Egyptian Journal of Rabbit Science, 33(2): 85-103 (2023)

EFFECT OF USING SOME SEA-GRASS (*Cymodocea nodosa*) AND VEGETABLE CROP RESIDUES AS UNTRADITIONAL FEEDS IN GROWING RABBITS DIET ON GROWTH PERFORMANCE UNDER NORTH SINAI CONDITIONS.

E. O. A. Bakr; Walaa, A. A. S.; Mousa, M. R. M. and M. M. Shetaewi
Department of Animal and Poultry Production, College of Environmental Agricultural Sciences, Arish University, Egypt.
e.mail: elsayedoab@gmail.com – walaaamer@aru.edu.eg – mosad.shetaewi@gmail.com

---

ABSTRACT

The aimed of this study to evaluate effects of sea-grass (Cymodocea nodosa), taro (Colocasia esculenta) haulms and tomato (Solanum lycopersicum) haulms as untraditional feeds on growth performance, nutrients digestibility, carcass traits and some blood parameters as well as economic efficiency of growing rabbits. Thirty two weaned New Zealand White (NZW) rabbits aged 6 wk and weighted 891.89 ± 53.2 g were randomly allotted into four groups (8 rabbits in each). The 1st group sarved as the control (CON) and fed on the basal diet. The 2nd group (SGR), the 3rd group (TAR) and the 4th group (TOM) were fed the basal diet containing 10% in each of sea-grass (Cymodocea nodosa), taro (Colocasia esculenta) haulms and tomato (Solanum lycopersicum) haulms, respectively during the experimental period (7 wk).

***Results revealed that** the experimental diets did not significantly affect live body weight (LBW) at the end of the experiment. Total and daily gain were higher significantly (P<0.05) in TOM group than TAR group. Total and daily feed intake were highest significantly (P<0.05) in rabbits of SGR group as compared to TAR group. Feed conversion efficiency did not differ significantly among treatment groups. All nutrient digestibilities and nutritive values of experimental diets did not affected significantly as compared with control diet. Hot carcass weight and organ weights did not differ significantly among treatment groups, except the kidney weight was lower (P<0.05) in the control group when compared to SGR group. Chemical analysis of hind leg meat releved that protein (%) in TOM group was higher (P<0.05) than those of TAR and CON groups. Whereas, fat (%) was higher (P<0.05)in TOM group as compared to SGR and CON groups and similar to TAR group. However, ash (%) did not differ significantly among treatment groups. Serum total protein,* *albumin, globulin, urea nitrogen and total cholosteral were insignificantly among treatment groups. Creatinine was decreased (P<0.05) in SGR group compared with the other treatment groups . AST enzyme in the serum of rabbits was increased (P<0.05) when fed on TAR diet compared with those fed on the other diets. ALT enzyme was higher (P<0.05) in SGR group than TOM group and similar to the other groups. Serum glucose was reduced (P<0.05) due to feeding on SGR or TAR diet compared with the control diet. Triglycerides was higher (P<0.05) in TOM group than SGR group and similar to the other groups. Economic efficiency (E.E) and relative E. E (%) were highest in TOM group followed by SGR group.*

Conclusively, *it could be concluded that feeding growing rabbits on diets conaining 10% sea grass, taro and tomato haulms without detrimental effects on productive performance, health status and economic efficiency.*

Key words: Rabbits, sea-grass, vegetable crop residues, growth, digestibility, carcass traits, blood parameters, economic efficiency.

INTRODUCTION

Rabbit production plays an important role in bridging the food gap caused by animal protein deficiency. The advantages of breeding rabbits are largely attributable to their high reproductive rate, precipitous maturity and rapid growth rate. Due to the high cost of feeding rabbits on traditional feedstuffs, it could be a wise practice to use some untraditional feeds with reasonable nutritional value to reduce the costs of their nutrition (Khayyal *et al.,* 2017, Bakr *et al.,* 2019 and Bakr *et al.,* 2021)

Sea-grass (*Cymodocea nodosa*) contains high carbohydrates, proteins, fiber, vitamins and minerals (Abdel-Hady *et al.,* 2007). It contains also high amounts of vitamin A, C and E in the rhizome/root (Jeevitha *et al.,* 2013) and large amounts of essential minerals such as Mg, Ca, K, Na, P, Zn, Ni and Cu (Kolsi *et al.,* 2017 a). Moreover, Kolsi *et al.,* (2018) reported that sea-grass could be used as natural antioxidants.

Most of vegetable crop residues 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). Tomato crop (*Solanum lycopersicum*) is considered main vegetable crop in Egypt. Crop area of them is estimated about 537582 fedan produce about 1,881,537 tons of tomato haulms (Agricultural statistics, Economic affaire sectors, Ministry of Agriculture, 2011). Tomato (*Solanum lycopersicum*) 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).

Taro (*Colocasia esculenta*) has high yield and most its varieties contain an irritating or acrid agent and cannot be eaten in fresh state. The cultivated area of taro was 6545 feddans, which gave a yield of 102563 tons waste, according to Ministry of Agriculture (2016). Taro by-product can be a potentially working as a protein source for animals, especially pigs due to its good nutritional quality where the leaves having (DM basis): 25% CP, 12.1% CF, 10.7 % EE, 1.74% Ca, and 0.58% P(FAO,1993), in addition rich in vitamins like vitamin B_6, vitamin C and minerals like thiamin, riboflavin, iron, phosphorus, zinc, niacin, potassium, copper and manganese, (Wikipedia, the free encyclopedia http://en. wikipedia.org/wiki/Taro).

Therefore, the objective of this work to evaluate and utilize of some untraditional feeds such as sea-grass, taro haulms and tomato haulms available in our surrounding areas with cheap prices to reduce the cost of feeding and to evaluate their effects on growth performance, digestibility of nutrients, carcass traits, some blood constituents and economic efficiency of New Zealand White (NZW) rabbits under North-Sinai conditions.

MATERIALS AND METHODS:

The present study was carried out at the Rabbitry Farm, Department of Animal and Poultry Production, Faculty of Environmental Agricultural Sciences, Arish University, North Sinai, Egypt.

