±0.02	2.08 ^b ±0.00	0.008
7-15 wks.	2.49±0.08	2.36±0.03	2.48±0.02	0.199
	4.69±0.10	4.47±0.01	4.56±0.02	0.118
Daily feed intake g/h/d				
7-11 wks.	78.67 ^a ±0.67	75.33 ^b ±0.67	74.00 ^b ±0.00	0.002
11-15 wks.	89.00±2.89	84.33±0.88	88.67±0.67	0.200
7-15 wks.	83.67±1.76	79.67±0.33	81.33±0.33	0.093
Feed conversion ratio				
7-11 wks.	3.60±0.17	3.59±0.17	3.93±0.30	0.514
11-15 wks.	6.47±0.57	5.94±0.41	6.6±0.31	0.566
7-15 wks.	4.71±0.28	4.52±0.22	5.02±0.26	0.419

¹Treatments, C = Control, containing no DTH; L = Containing 10% DTH; H = Containing 20% DTH.

²Values are least-squares means.

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

Total feed intake and daily feed intake of diets contained DTH (Land H) were significant (P< 0.01) decreased compared to that of control diet during the period (7 – 11 wks) while they were nearly comparable during the periods (11 – 15 wks and 7 – 15 wks) for the dietary treatments (Table 3). Decreasing total feed intake and daily feed intake of DTH diets during (7 – 11 wk of age) may be due to the oxalate effect which is considerably working as major factor contributing to the anti-palatability (Ravindran *et al.*, 1996, Agwunobi *et al.*, 2002 and Amany *et al.*, 2017). Regarding feed conversion ratio, results cleared that no significant effect due to inclusion of DTH into the rabbit diets during the different ages (from 7 – 15 wk). The 2nd group (L) had the

best values (3.59, 5.94 and 4.52) and the 3rd group (H) had the lowest values (3.93, 6.6 and 5.02). From pervious results, it mean that DTH could be incorporated in the rabbit diets up to H level (20%) without causing adverse effect on the productive performance.

Nutrients digestibility and nutritive values of experimental diets

Table (4) showed that all nutrients digestibility coefficients were not significant ($P>0.05$) among treatments. Digestion coefficients of CP and CF tended to be lower in rabbits fed on diets containing DTH. In the same way, total digestible nutrients (TDN) did not differ significantly among treatments. Meanwhile, digestible crude protein (DCP) of rabbits fed H-diet (20%) was lower ($P<0.05$) than that fed DTH-free diet (control diet).

Decreasing digestibility coefficients (CP and CF) and digestible crude protein (DCP) of rabbits fed DTH diet might be due to the oxalate effect which is considered working as major factor contributing to the anti-palatability effect (Agwunobi *et al* 2002 an Salem, 2020)

Table (4): Effect of dietary containing of different levels of dary tomato haulms (DTH) on apparent nutrients digestion coefficients and nutritive values of the experimental diets.

Parameter	Treatment ¹			P-Value ²
	Control (C)	L	H	
Digestibility coefficient (%)				
(DM)	65.49±2.34	65.58±1.51	64.07±1.60	0.82
(OM)	67.52±2.05	67.53±1.54	65.86±1.57	0.75
CP	78.04±2.89	76.11±3.25	68.19±3.05	0.13
EE	80.03±1.44	77.26±3.14	76.32±2.24	0.55
CF	28.15±4.98	24.83±2.89	19.25±0.60	0.24
NFE	74.45±1.90	74.83±1.85	75.97±1.01	0.80
Nutritive values (%)				
TDN	65.22±2.38	63.96±1.48	62.17±1.14	0.50
DCP	15.13 ^a ±0.56	14.20 ^{ab} ±0.61	12.31 ^b ±0.55	0.03

¹ Treatments, C = Control, containing no DTH; L = Containing 10% DTH;

H= Containing 20% DTH. ² Values are least-squares means.

