UTILIZATION OF PALM TREE LEAVES IN FEEDING GROWING RABBITS.

N.E. El-Bordeny [2] and F. Abdel-Azeem[1]

1-Dept. of Poultry Production, Fac.of Agri.,AinShams Univ., Cairo, Egypt.

2-Dept. of Animal Production, Fac. of Agri., Ain Shams Univ, Cairo, Egypt.

ABSTRACT

To invistigate the effect of using palm tree leaves as a replacer of 33.33, 66.66 or 100% of clover hay as a source of fiber in growing NZW rabbit's ration, a total number of 60 unsexed, weaned New Zealand White rabbits of 5 weeks old were randomly divided into four experimental groups (15 for each). Four pelleted experimental diets were formulated to be approximately isocaloric, isonitrogenous and isofibrous. Insignificant ($P \geq 0.05$) differences were observed in feed consumption among the different experimental groups through all the experimental periods. Replacing 33.33 % of the clover hay by PTL increased the values of CP and CF digestibility compared to the other groups. Also using 100% PTL as replacer to clover hay increased EE digestibility than the other groups. The group received 33.33% of clover hay as PTL showed higher TDN and DCP values. Insignificant effects were observed in blood parameters. Using of PTL in growing rabbits diet increased significantly live body weight and daily weight gain through the whole experimental period. Feed conversion ratio was improved with feeding PTL in the rabbit diets compared to control diet. Also insignificant differences were observed in carcass traits. Using PTL as a replacer to clover hay decrease feed cost, improve economic efficency and prformance index.

Key words: palm tree leaves , rabbit , performance, carcass traits, economic efficency

INTRODUCTION

The prices of the main ingredients of feedstuffs used in formulating rabbits diets show spontaneous increases. The available amount of clover hay through the summer season in Egypt is usually insufficient for animal feeding leading to increasing prices of diets. Therefore, attempts have been carried out to search for alternative non-conventional low price by-products, which could be used in animal feeding. Rabbits are herbivorous animals, consuming high-roughage diets. Nevertheless, rabbits are poorly digest fibrous materials and their use of agriculrural by-products may be limited if the lignin fraction is high. It has been shown that dietary fiber components determine growth responses in rabbits **(Harris and Johnston, 1979)**, and physicochemical properties of fibrous polysaccharides are important for the development of the digesta in the gut and the utlization of nutrients. Moreover 21 million tons of agriculture crop residues are produced in Egypt annually (**Deraz, 1996**). However only 4.0 to 4.3 million tons of these crop residues are used for feeding animals (**El-Shinnawy, 1990; Hathout and El-Nouby, 1990 and Khorshed, 2000**).

Therefore , more researches has been conducted to evaluate the effect of using some agriculture by products as it is or after some treatments (chemical and biological) as untraditional feedstuffs on animal performance. It was generally known that date have a fundamental economic importance in many desert areas especially in Sinai and El-Wadi El-Gedid governorates in Egypt, where inedible dates, date pits, pinne of date palm and mid rib of date palm are not utilized for human consumption. However, several experiments by different investigators reveald that date stone meal can be included in animal rations (**Khattab *et al.* 1977**).

The aim of this study was to investigate the effect of utilizing palm tree leaves in ration of growing rabbit on productive performance, economic efficiency and carccas traits.

MATERIALS AND METHODS

The present study was carried out at the Centre of Agricultural Studies and Consultations (CASC), Rabbits Production Unit (RPU), Faculty of Agriculture, Ain Shams University, Cairo, Egypt.

A total number of 60 unsexed, weaned New Zealand White (NZW) rabbits of 5 weeks old were randomly divided into four experimental groups (15 rabbits/group). Each group was subdivided into five replicates, each of 3 rabbits and the initial live body weights of all experimental groups were almost equal.

Four pelleted experimental diets were formulated to be approximately isocaloric, isonitrogenous and isofibrous. All experimental diets were formulated at Atmida company to meet the recommended nutrient requirements of rabbits according to **NRC (1977)** and **Cheeke(1987)**, but with a replacement clover hay by palm tree leaves (PTL) or equal 12, 24 and 36% of the complet diet chemical composition of clover hay and palm tree leaves as well as Ingredients and experimental diets are shown in Table (2).