Sea-grass, taro and tomato haulms collection and preparation:

Sea-grass (*C.nodosa*) was collected from the area around Bardawil lake in North Sinai, which included all parts of the plant. Taro haulms (*C.esculenta*) which included leaves and petioles (false stems) was provided by Menofiya Governorate. Tomato haulms (*S.lycopersicum*) which included leaves and stems after harvest was collected from Bir El-Abd area, North Sinai, Egypt. Sea-grass, taro and tomato haulms were sun-dried, then grounded as meal and stored in a well tight Polythylene bags at room temperature until they were used. Samples of them were taken in plastic bags for chemical analysis according to A. O. A. C. (2012).

Experimental design and management:

Thirty two newly weaned NZW rabbits aged 6 wk and weighed approximately 891.8 ± 53.2 g were randomly allotted into four groups (8/ each). The 1st group sarved as the control (CON) and fed on the basal diet only. The 2nd group (SGR) was fed the basal diet, in which a 10% was replaced with sea-grass (*C.nodosa*), the 3rd group (TAR) was fed the basal control diet containing 10% taro haulms (*C.esculenta*) and the 4th group (TOM) was fed the basal control diet containing 10% tomato haulms (*S.lycopersicum*). SGR, TAR and TOM were handly mixed with feed ingredients and the experimental diets were pelleted under a temperature of 70 ^oC, 0.3 cm diameter and 2 cm length. The experimental diets were formulated to be iso-nitrogenous (≈17% CP), iso-caloric (2500 kcal DE / Kg diet) and fulfill the nutrient requirements for rabbits according to (NRC, 1977). Ingredients of the experimental diets are showed in Table (1). This experiment lasted for 7 wk and aimed to study the effects of these experimental diets on growth performance, carcass characteristics and blood metabolites of growing rabbits.

Rabbits were housed in galvanized wire maternity as two per cage (30*40*40cm). Each cage had a stainless nipple for drinking and a feeder in a well-ventilated building (natural air and light throw the window). 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 from 6 to 13 weeks of age. Live body weight, weight gain, feed intake, feed conversion ratio (g feed/ g gain) and economic efficiency were calculated.

Digestibility trials:

At the end of the growth experimental period (13 wks 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 metabolis cages facilitate the collection of feces. The same feeding regimed 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 (g) 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 ^oC 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:

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

Digestible enegy (DE, Kcal/kg diet) was calculated according to the formula described by Schiemann *et al*.(1972), cited by El-Kerdawy (1997) as follows:

Table (1): Ingredients of the experimental diets used in the present study.

Ingredients (%)	Experimental diets[1]			
	CON	SGR	TAR	TOM
Yellow corn	18	14.5	18	18
Wheat bran	29.6	26.5	24.6	29.6
Soybean meal (44% CP)	15	16.6	15	15
Alfalfa hay	32	27	27	22
Test material[2]	0	10	10	10
Molasses	3	3	3	3
Di-calcium P.	0.35	0.35	0.35	0.35
Sodium chloride (salt)	0.3	0.3	0.3	0.3
Calcium carbonate (lime stone)	1.05	1.05	1.05	0.05
Vitamins & Mineral Premix[3]	0.5	0.5	0.5	0.5
Anti-fungus	0.1	0.1	0.1	0.1
Anti-coccidiosis	0.1	0.1	0.1	0.1
Total	**100**	**100**	**100**	**100**

[1,2], Experimental diets **CON**= Control, basal diet, **SGR**=10% Sea grass, **TAR**=10% Taro haulms, **TOM** = 10% Tomato haulms.

[3] One kilogram of premix contain: Vit. A 12000 000 IU, Vit. D_3 2200 00 IU, Vit. E 1000 mg, Vit. K_3 2000 mg, Vit. B_1 1000 mg, Vit. B_2 4000 mg, Vit. B_6 100 mg, Vit. B_{12} 10 mg, Pantothenic acid 3.33 g, Biotin 33 mg, Folic acid 0.83 g, Choline chloride 200 g, Zn 11.79 g, Mn 5 g, Fe 12.5 g, Cu 0.5 g, I 33.3 mg, Se 16.6 mg and Mg 66.7 g.

DE (Kcal/kg diet)=5.28(DCP, g/kg)+9.51(DEE, g/kg)+4.2(DCF+DNFE, g/kg) $\pm$ 0.3

Carcass traits:

At the end of the experimental period (6 to 13 weeks of age), 20 rabbits (5 from each treatment group) were chosen randomly and slaughtered to study the effect of different dietary treatments on carcass traits and blood constituents. Animals were kept off feed overnight and body weights were recorded next morning prior to slaughter. Carcass traits as described by Blasco *et al.*, (1992) were evaluated. Hot carcass weight (HCW) was obtained 15 to 30 min after slaughter and did not include blood, skin, distal parts of tail, fore and hind legs, gastrointistinal tract and urogenital tract. The hind leg was cut from the carcass, weighed and its meat was separated from bone. The meat and bone were weighed separately and the ratio between them was obtained (Shetaewi, 1998).

***The following carcass traits were evaluated*:**

- Pre-slaughter weight.
- Empty body weight (EBW i.e.) (BW after slaughter including head, skin, empty G.I.T – G.I. tract contents).

- HCW= weight of carcass (without of each skin, limbs, ears, G.I.T) + liver + kidneys + head + (lungs, esophagus, trachea, thymus, heart) as carcass weight.
- LHW= Weight of (lungs, esophagus, trachea, thymus and heart).
- Commercial dressing % = (HCW/ Pre-slaughter weight)X100.
- Biological dressing, % = (HCW/EBW) X 100.
- Hind Leg (HL) weight, HL meat, HL bone and meat/bone.
- Organ weights *i.e*. heart, liver, kidney… *etc*.

Meat quality:

Chemical analysis of hind leg meat (protein, fat and ash) were analysed according to A. O. A. C (2012).

Blood constituents:

Blood samples were collected directly from each rabbit after slaughter at the end of experimental period. Blood samples were collected into centrifuge tubes allowed to clot at room temperature. Serum was centrifuged at 3,000 rpm for 15 min. serum was then decanted into glass vials and frozen at -20°C until it was analyzed. Various chemical analyses were conducted using commercial kits and measuring the optical density by spectrophotometer, following the same steps as described by manufactures.

Economical efficiency

All diets of trials were subjected to economic evaluation. Economical efficiency is predefined as the net revenue per unit feed cost calculated from input output analysis as described by Hassan *et al.* (1996), El-Kerdawy (1997) and Mousa and Abd El-Samee (2002).