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

Carcass traits

All carcass traits either weight or percentage of pre-slaughter were unaffected significantly ($p>0.05$) by dietary treatments. In respect of dressing percentage, the highest value being occurred with control group (C, 66.84%) versus (63.39 and 63.64%) for groups L and H, respectively (table 5). These results indicated that using DTH up to 20% had not adverse effects on carcass traits and the internal organs (liver, kidneys and heart) were appeared normal in size and did not show any signs of toxicity.

Blood constituents

Data presented in Table (6) showed that inclusion of dried tomato haulms (DTH) in rabbit diets up to 20% had no significant effect on most of selected serum constituents (except total protein, Globulin and Alb / Glo ratio) which were significantly lower in the group (H) than control group (C). The significant decrease in serum total protein in group (H) than that of control group (C) could be attributed to lower degradability of protein in tomato haulm. However, it contains anti-nutritional factors such as tomatine, solanine, chaconine, lactins and oxalats (Khogali *et al*, 2010 cited by Novak and Haslberger, 2000). All serum constituents were within the normal range of healthy rabbits (Manning *et al.*, 1994). The non-significant effects of the dietary treatments on most serum constituents may be due to the adequacy of nutrients. (Eggum, 1989; Onifade and Abu, 1998, Amany *et al* 2017 and Bakr *et al*, 2019).

Table (5): Effect of the different levels of *tomato haulm* in growing New Zealand White rabbit diets on carcass characteristics

Item	Treatments ¹			P-Value ²
	Control (C)	L	H	
Live-body weight (LBW)	1949.33±16.80	1933.00±33.86	1884.00±49.79	0.460
Empty carcass weight (g)	1247.33±26.52	1169.00±29.51	1140.67±28.42	0.084
% of LBW	63.98±0.82	60.48±1.25	60.57±1.05	0.094
Total edible parts (g) ³	1303.33±28.26	1225.00±27.84	1198.67±30.77	0.097
% of LBW(dressing)	66.84±0.88	63.39±1.33	63.64±1.01	0.118
Edible giblets (g) ⁴	56.00±2.52	62.00±2.00	58.00±3.06	0.312
% of LBW	2.87±0.11	3.20±0.05	3.08±0.08	0.086
Head (g)	118.33±2.33	117.33±3.38	111.67±1.76	0.224
% of LBW	6.07±0.13	6.07±0.07	5.93±0.19	0.723
Liver(g)	40.67±2.33	47.00±2.08	43.33±1.76	0.176
% of LBW	2.09 ^a ±0.11	2.43 ^b ±0.07	2.30 ^{ab} ±0.03	0.053
kidney (g)	9.67±0.33	9.67±0.33	9.67±0.33	1.000
% of LBW	0.50±0.01	0.50±0.02	0.51±0.01	0.763
Heart (g)	5.67±0.33	5.33±0.88	5.00±1.00	0.842
% of LBW	0.29±0.02	0.28±0.05	0.26±0.05	0.895

^{a,b}Means in the same row with different superscripts differ ($P < 0.05$).

¹ Treatments; C= Control, containing no DTH; L= containing 10% DTH; H= containing 20% DTH. ²Values are least-squares means.

³Total edible parts wt. = empty carcass wt. (with head) + edible giblets wt.

Total edible parts % = total edible parts wt. /fasted wt. * 100

⁴Edible giblets wt. = Liver + Kidneys wt. +Heart wt.

Table (6): Effect of the different levels of dried tomato haulm in growing New Zealand White rabbits' diets on some blood constituents.