The experimental rabbits were housed in galvanized metal wire cages (60 x 50 x 40 cm for length, width and height respectively), and provided with feeders and automatic watering system, with three rabbits per each cage. The cages were located in a naturally ventilated and lighting building. The experimental diets were offered to the rabbits ad libitum and fresh water was available all the time during the experimental period. Rabbits were individually weighed at the beginning of the experiment, then at weekly intervals until the end of the experiment. Daily weight gain, daily feed consumption, feed conversion ratio and mortality rate were calculated. This experiment lasted for 8 weeks, when the rabbits were 13 weeks old.

At the last week of the experiment, digestibility trials were conducted using ٢٠ rabbits (5 male rabbits from each treatment group). Rabbits were housed individually in metabolism cages that allow faeces and urine separation. The preliminary period continued for 7 days and the collection period extended for 3 days. Feed intake was exactly determined. Faeces were collected daily , weighed and dried at 60-70°C for 24 hours, bulked, finely ground and stored for chemical analysis. The apparent digestibility coefficients of DM, OM, CP, CF, EE and NFE for the tested diets were estimated. The chemical composition of the clover hay, palm tree leaves (PTL), experimental diets and faeces were analyzed according to A.O.A.C.(1990). The total digestible nutrients (TDN) were calculated according to the classic formula (**Cheeke et al., 1982**). The digestible energy (DE) of palm tree leaves (PTL) was calculated according to Fekete and Gippert (1986) by applying the equation:-

DE (kcal/kg) = 4253-32.6 (CF%) -144.4 (total ash%).

At the end of the growth trial, five randomly chosen rabbits (13 weeks of age) representing each group were slaughtered according to the standard technique of **Cheeke et al., (1982)**. Dressing percentage included relative weights of carcass, giblets and head. While, non-carcass fat included relative weights of heart, kidney, caul and mesenteric fat were determined.

Blood samples were collected at slaughtering in heparinized glass tubes (5 samples per each treatment group). Blood plasma was separated by centrifugation at 3000 rpm for 15 minutes. The collected plasma was stored at -20°C until assay. Values of total protein, albumin, total lipids, total cholesterol and liver enzyme activities (GOT and GPT) were determined by using kits purchased from Boi-diagnostics Company, Egypt. The globulin values were obtained by subtracting the values of albumin from the corresponding values of total proteins.

The EE was calculated according to the following equation: EE = A-B/B X 100. where A is selling cost of obtained gain (LE per kg) and B is the feeding cost of this gain. The performance index (PI) was calculated according to the equation described by **North (1981)** as follows:

PI = Live body weight (Kg)/ Feed conversion x 100

Data were analyzed according to statistical analysis system User's Guide, (**SAS, 1998**). Separation among means was carried out by using Duncan's multiple range test (**Duncan, 1955**). The model was as follows: $Y_{ij} = \mu + T_i + e_{ij}$

Where: Y_{ij} = The observation on the I^{th} treatment μ = Overall mean T_i = Effect of the I^{th} treatment e_{ij} = Random error treatment.

RESULTS AND DISCUSSION

1-Proximate analysis of palm tree leaves (PTL) and rations:

The chemical analysis of palm tree leaves (PTL) and clover hay (table 1) show that the palm tree leaves had higher DM, OM and NFE than clover hay. On the contrary the clover hay had higher CP, EE and total ash, while CF content is close for the two sources. Similar results were obtained by **El-Faham, (2005).**

The different formulations of experimental rations presented in Table (2) showed that, the different ingredients used by different ratio to formulate the rations to be approximately isocaloric, isonitrogenous and isofibrous. Also it contained similar percentage of Calcium, Phosphorus, Methionine + cystine and Lysine.

2- Feed consumption (g/rabbit/day):

Insignificant ($P \geq 0.05$) differences were observed in feed consumption among the different experimental groups through all the experimental periods (5-9 weeks of age, 9-13 weeks of age and 5-13 weeks of age), Table (3).

These results may be attributed to that the different diets are approximately isocaloric, isonitrogenous and isofibrous and contain similar percentage of calcium, phosphorus, methionine + cystine and lysine. This may be prove that PTL can be used as a replacer to clover hay as a source of fiber without any adverse effect on feed consumption

The mean feed intake were low during the first period (5-9 weeks of age) then increase during the second period (9-13 weeks of age). **NRC (1977)** reported that rabbits, like most animals, voluntarily adjust their feed intake to meet their needs. Also, it can be seen that all diets have similar percentage of methionine amino acid, **Colin, *et al.*, (1973)** reported that the increase in methionine percentage cause a large decrease in feed intake. They added that rabbits fed on low protein diet and low total sulpher amino acids consumed greater amount of feed.