Statistical analyses:

Data were analyzed by least – squares analysis of variance using the General linear model (GLM) procedure of SAS (2004) according to Steel and Torrie (1980). Data of growth performance (body weights and gain, feed intake and feed efficiency of kits), carcass characteristics and blood metabolites were analyzed by completely randomize deisgn as one-way analysis of variance. Whenever F value was significant (P<0.05), means were compared using Duncan (1955).

RESULTS AND DISCUSSION

Chemical analysis of sea-grass (C.nodosa), Taro (C.esculenta) haulms, Tomato (S. lycopersicum) haulms and the experimental diets.

Data in Table (2) shows the chemical composition of SGR (*C. nodosa*), TAR (*C. esculanta*),TOM (*S. lycopersicum*) and the experimental dites used in this study.

Table(2): Chemical analysis (%) of Sea-grass (*C. nodosa*), Taro waste (*C. esculanta*), Tomato waste (*S. esculentum*) and the experimental diets.

Items	% On DM basis						
	DM	**OM**	**CP**	**EE**	**CF**	**NFE**	**Ash**
Sea-grass (*C. nodosa*)	89.20	70.29	8.41	0.99	10.12	50.77	29.71
Taro haulms (*C. esculanta*)	90.09	83.08	16.41	7.42	14.30	44.95	16.92
Tomato haulms (*S. esculentum*)	90.40	81.68	10.73	1.39	24.45	45.11	18.32
Chemical composition of experimental diets given to NZW rabbits							
Diet (1): Control	89.90	92.78	19.02	3.04	14.35	56.37	7.22
Diet (2): SGR (10%)	89.70	90.48	19.15	2.79	13.51	55.03	9.52
Diet (3): TAR (10%)	90.34	91.90	19.10	3.45	13.64	55.71	8.10
Diet (4): TOM (10%)	90.20	91.99	18.57	2.91	13.80	56.71	8.01

The SGR contained 8.41 % CP, which is lower than those reported by Abdel-Hady *et al.* (2007) and Mensi *et al.,* (2001) (18.6 and 15.13% CP, respectively). But it was close to those reported by Kolsi *et al.,* (2017a) (7.21 %). The SGR contained 0.99% EE which is lower than that reported by Abdel-Hady *et al.,* (2007) and Kolsi *et al.,* (2017 a) (3.65 and 4.54 % EE, respectively). But close to those reporded by Mensi *et al.,* (2001) (2.2 % EE). Ash content in SGR in this study was 29.71 %, which was higher than that reported by Kolsi *et al.,* (2017 a) (16.4 %). It was close to that reported by Mensi *et al.,* (2001) (21.4 %). The reason for the difference between the different studies of the chemical composition of sea-grass may be due plant growth environment, season of collection, species and method of analysis.(Kolsi *et al.,* 2017 a, Mensi *et al.,* 2001 and Ortiz *et al.,* 2006)

Moreover, the seasonal changes affect the content of the chemical components of the SGR, as the fat content increases during the summer, while the protein increases in the winter. Furthermore, natural cycle of the plant with different uptake, translocation in the different part of the plant (rhizome, leave, roots) regarding the seasons which probably regarding temperature and light (Geneid and El-Hady, 2006).

The CP, EE, CF, ash and NFE content in the TAR (*C. esculanta*) in this study were 16.41, 7.42, 14.30, 16.92 and 44.95%, respectively. This result was different from the results those reported by Phillip *et al.,* (2017) of the dried taro waste, which were CP, EE, CF, ash and NFE content were 13.52, 2.27, 23.64, 25.76 and 34.81%, respectively. The reason for the difference between the different studies of the chemical composition of taro waste may be due plant growth environment and method of analysis.

Table (2) shows the chemical analysis of the TOM (*S. lycopersicum*) in this study. The TOM contained 10.73% CP, which is close to this reported by

Hassan *et al.,* (2010) (7.88 % CP). But less than this reported by Khogali *et al.,* (2010) (15.75 % CP). Ether extract (EE) content in TOM in this study was 1.39% EE, which is agreement with this reported by Hassan *et al.,* (2010) and Khogali *et al.,* (2010) (1.85 and 1.04 % EE, respectively). The CF content in TOM in this study was 24.45 % CF, which is less than this reported by Hassan *et al.,* (2010) and Khogali *et al.,* (2010) (43.59 and 32.22 % CF, respectively). Ash content in TOM in this study was 18.32 %, which is higher than this reported by Hassan *et al.,* (2010) (8.97 % Ash). However, close to this reported by Khogali *et al.,* (2010) (13.87 % Ash). The reason for the difference between the different studies of the chemical composition of taro and tomato haulms may be due plant growth in different environment and method of analysis.

Table (2) showed the chemical analysis of crude potein , either extract, crude fiber, ash and nitrogen free extact of experimental diets given to NZW rabbits in this study. Moreover, dry matter and organic matter.

Growth performance of growing rabbits.

Results presented in Table (3) show that the initial and final body weights of the growing rabbits did not differ significantly among treatment groups. However, rabbits fed TOM group gained faster significantly from 6 to 13 weeks of age (19.2 g/hd/d) and those of TAR group gained the lowest (17.1 g/hd/d (P<.05) whereas, those of the other groups gained intermediate (18.7 and 18.5 g/hd/d for CON and SGR groups, respectively) .The same results were obtained by Soad Ahmed *et al.,* (1994).

Total feed intake was also significantly lowest consumed in rabbits of TAR group (3813.6 g) as compared to the other groups (3859.9, 3984.7 and 3949.4 g, for CON, SGR and TOM groups, respectively). Similarly, Khayyal *et al.,* (2017) reported that total feed intake of diets containing different levels of taro haulms during the experimental period was decreased. The low feed intake of rabbits in TAR group could be attributed to the presence of anti-nutritional factors such as tannins, saponins, oxalates, phytates, and hydrocyanide in taro waste (Abdulrashid and Agwunobi, 2009 and Olajide *et al.,* 2011).

Previous research showed that voluntary feed intake has a significant (P< 0.05) impact on both body weight gain and feed conversion in all animal species. Edmore *et al.,* (2015) found that rabbits who had more feed intake gained significantly (P< 0.05) more weight than those who had less feed intake after 5 weeks.