Item	Treatments ¹			P-Value ²
	Control (C)	L	H	
Total protein g/dl	6.50 ^a ±0.14	6.15 ^{ab} ±0.09	5.92 ^b ±0.17	0.058
Albumin (g/dl)	4.67±0.13	4.67±0.09	4.70±0.15	0.978
Globulin (g/dl)	1.83 ^a ±0.04	1.49 ^{ab} ±0.17	1.22 ^b ±0.05	0.018
Alb/Glo	2.55 ^b ±0.10	3.24 ^{ab} ±0.43	3.88 ^a ±0.19	0.042
Glucose (mg/dl)	91.67±8.25	93.67±1.45	81.33±6.33	0.367
Cholesterol (mg/dl)	45.33±0.67	55.67±0.88	51.00±5.29	0.142
Urea (mg/dl)	42.33±0.88	43.67±5.21	45.33±1.45	0.804
Creatinine (mg/dl)	1.66±0.16	1.51±0.08	1.60±0.02	0.604
AST (U/L)	68.33±6.23	59.00±6.81	64.00±5.69	0.600
ALT (U/L)	55.33±4.67	50.00±7.00	50.33±11.86	0.883

¹ Treatments; C= Control, containing no DTH; L= containing 10% DTH; H= containing 20% DTH. ²Values are least-squares means.

^{a,b}Means in the same row with different superscripts differ ($p < 0.05$).

Economic efficiency

It is evident that the lower price of tomato haulms was reflected on the price of the experimental diets. Feed cost / kg gain of the diets contains DTH (L and H) was decreased by 13.33 and 13.29 % compared with that of control diet (C), respectively. Net revenue / rabbit (L.E), Economic efficiency (E. E) % and Relative E.E (%) of L-DTH diet (10%) were higher than C-diet and H-DTH diet (20%). These results were in agreement with those obtained by Amany *et al* (2017) and Salem (2020).

CONCLUSION

It could be concluded that the use of vegetable crop residues is necessary to reduce the price of feed, because feed cost is one of the main obstacles to the development of rabbit production. Therefore, dried tomato haulm (DTH) could be used in feeding growing rabbits up to 20% of the diet replacing from

Alfalfa hay with no harmful effects compared with feeding the commercial diet. In addition, due to the lower prices of dried tomato haulm compared to traditional feeds, the economic efficiency could be increased when using it as a substitute.

Table (7): Economic efficiency as affected by dried tomato haulms (DTH) in rabbits' diet.

Item	Treatments*		
	Control (C)	L	H
Price/kg diet. (L.E)	5.07	4.76	4.51
Total feed intake/rabbit(g)	4.69	4.47	4.56
Total feed cost/rabbit (L.E)	23.78	21.28	20.56
Total weight gain/rabbit(g)	1004.78	999.60	913.44
Feed cost/kg gain (L.E)	23.68	21.27	22.52
Price/kg weight gain (L.E)	37	37	37
Total revenue/weight gain(L.E)	37.18	37	33.78
Net revenue/rabbit (L.E)	13.50	15.73	11.26
Economic efficiency (E.E)%	57.01	73.95	0.50
Relative E. E (%)	100	129.71	87.72

*Treatments, C = Control, containing no DTH;

L = Containing 10% DTH; H= Containing 20% DTH.

Based on price of ingredients of the diets and market price of live body weight as kg during the experimental period (2021).The price of one ton of alfalfa hay, yellow corn, soybean meal (44%), wheat bran and tomato haulm were 3400, 5200, 7800, 3750 and 500 LE, respectively and the price of kg of salt, lime stone, Di-calcium phosphate, premix, molasses, DL-methionine, Anti-fungi and Anti-coccidian were 1, 0.5, 12, 50, 3, 80, 42 and 150 LE. Price of live body weight as kg was 37 LE.