3- Nutrient digestibility coefficeints:

Replacing clover hay by 12% PTL increased ($P \leq 0.05$) the values of CP and CF digestibility in comparison with the control and the other experimental groups. Also using 36% PTL increased ($P \leq 0.05$) EE digestibility than the other groups. The highest value of EE digestibility was recorded for the group received 36 % PTL followed by the group received 24 then 12 % PTL, while the lowest value ($P \leq 0.05$) was recorded for the control group, (table 3). On the other hand, insignificant differences were observed in DM, OM and NFE digestibility.

The group received 12% PTL showed higher TDN and DCP values than the other groups, (table 3). This may be attributed to the increase of CP, CF and EE digestibilities in comparison with the other groups.

4- blood parameters:

Replacing clover hay by PTL caused insignificant increase ($P<0.05$) in total serum proteins, albumin and globulin concentrations than the control as showed in Table (4). These may be attributed to that the different diets were approximately isocaloric, isonitrogenous, **Bush (1991)** reported a positive correlation between dietary protein and plasma protein concentration. Also, the same author stated that the low level of plasma proteins may be attributed to a decrease in the protein absorbed and synthesized and an increase in protein losses. **Cornelius (1970)** stated that, albumin is affected more readily than globulin by nutritional factors, e.g., restricted protein intake because of their different functions, metabolism and sites of origin. **Ashour *et al.*, (2004)** stated that the

concentration of albumin was considered as a reflection of the animal ability to synthesize and store protein. It is known that, the change in albumin level reflects the change in liver function. The liver is the site of albumin synthesis but globulin is formed by lymphatic tissues (**Jones and Bark, 1979**). However, values of total plasma protein and its fractions are within the normal ranges reported by **Melby and Altman (1974),** who found that the normal values of total protein in rabbits ranged between 4.9 and 7.2 g/100ml and the normal values of blood albumin ranged between 3.3 and 5.1 g/100ml, while the normal values of globulin are ranging between 1.85 and 3.6 g/100ml.

Rabbits group received 36%of the diet PTL recorded the lowest value ($P \leq 0.05$) of total lipids concentration compared to the other experemintal groups. Insignificant differences were observed in total cholesterol and GOT among the different experimental groups. The control group recorded the highest value ($P \leq 0.05$) of GPT activity followed by the group reieved 24% then 36% PTL, while the lowest value was that of the group received 12% PTL. The results of GOT and GPT are in good agreement with those reported by **Chiericato *et al.* (1985)** and lies within the normal levels. It is worthy to note that, plasma cholesterol content was inversely related to the total plasma proteins and their fractions (albumin and globulin). Which is in accordance with **Leveile and Sauberlish (1961)**. The obtained resutls of the blood components in the present study were within the normal values reported by **Hillyer and Quesenberry (1994)**.

5-Growth parameters.

5-1. Live body weight (LBW) and daily body weight gain (DBWG):

Regarding to rabbit body weight (Table 5), insignificant differences were observed in intial body weight at 5 weeks of age.

During the first period (4 weeks after weaning), it could be observed that rabbit fed on diets containing PTL as a replacer to clover hay as the main source of fiber, grew faster ($P \leq 0.05$) than the control group. While insignificant effects were observed in average daily gain during the period from 9-13 weeks of age.The same trend was obtained during the entire experimental period (5-13 weeks of age). This may be due to increase CP, CF and EE digestibilities for the groups received PTL than the control group (Table 3).

5-2. Feed conversion ratio (FCR):

Replacing clover hay by PTL caused significant improvement ($P \leq 0.05$) in values of feed conversion ratio than the control group during the first experimental period of growth (5-9 weeks) as shown in Table 5. This indicates that rabbits fed on different dietary levels of PTL converted their feed into body weight gains more efficient than those received control diet. This improvement may be attributed to the greater palatability and utilizability of PTLcontaining diets. And / or to the insignificant differences which were observed in feed consumption (table 3) and the higher average daily gain recorded for the groups received PTL containing diets (table 5). The same trend was observed in feed conversion ratio during the entire of the experimental period (5-13 weeks). While the differences were not significant during the second experimental period of growth (9-13 weeks), it can be attributed to the insignificant differences were observed in feed consumption and to the close mean daily gain during this period.