Feed conversion ratio (feed/gain) did not differ significantly among treatment groups (P>0.05). Means ranged between 4.23 to 4.62 (Table 3). Similar results of feed conversion (4.23- 4.71) was obtained in NZW rabbits by Ibrahim (2016) who was feeding rabbits on diets containing medicinal plants.

Table (3): Body weight gain (g), feed intake (g) and feed conversion ratio (feed/gain) of NZW growing rabbits as influenced by dietary treatment groups from 6 to 13 weeks of age.

Items	Treatment groups[1,2]				S.E.[3]
	CON	SGR	TAR	TOM	
Initial weight (6wks)	901.7	920.0	898.6	846.9	53.2
Final weight (13wks)	1818.3	1827.9	1739.4	1789.4	58.9
Total body gain (6-13 wks)	916.6[ab]	907.9[ab]	840.8[a]	942.5[b]	35.4
Daily body gain (6-13 wks)	18.7 [ab]	18.5 [ab]	17.1 [a]	19.2 [b]	0.72
Total feed intake (g)	3859.9[ab]	3984.7[a]	3813.6[b]	3949.4[a]	58.5
Daily feed intake (g)	78.7[ab]	81.3[a]	77.8[b]	80.6[ab]	1.19
Feed conversion ratio (feed/gain)	4.23	4.43	4.61	4.62	0.18

[a,b]Means in the same row with different superscripts, differ (P<0.05).
[1]Treatment groups, **CON**= Control, basal diet, **SGR**=10% Sea grass, **TAR**=10% Taro haulms, **TOM** = 10% Tomato haulms.
[2]Values are least-squares means. [3]**SE**= Standard error of least-square means.

Digestibility coefficients and nutritive values:

Results in Table (4) showed no significant differences among treatment groups in digestion coefficients of DM, OM, CP, EE, CF and NFE. However, means of (DM, OM and NFE) tended to be higher in rabbits fed on TOM. In the same way, also, the nutritive values of SGR, TAR and TOM diets, in terms of total digestible nutrients (TDN), digestible crude protein (DCP) and digestible energy (DE) did not differ significantly among treatment groups.

Feeding rabbits on TAR diet decreased the digestibility coefficients that might be due to the oxalate effect which is considered working as a major factor contributing to the anti-palatability effect of taro waste as recorded by Agwunobi *et al.*, (2002). Also, could be attributed to the presence of anti-nutritional factors such as tannins, saponins, phytates, and hydrocyanide in taro waste (Abdulrashid and Agwunobi, 2009 and Olajide *et al.*, 2011). These results are agreement with Khayyal *et al.*, (2017) who reported that no significant differences were found among all experimental treatment groups (0, 7.5, 15 and 22.5% taro waste) for all digestibility coefficients (CP, CF, EE and NFE).

Table (4): Digestion coefficients (%) and nutritive values (%) of the experimental diets.

Items	Treatment groups[1,2]				±SE[3]
	CON	SGR	TAR	TOM	
Digestion coefficients(%)					
DM	68.84	69.50	67.40	71.47	1.6
OM	70.95	71.20	69.57	73.36	1.5
CP	78.17	78.28	75.88	78.04	1.3
EE	78.69	78.67	80.31	79.59	1.1
CF	26.26	30.91	24.97	29.83	3.9
NFE	79.48	78.21	78.41	81.14	1.1
Nutritive value (%)					
TDN	69.48	67.13	67.80	69.83	1.3
DCP	14.87	14.99	14.49	14.49	0.3
DE	3052.047	2982.24	3005.54	3090.39	60.0

[1]Treatment, **CON**= control, basal diet, **SGR**= 10%. sea-grass, **TAR**= 10% Taro haulms
[2]Values are least-squares means.
[3]S.E. = Largest standard error of the means.

Carcass traits

Results presented in Table (5) showed that pre-slaughter weight, empty body weight and hot carcass weight did not differ significantly (P>0.05) among treatment groups, although their means seemed to be a little lower in TAR group as compared to the other treatment groups. Dressing percentages also, did not differ significantly among treatment groups and means were almost similar (Table 5).

Hind leg weight and hind leg meat were lower significant (P<0.05) in TAR group as compared to CON and SGR groups, but did not differ (P>0.05) from TOM group. Organ weights as giblets weight did not differ significantly among treatment groups, except the kidney weight, which was lower in the CON group as compared to the other treatment groups (Table 5). Similar results were obtained by Soad Ahmed *et al.,* (1994).

Chemical analysis of meat rabbits:

Table (6) shows the chemical analysis of hind leg meat of NZW growing rabbits**.** Protein (%) was higher (P<.05) in treatment groups that were fed on tomato haulms (22.37%) and sea-grass (22.06%) than those fed on taro haulms (21.43%) or the CON. (21.23%). Fat (%) was also, higher in TOM group as compared to SGR and CON groups and similar to TAR group. Ash (%) did not differ significantly among treatment groups.

Table (5): Carcass traits and dressing percentages of NZW growing rabbits as affected by dietary treatment groups.

Items			Treatment groups[1,2]				S.E.[3]
			CON	SGR	TAR	TOM	
Body Weight (BW), kg	Pre-slaughter weight		1.828	1.870	1.771	1.892	0.038
	Empty body weight (EBW)[4]		1.650	1.662	1.573	1.624	0.038
Carcass	Hot carcass wt. (HCW)[5], kg		1.214	1.222	1.167	1.209	0.033
	Dressing%	Commercial[6]	66.42	65.30	65.87	63.91	0.93
		Biological[7]	73.57	73.47	74.17	74.44	0.59
Hind Leg (HL)	HL weight, g.		151^{a}	151^{a}	134.5^{b}	145^{ab}	6.00
	HL meat, g.		133.70^{a}	133.80^{a}	118^{b}	127.9^{ab}	5.20
	HL bone, g.		17.30	17.20	16.50	17.10	0.78
	HL Meat,%		88.54	88.60	87.73	88.21	0.60
	HL Meat/bone		7.73	7.78	7.17	7.48	0.40
Geblets , g	Liver		42.67	46.74	42.83	43.01	3.33
	Kidney		8.97^{a}	10.95^{b}	9.89^{ab}	10.01^{ab}	0.47
	LHW[8]		16.13	17.72	17.58	16.13	1.02

[a,b]Means in the same row with different superscripts, differ ($P<0.05$).
[1]Treatment groups, **CON**= Control, basal diet ad lib., **SGR**=10% Sea grass, **TAR**=10% Taro haulms, **TOM** = 10% Tomato haulms,
[2]Values are least-squares means.
[3]**SE**= standard error of least-square means.
[4]**EBW**= empty body weight (live BW including head, skin, empty **G.I.T** – **G.I.** tract contents).
[5] **HCW**= Weight of carcass (without skin, limbs, ears, G.I.T) + liver+ kidneys + head + (lungs, esophagus, trachea, thymus, heart).
[6] Commercial dressing % (HCW/Live BW)X100.
[7] Biological dressing % = (HCW/EBW)X100.
[8] **LHW**= Weight of (lungs, esophagus, trachea, thymus, heart).