REFERENCES

- A.O.A.C. (2012) Association of Official Analytical Chemists. Official methods of analysis. 19th Ed. A.O.A.C. Washington. DC, USA.
- Agricultural statistics, Economic affairs sectors, Ministry of Agriculture (2011).
- Agwunobi, L.N., P.O. Angwukan, O.O. Cora and M.A. Isika (2002). Studies of the use of *Colocasia esculenta* (Taro cocoyam) in the diets of weaned pigs. Tropical Animal Health and Production. 34 (3): 241-247.
- Amany A. Khayyl; E.O.A. Bakr; Y.L. Phillip; A.M. Hussein and A.A. Khir (2017). Effect of diets containing dried taro (*colocasia esculanta*) waste and dried yeast (*saccharomyces cerevisiae*) on performance of growing rabbits. J. Anim. And poultry prod. Mansoura Univ. Val. (6): 109-117.
- Cheeke, P.R. (1987). Rabbit feeding and nutrition. Academic press. Ozlanda, Florida, U. S. A.
- Cheeke, P.R.; N.M. Patton and G.S. Templeton (1982). Rabbit Production. 5th Ed. Print and Published. USA.
- Duncan, D.B. (1955). Multiple range and multiple F tests. Biometrics 11:1-42.
- Eggum, B.O. (1989). Biochemical and methodological principles. In: Bock, H.D., B.O. Eggum, A.G. Low, O. Simon, T. Zebrowska (Eds), Protein Metabolism in Farm Animals. Evaluation, Digestion, Absorption, and metabolism. Oxford Science Publications, Deutscher Landwirtschafts Verlag, Berlin, pp.1-52.
- El- Kerdawy, D.M.A. (1997). Olive pulp as a new energy source for growing rabbits. Egyptian journal of Rabbits Science, 7 (1): 1 – 12.
- EL-sayed, H.M; Z.H. Abd EL-Hamid; EL-SH.M. Ramadan; M.H.M. Yacout and H.EL-S. Abbas (2012). Study on the use of tomato vines in ruminant feeding. 1- Mitigation of impact of pesticide residues in tomato vines. Journal of environmental science, institute of environmental studies and research, Ain Shams University, Value (25), No, (1).

- Khogali, H; K. Faze; A. Gofoon and B. Ali (2010). Comparative study between tomato (*lycopriscon esculintum*) straw and ground nut hay for feeding male Sudanese desert sheep. J. of Agricultural Sciences of Damascus University, 2 (26): 301-309.
- Manning, P.J., D.H. Ringler and C.E. New comer (1994). The Biology of Laboratory Rabbit, 2nd ed. Academic press inc., San Diego, California, USA.
- Marai, I.F.M., M.S. Ayyat and U.M. Abd EL-Monem (2001). Growth performance and reproductive traits at first parity of New Zealand white female rabbits as affected by heat stress and its alleviation under Egyptian conditions. Trop. Anim. Health prod., 32 (6): 451-462.
- MOA (2001). Feed composition tables for Animal and Poultry feed stuff used in Egypt. Technical Bulletin No.1, central Lab for feed and food, Ministry of Agriculture, Egypt.
- Novak, W.K and A.G. Haslberger (2000). Substantial equivalence of antinutrients and inherent plant toxins in genetically modified novel foods. Journal of Food and Chemical Toxicology. 38: 473-483.
- NRC (1996). National research council nutrient requirements of rabbits. Washington, DC. USA.
- Onifade, A.A. and O.A. Abu, (1998). Productive response of rabbits to supplemental copper in a diet based on tropical feedstuffs. J. Appl. Anim. Res., 13: 129-135.
- Ravindran, V., R. Sivakanesan and H.W. Cyril (1996). Nutritive value of raw and processed colocasia (*Colocasia esculenta*) corm meal for poultry. Animal Feed Sci. & Technology, 57 (4): 335-345.
- Renard, C. (2001). Crop residues in mixed crop / livestock farming systems. CAB International in association with the association with the International Crops Research Institute for the Semi-Arid Tropics and the International Livestock Research Institute. Pp. 25-36.
- Salem, W. A., (2020). Effect of using untraditional feeds on reproduction, growth and carcass characteristics of New-Zealand white rabbits in North Sinai. M. Sc., Thesis, Fac. Of Environmental Agricultural Sciences Arish University, Egypt.
- Schiemann, R.; K. Nehring; L. Hoffman; W. Jentsch and A. Chudy (1972). Energetische futterbewertung und energienormen. VEB Deutscher Landwirtschaftsveriag. Berlin. 344.
- SPSS (2007). User's guide: statistics. Version 16. SPSS Inc. Chicago, IL, USA.