Serum biochemical profiles:

Serum biochemical profiles could be used as indicator for the nutritional and physiological status of the animal. Results presented in Table (7) showed that all serum constituents were within the normal range for rabbit (Manning *et al.,* 1994).

Liver fraction:

Results presented in Table (7) showed no significant differences in total protein (TP), albumin and globulin concentrations. However, means tended to be higher in rabbits fed on sea-grass (SGR), which indicates that the SGR

Table (6): Chemical analysis of hind leg meat of NZW growing rabbits as influenced by dietary treatments.

Items (%)	Treatment groups[1,2]				S.E.[3]
	CON	SGR	TAR	TOM	
Protein	21.23[a]	22.06[ab]	21.43[a]	22.37[b]	**0.43**
Fat	3.13[c]	2.50[c]	4.83[d]	5.87[d]	**0.36**
Ash	2.34	2.02	2.31	2.20	**0.21**

[a,b]Means in the same row with different superscripts, differ (P < 0.05).
[c,d]Means in the same row with different superscripts, differ (P < 0.05).
[1]Treatment groups, **CON**= Control, basal diet ad lib., **SGR**=10% Sea grass, **TAR**=10% Taro haulms, **TOM** = 10% Tomato haulms. [2]Values are least-squares means.
[3]**SE**= Standard error of least-square means.

treatment group was nutritionally in good condition. Tawfeek *et al.,* (1995) reported that doe and buck rabbits fed tomato pomace (10%) did not differ significantly among other groups.

Liver function:

Results showed that feeding TAR elevated (P<0.05) AST enzyme concentration in the serum (Table 7). ALT enzyme concentration in SGR group was higher (36.11 IU/dl) as compared to TOM group (29.20 IU/dl) and similar to CON and TAR groups. Khayyal *et al.,* (2017) and Phillip *et al.,* (2017) reported that feeding taro waste did not affect ALT and AST/ALT ratio when compared with control group.

***Kidney function*:**

Dietary treatments had no effect (P>0.05) on serum U-Nitrogen (Table 7). However, the TOM group tended to be higher (32.86 mg/dl) as compared to other treatment groups. Growing rabbits fed on SGR decreased serum creatinine (P<0.05) when compared with the other treatment groups. Khayyal *et al.,* (2017) and Phillip *et al.,* (2017) reported that taro waste in diets did not affect urea-N or serum creatinine when compared with control group. Soad Ahmed *et al.,* (1994) reported that rabbits fed tomato pomace (10%) was significantly effect on urea-N and creatinine values.

Lipid profiles:

Triglycerides tended to be high in TOM group and low in SGR group as compared to the CON and TAR groups. Total cholesterol did not differ

Table (7): Effect of dietary treatment groups on some serum constituents of NZW growing rabbits at 13 wks of age.

Item	Treatment groups[1]				±SE
	CON	SGR	TAR	TOM	
Liver fraction					
Total protein, g/dl	6.16	6.44	5.99	5.36	**0.69**
Albumin, g/dl	3.51^{ab}	3.56^{a}	3.49^{ab}	3.30^{b}	**0.096**
Globulin, g/dl	2.64	2.88	2.50	2.09	**0.67**
Alb./Glob. Ratio	1.51	1.52	1.46	2.39	**0.48**
Liver function					
AST[2], IU/dl	19.98^{a}	22.28^{ab}	29.20^{b}	16.91^{a}	**2.58**
ALT[3], IU/dl	32.27^{ab}	36.11^{a}	34.57^{ab}	29.20^{b}	**2.72**
AST/ALT ratio	0.654^{ab}	0.625^{ab}	0.844^{a}	0.581^{b}	**0.084**
Kidney function					
Urea-N, mg/dl	27.43	27.64	26.20	32.86	**4.26**
Creatinine, mg/dl	1.76^{a}	1.44^{b}	1.77^{a}	1.71^{a}	**0.098**
Lipid profile					
Triglyceride, mg/dl	63.08^{ab}	53.5^{a}	60.27^{ab}	73.60^{b}	**7.25**
Total cholesterol, mg/dl	69.13	59.77	70.82	65.4	**4.54**
Glucose, mg/dl	143.8^{a}	115.3^{b}	124.3^{b}	128.3^{ab}	**7.16**

[a, b]: Means within the same row with different superscripts differ (P<0.05),
[1]Treatment groups, **CON**= Control, **SGR**=Sea grass, **TAR**= Taro haulms, **TOM** = Tomato haulms. SE= standard error.
[2,3] Aspartate transaminase (AST), alanine aminotransferase (ALT).

significantly among treatment groups. Phillip *et al.,* (2017) reported that dried taro did not affect blood cholesterol level. But, Khayyal *et al.,* (2017) showed that blood cholesterol decreased with increased rate of taro waste in rabbit diets when compared with the control and attributed this to the presence of saponins in taro waste. Saponins are connected to bile acids and cholesterol, so they are believed to be able to cleanse these fatty compounds from the body, which lowers cholesterol levels in the blood (Michael, 2005). Kolsi *et al.,* (2017 b) reported that *C. nodosa* extract (CNE) decreased triglycerides, low density lipoprotein (LDL) cholesterol and total cholesterol levels in the plasma of diabetic rats, and increased the high density lipoprotein (HDL) cholesterol, which helped maintain the homeostasis of blood lipids when compared with diabetic rats.

Serum glucose:

Results presented in Table (7) showed that SGR and TAR treatments reduced (P<0.05) serum glucose level as compared with the control. The decrease due to feeding sea-grass was 19.8% and due to feeding taro waste was 13.5% when compared with the control. Means of TOM and CON groups did not differ significantly from each other groups, but tended to be lower in the

TOM group than CON group (128.3 vs 143.8 mg/dl). Kolsi *et al.,* (2017 b) found that *C. nodosa* extract (CNE) lowered blood glucose levels in diabetic rats. They attributed this effect to the presence of phenolic compounds in CNE and suggested its use in the treatment of diabetes and low glucose tolerance. In addition, Phillip *et al.,* (2001) reported that *C. esculenta* (taro haulms) is effective in the treatment of hypoglycemia due to the presence of cyanoglucoside**.**

Economic efficiency:

Data presented in Table (8) showed that the best value for economical efficiency and relative economical efficiency were recorded by rabbits fed diet containe 10% tomato halums (TOM) (135.89 and 112.42%), respectively,

Table (8): Effect of the experimental diets on economical efficiency of growing NZW rabbits from 6 to 13 wks of age.

Items	**Treatment groups** [1]			
	CON	**CGR**	**TAR**	**TOM**
Price/kg diet. (L.E)	4.84	4.58	4.54	4.55
Total feed intake/rabbit(g)(7wks).	3.86	3.98	3.81	3.95
Total feed cost/rabbit (L.E)[2]	18.68	18.23	17.30	17.97
Total weight gain/rabbit(gm)	916.6	907.9	840.8	942.5
Feed cost/kg gain (L.E)	20.37	20.08	20.57	19.08
Price/kg gain (L.E)	45	45	45	45
Total revenue/ rabbit (L.E)[3]	41.26	40.86	37.84	42.39
Net revenue/rabbit (L.E)[4]	22.58	22.63	20.54	24.42
Economic efficiency (E.EF)[5]	1.2	1.24	1.18	1.35
Economic efficiency (E.EF) x 100	120.88	124.14	118.73	135.89
Relative E. EF (R. E. E) (%)[6]	100	102.70	98.22	112.42

[1]Treatment groups, **CON**=Control, **SGR**=Sea grass, **TAR**= Taro haulms, **TOM** = Tomato haulms
Based on price of ingredients of the diets and market price of live body weight as kg during the experimental period.The price of one kg of alfalfa hay, yellow corn, soybean meal (44%), wheat bran,molasses, Di- calciumphosephate, lime stone, salt, premix, antifungus, anticoccidiosis, test material and manufacturing price were 3.35, 4.1, 7.2, 3.7, 5.0, 13.00, 0.5, 1.00, 50.00, 35.00, 105.00, 0.5 and 200 LE, respectively.
[2]*Total feed cost /kg gain = Total feed cost / (total weight gain/1000)*
[3]*Total revenue = Total weight gain x price / kg gain*
[4] *Net revenue = different btween total revenue and total feed cost*
[5]*Economic efficiency (E.EF) = (Net revenue / Total feed cost)x 100*
[6]*Relative Economic efficiency (R. E. E,) assuming control treatment =100%*

followed by those fed 10% sea-grass (SGR)(124.14and102.70%), respectively. Moreover, the total cost of feed/ rabbits in the TAR group was low (19.30 L.E) followed by the TOM group (17.97 L.E). Similar results were obtained by Soad Ahmed *et al.,* (1994) on rabbits fed tomato pomace (10%).

Conclusively,it could be concluded that growing rabbits fed on diets containing 10% sea-grass, taro and tomato haulms without detrimental effects on productive performance, health status and economic efficiency.

REFERENCES

A.O.A.C. (2012) *Association of Official Analatical Chemists*. Official methods of analysis. 19th Ed. A.O.A.C. Washington. DC, USA.

Abdel-Hady, H. H.; Daboor, S. M. and Ghonemy, A. E. (2007). Nutritive and anti-microbial profiles of some sea-grasses from Bardawil Lake, Egypt. *Egyptian J. Aquatic Research*. 33(3):103-110.

Abdulrashid, M. and Agwunobi, L. N. (2009). Taro cocoyam (*Colocasia esculenta*) meal as feed ingredient in poultry. *Asian Network for Scientific Information. Pakistan J. Nutrition*. 8(5):668-673.

Agwunobi, L. N.; Angwukan, P. O.; Cora, O. O. and Isika, M. A. (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.

Bakr, E. O. A.; Shetaewi, M. M. and EL-Desoky, A. M. I. (2019). Effect of olive cake pulp as a partial or a complete substitute of wheat barn in growing rabbits diet on growth performance, carcass traits and blood constituents under North Sinai conditions, *J. Animal and Poultry Pord.,* Mansoura Univ., 10 (3): 83 – 88.

Bakr, E. O. A.; Galal, H. M. F. and Abbas, H. EL-S. (2021). Nutritional evaluation of dried tomato (Lycoprison Esculintum) haulms instead of Alfalfa hay in feeding growing rabbits under North Sinai conditions. *Egyptian J. Nutrition and Feeds, Special* , Issue: 55 – 63.

Blasco, A.; Ouhayoun, J. and Masoero, G. (1992). Status of rabbit meat and carcass: Criteria and terminology. *Options Mediterraneennes- Serie Seminaires.* 17:105-120.

Cheek, P. R.; Patton, N. M. and Tempelton, G. S. (1982). *Rabbit Production.* USA. 5th Ed.

Duncan D. B. (1955). Multiple range and multiple F Test. *Biometrics,* 11:1-42.

Edmore, M.; Gospell, M.; Godfrey, N.; Venancio, I. C.; Zezai, C. and Tawanda, M. (2015). Growth performance of weaner rabbits fed cowpea based rations as protein source. *J. Anim. Pro. Adv*., 5(10):777-783.

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 KL-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).

FAO(1993). FAOSTAT.*Food and Agricultural Organization of the United Nations*.

Geneid, Y. A. and El-Hady, H. H. (2006). Distribution, biomass and biochemical contents of the sea-grasses species of Lake Bardawil. *Biology and Marine Mediterranean*. 13(4): 225–229.

Hassan, A. A.; Khalel, M. S.; Shwerab, A. M.; Yacout, M. H.; Borhami, B. E. and Ibrahim, H. Z. (2010). Microbial degradation of pesticide residues in tomato haulms and their effects on performance of dairy cows. Egyptian Journal of Nutrition and Feeds. 13(3): 485-505.