التقييم الغذائي لعرش الطماطم الجاف كبديل لدريس البرسيم الحجازي في تغذية الأرناب النامية تحت ظروف شمال سيناء.

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هذه الدراسة أجريت لتقييم استخدام عرش الطماطم الجاف كبديل لدريس البرسيم الحجازي في تغذية الأرناب النامية. ثلاثون أرناب نيوزلاندي ابيض مبطوم عمر سبع أسابيع بمتوسط وزن 970.8 جرام قُسمت لثلاثة مجموعات بكل منها 10 أرناب. المجموعة الأولى (الكنترول) غُذيت علي عليقة مقارنة (0% عرش الطماطم الجاف) بينما المجموعتان الثانية والثالثة غُذيت علي عليقة تحتوي علي 10% و 20% عرش الطماطم الجاف استبدالاً من دريس البرسيم الحجازي علي التوالي. كانت العلائق الثلاثة متساوية في محتواها من الطاقة (2500 كيلو كالوري/ كيلوجرام) والبروتين (~17%) بحيث تُغطي الاحتياجات الغذائية للأرناب النامية. وفي نهاية التجربة أجريت تجربة هضم لتقدير معاملات الهضم للمكونات الغذائية والقيمة الغذائية للعلائق الثلاثة بالإضافة لذبح ثلاثة أرناب من كل مجموعة لتقدير صفات الذبيحة وبعض مكونات الدم.

أوضحت النتائج المتحصل عليها ما يلي:

- عدم وجود فروق معنوية في الوزن الحي والزيادة الكلية والزيادة اليومية بين المجموع الثلاث.
 - المأكول الكلي والمأكول اليومي للعلائق المحتوية علي عرش الطماطم قل معنوياً مقارنة بالكنترول خلال الأربعة أسابيع الأولى من التجربة بينما لم يختلف معنوياً أثناء فترة التجربة الكلية (8 اسابيع)
 - معدل التحويل الغذائي لم يختلف معنوياً بين المجموع الثلاث أثناء التجربة.
 - لم توجد اختلافات معنوية في معاملات الهضم للمركبات الغذائية والقيمة الغذائية في صورة مجموع المركبات الكلية المهضومة TDN بين المجموع الثلاث.
 - البروتين المهضوم الكلي قل معنوياً في المجموعة الثالثة (20% عرش الطماطم) مقارنة بالكنترول.
 - لم توجد اختلافات معنوية لمعظم صفات الذبيحة (فيما عدا وزن الذبيحة الفارغ والأجزاء المأكولة) بين المجموع الثلاث.
 - وزن الذبيحة الفارغ والأجزاء المأكولة للمجموعة الثالثة قل معنوياً مقارنة بمجموعة الكنترول.
 - لم توجد اختلافات معنوية لمعظم مكونات الدم (الألبومين، الجلوكوز، الكوليسترول، اليوريا، والكرياتين، وأنزيمات الكبد AST & ALT).
 - البروتين الكلي والجلوبيولين قل معنوياً للمجموعة الثالثة مقارنة بمجموعة الكنترول بينما الألبومين / الجلوبيولين للمجموعة الثالثة زاد معنوياً مقارنة بالكنترول.
 - وعموماً كل مكونات الدم كانت في المستوي الطبيعي للأرناب النامية للمجموع الثلاث.
 - حققت المجموعتان الثانية والثالثة التي تغذت علي علائق محتوية علي عرش الطماطم الجاف أعلى عائد اقتصادي مقارنة بمجموعة الكنترول.
- الخلاصة: يمكن تغذية الأرناب النامية علي علائق محتوية علي عرش الطماطم الجاف حتي 20% من العليقة استبدالاً من دريس البرسيم الحجازي دون أن يؤثر ذلك علي الصفات الإنتاجية والفسولوجية للأرناب النامية.