Hassan, I.; Abdallah, A. G. and Abo El-wafa, S. (1996). Utilization of decorticated local cotton seed meal in broiler diets. *Egyptian Poultry Sci.* (16):31-49.

Ibrahim, M. M. (2016). Effect of feeding some medicinal plants on reproductive performance of male and female rabbits under Sinai condition. Thesis Ph. D. Environ. Agric. Sci., Suez Canal Univ., EGYPT.

Jeevitha, M.; Athiperumalsami, T. and Kumar, V. (2013). Dietary fibre, mineral, vitamin, amino acid and fatty acid content of sea-grass from Tuticorin Bay, *Southeast coast of India.* 90:135-146.

Khayyal, A. A.; Bakr, E. O. A.; Phillip, Y. L.; Hussein, A. M. and Khir, A. A. (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.8(6): 109- 117.

Khogali, H.; Faze, K., Gofoon, A. and Ali, B. (2010). Comparative Study Between Tomato (*Lycopriscon esculintum*) Straw and Groundnut Hay for Feeding Male Sudanese Desert Sheep. *Damascus University Journal for Agricultural Sciences.* 26(2):301-309.

Kolsi, R. B. A.; Salah, H. B.; Saidi, S. A.; Allouche, N.; Belghith, H. and Belghith, K. (2017 a). Evaluation of nutritional value, characteristics, functional properties of *Cymodocea nodosa* and its benefits on health diseases. Lipids Health Dis. 16(1):238.

Kolsi, R. B. A.; Salah, H. B.; Jardakc, N.; Chaabend, R.; El Fekie, A.; Rebaic, T.; Jamoussid, K.; Alloucheb, N.; Belghithf, H. and Belghitha, K. (2017 b). Effects of *Cymodocea nodosa* extract on metabolic disorders and oxidative stress in alloxan-diabetic rats. *Biomed Pharmacother.* 89:257–267.

Kolsi, R. B. A.; Allah, F. B. A.; Elleuch, M.; Kolsi, B.; El Feki, A. and Belghith, K. (2018). Antioxidant and fertility potentials of a marine sulfated polysaccharide potentiel antioxydant et de fertilite d'un polysaccharide sulfate marin. *J. I. M. Sfax, N.* 28:36-44.

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.

Mensi, F.; Jamel, K. and Amor, E. A. (2001). Potential use of seaweeds in Nile tilapia (*Oreochromis niloticus*) diets. *Cahiers Options Méditerranéennes*. 63: 151-154.

Michael, W. D. (2005). Saponin. The Florida State University, USA.

Millen, B. E.; Abrams, S.; Campbell, L. A.; Anderson, C. A.; Brenna, J. T.; Campbell, W. W.; Clinton, S.; Hu, F.; Nelson, M.; Neuhouser, M. L.; Escamilla, R. B.; Siega-Riz, A. M.; Story, M. and Lichtenstein, A. H. (2016). The 2015 Dietary Guidelines Advisory Committee Scientific Report: *Development and Major Conclusions*. 7(3):438-444.

Ministry of Agricultures(2011).*Agricultural Statistics*, Economic Affaire Sectors.

Ministry of Agriculture (2016). Bulletin of the Agricultural Statistics, Part (2) *Summer & Nili Crops*, 2014/2015, pp. 203.

Mousa, M. R. M. and Abd El-Samee, A. M. (2002). Effect of olive pulp feeding on the growth performance and some related blood biochemical changes of growing rabbits under semi- arid conditions. *Egyptian Journal of Rabbit Science*. 12(1): 59-68.

NRC (1977). National Research Council. *Nutrient Requirements of Rabbits*. Washington, DC. USA.

Olajide, R.; Akinsoyinu, A. O.; Babayemi, O. J.; Omojola, A. B.; Abu A. O. and Afolabi, K. D. (2011). Effect of processing on energy values, nutrient and anti-nutrient components of wild cocoyam (*Colocasia esculenta (*L.*) Schott*) corm. Pakistan Journal of Nutrition. 10 (1): 29-34.

Ortiz, J.; Romero, N.; Robert, P.; Araya, J.; Lopez-Hernandez, J.; Bozzo, C.; Navarrete, E.; Osorio, A. and Rios, A. (2006). Dietary fiber, amino acid, fatty acid and tocopherol contents of the edible seaweeds *Ulva lactuca* and *Durvillaea antarctica*. *Food Chem.*, 99:98-104.

Phillip, B. A.; Grindleya, O. F.; Asemotaa, H. N.; Errol, Y. and Morrisona, A. (2001). Carbohydrate digestion and intestinal ATPases in streptozotocin-induced diabetic rats fed extract of yam (Dioscorea cayenensis) or dasheen (*Colocasia esculenta*). *Int J Food Sci Nutr*. 52: 429-433.

Phillip, Y. L.; Khirm A. A.; Khayyal, A. A.; Mahgoub, A. A. S. and Abdel-Salam, O. (2017). Effect of using different levels of dried taro (*Colocasia esculanta*) waste without or with dried yeast (*Saccharomyces cerevisiae*) on growth performance of growing lambs. *J. Animal and Poultry Prod*., Mansoura Univ. 8 (9): 355- 361.

Renard, C. (2001). Crop residues in mixed crop / livestock farming systems. CAB *International in association with the association with the International Crops Resarch Institute for the Semi-Arid Tropics and the International Livestock Research* Institute. Pp. 25-36.

SAS, (2004). SAS procedures Guide for personal Computers, Statistical Analysis System Institute, Inc., Cary, N.C.

Schiemann, R.; Nehring, K.; Hoffman, L.; Jentsch, W and Chudy, A. (1972). Energetische futterbewertung und energienormen. *VEB Deutscher Landwirtschaftsveriag.* Berlin. 344.

Shetaewi, M. M. (1998). Efficiency of dietary high levels of antioxidant vitamins C and E for rabbits subjected to crowding stress. *Egyptian J. Rabbit Sci,* 8 (2): 95–112.

Soad, S. Ahmed; EL-Gendy, K. M.; Ibrahim, H.; Rashwan, A. A. and Tawfeek, M. I. (1994). Growth performance, carcass traits and some physiological aspects of growing rabbits fed tomato pomace as a substitution for Alfalfa meal. *Egyp. Journal of Rabbit Science*, 4 (1):1 – 13.

Steel, R. G. D. and Torrie, J. H. (1980). Principles and procedures of Statistics: A Biometrical Approach (2nd Ed.). McGraw-Hill Book Co., New York, USA.

Tawfeek, M. I; Rashwan, A. A; Ibrahim, H; EL-Kerdawy, D. and Soad S. Ahmed. (1995). Reproductive efficiency, semen characteristics, digestibility and some blood constituents of breeding rabbits fed tomato pomace as a partial substitution for Alfalfa meal. *Zagazig J. Agric. Res*. Vol. 22 No (3). 739 – 749.

Wikipedia, *the free encyclopedia. http://en. wikipedia*. org/wiki/Taro.

تاثير استخدام بعض الاعشاب البحرية ومخلفات محاصيل الخضر كاعلاف غير تقليديه في علائق الارانب النامية علي الاداء الانتاجي تحت ظروف شمال سيناء

السيد عثمان عبدالنبي بكر، ولاء عبد الحكيم عامر سالم ، محمد رضا موسي، مسعد مسعد احمد شتيوي

قسم الانتاج الحيوانى – كلية العلوم الزراعية البيئية – العريش –جامعة العريش- مصر

الهدف من هذه الدراسة دراسة تأثير استخدام بعض الاعشاب البحرية ومخلفات محاصيل الخضر كأعلاف غير تقليدية علي صفات النمو ومعاملات الهضم وصفات الذبيحة وبعض مكونات الدم للأرانب النيوزيلاندي الأبيض النامية في شمال سيناء.

تم تقسيم اثنين وثلاثون ارنباً نيوزيلاندي من كلا الجنسين مفطومة عمرها 6 اسابيع و متوسط وزن ٨٩١.٨ جم عشوائياً إلي ٤ مجموعات (٨ لكل مجموعة) غُذيت المجموعة الأولي (الكنترول CON)علي العليقة الاساسية فقط ، وغُذيت المجموعة الثانية (SGR) علي العليقة الاساسية محتوية علي ١٠%

منها عشب بحر (*C. nodosa*)، وغُذيت المجموعة الثالثة (TAR) علي العليقة الاساسية محتوية علي ١٠ % منها عروش قلقاس (*C. esculenta*) ، وغُذيت المجموعة الرابعة (TOM) علي العليقة الاساسية محتوية علي ١٠% منها عروش طماطم *(S.lycopersicum*)، وغطت العلائق الأربعة الأحتياجات الغذائية للأرانب النامية ، وفي نهاية التجربة تم إجراء تجربة هضم (عمر ١٣ اسبوع) لتقدير معاملات الهضم للمكونات الغذائية والقيمة الغذائية للعلائق الأربعة بالإضافة لذبح خمس ارانب من كل مجموعة لتقدير صفات الذبيحة وبعض مكونات الدم.

أوضحت النتائج المتحصل عليها مايلي:

* عدم وجود فروق معنوية في الوزن الحي النهائي بين المجاميع الأربعة.
* مقدار الزيادة الكلية ومعدل النمو اليومي للمجموعة التي تغذت علي عروش الطماطم (TOM) كان أعلي معنوياً مقارنتاً بالمجموعة التى تغذت علي عروش القلقاس (TAR) بينما لم تختلف معنوياً مع مجموعتى الكنترول (CON) وعشب البحر (SGR).
* زاد مقدار المأكول اليومي والكلي للمجموعة التي تغذت علي عشب البحر (SGR) مقارنتاً بالمجموعة التى تغذت علي عروش القلقاس (TAR) بينما لم يختلف معنوياً مع مجموعتي الكنترول (CON) وعروش الطماطم (TOM).
* لم توجد اختلافات معنوية في كفاءة تحويل الغذاء بين المجاميع الأربعة .
* لم توجد اختلافات معنوية في جميع معاملات الهضم (DM, OM, CP, CF, EE and NFE) والقيمة الغذائية (TDN, CP and DE) بين العلائق الأربعة.
* لم توجد اختلافات معنوية بين المجاميع الأربعة في صفات الذبيحة بإستثناء الكلي التي كانت اقل وزناً في مجموعة الكنترول (CON) مقارنةً بالمجاميع الثلاثة الاخرى.
* زادت نسبة البروتين للحم الفخذ الخلفية في الأرانب التي تغذت علي عروش الطماطم (TOM) وعشب البحر(SGR) معنوياً عن التي تغذت علي العليقة الاساسية (CON) وعروش القلقاس (TAR).
* نسبة الدهون للحم الفخذ الخلفي كانت أعلي في المجموعة التي تغذت علي عروش الطاطم (TOM) مقارنةً بالتي تغذت علي العليقة الاساسية (CON) وعشب البحر (SGR) بينما لم تختلف معنوياً مع التي تغذت علي عروش القلقاس (TAR).
* لم توجد اختلافات في نسبة الرماد للحم الفخذ الخلفية بين المجاميع الأربعة.
* حققت مجموعتي عشب البحر وعروش القلقاس انخفاض معنوي في مستوي الجلوكوز مقارنةً بمجموعة الكنترول.
* لاتوجد اختلافات معنوية في البروتين الكلي والجلوبيولين والنسبة بين الألبيومين : الجلوبيولين ، الكوليسترول واليوريا بين المجاميع الأربعة.
* انخفض الالبيومين في مجموعة عروش الطماطم معنوياً مقارنةً بمجموعة عشب البحر.
* الجليسريدات الثلاثية كانت أعلي معنوي في مجموعة عروش الطماطم عن مجموعة عشب البحر ومماثلة للمجموعات الاخري.
* أدت التغذية علي عشب البحر لإنخفاض معنوي في الكرياتنين مقارنةً بالمجموعات الاخري.
* أدت التغذية علي عروش الطماطم لإنخفاض معنوي في AST مقارنةً بالتغذية علي عروش القلقاس.
* حققت مجموعة عشب البحر ارتفاع معنوي في ALT مقارنةً بمجموعة عروش الطماطم ، بينما لم تختلف معنوي مع مجموعتي الكنترول وعروش القلقاس.

التوصية: يمكن تغذية الأرانب النامية على علائق تحتوي علي ١٠% من كل من عشب البحر وعروش القلقاس وعروش الطماطم دون ان يؤثر ذلك علي نموها والحالة الصحية لها.