5-3. Mortality rate:

From data in Table (5) it is noticed that there were no death losses during the whole experimental period niether for the rabbit fed on clover hay as the main source of fiber nor the groups received PTL as a replacer to clover hay. This may be an indication that growing rabbits can utilized different dietary levels of PTL.

6-Carcass traits

Data concerning carcass traits are presented in Table (6). No significant effects (P>0.05) were detected in absolute or relative weights for carcass traits which estimated due to feeding diets containing dietary PTL levels.

7-Economic efficeincy

Replacing clover hay by increasing levels of PTL caused (P≤0.01) a gradual decrease in total feed cost (Table 7). This may be attributed to the insignificant difference which was observed in feed consumption (Table 3) in parallel to the gradual increase in PTL percentage as a replacer of clover hay which led to decrease cost of kg feed as showen in Table (7). The performance index (PI) increase may by related to the improvement in live body weight and feed conversion ratio. Concerning economic efficiency (EEF), relativ economic efficiency REEF and PI were markedly increased with increasing dietary PTL in the diets. The present results show that, EEF, REEf and PI of the rabbits were highest with 36% PTL being (348.90, 151.72 and 50.76%) respectively.

Conclusion

Palm tree leaves can be successfully used as a source of fiber to replacer clover hay in rabbit ration without any adverse effect on the rabbit performance and carcass traits. It can be useful in reducing rabbit feed cost.

Using the palm tree leaves in animal ration can be one of the alternative soulotion to environmental problems in some region as El-Wadi El-Gadid and Sinai, where the palm tree leaves and fronds accumulated and caused many invironmental hazards.

REFERENCES

A.O.A.C. (1990). Official Methods of Analysis, Association of Official Analytical Chemists. 15th edition, Washington, USA.

Ashour, G.; Ibrahim, S.A.; Ismail, A.M and El-Kholy, K.H. (2004). Physiological reactions and biological performance of rabbits to summer heat stress. 2th Sci. Conf. on Physio. Resp. to Environ. Condi. 28-31 July, 2004, El-Arish, Egypt pp.165-186.

Bush. B.M (1991). Interpretation of laboratory results for small animal clinicians. Oxford Blackwell scientific puplications , London .

Cheeke, P.R.; N.M. Patton; S.D. Lukefahr and J.I. McNitt (1987). In: Rabbit Production 6th Ed. Interstate Printers and Publishers. INC., USA.

Cheeke, P.R. (1987). Rabbit Feeding and Nutrition. Academic press, New York.

Cheeke, P. R., N.M. Patton and G.S. Tempelton (1982). Rabbit production. 5th Edition, Interstate Printers and Publishers Danville II., USA.

Chiericato, G.M.; Schiapelli, M.P. and Filotto, U. (1985). Studo della relazioni esistenti fra prestazioni produttive eprobilo metabolico nel coniglio. Estratto da Coniglicoltura XXLL, N. 12.

Colin. M., G.Arkurst and F. Lebas (1973). Effect of addition of methionine to the diets of growth of the rabbit. Annals de Zooteches, 22(4): 485-491.

Cornelius, C E. (1970). Liver function in clinical biochemistry of domestic animals.P 161., ed.) Kanekof Cornelius, New York Acad.

Deraz, T.A (1996). The production of microbial protein from some agricultural wastes and its utilization in ruminant. Ph.D thesis Faculty of Agriculture, Ain Shams University.

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

Fekete, S and T. Gippert (1986). Digestibility and nutritive value of nineteen important feedstuffs for rabbits. J. Appl. Rabbit Res., 9 (3) : 103.108.

El-Faham A.I (2005) The effect of using date palm waste (mid rib and pinne of dat palm as ingredients in broiler diets. J. Agric. Sci. Mansoura Univ., 30(9): 5103-5114,2005

El-Shinnawy M.M. (1990) the role of fibrous residues in feeding ruminants. 3rd International Symposium on feed Manufac and quality control., pp, 321-326.

Harris, D. J and Johnston, N. P. (1979). Effect of roughage source on rabbit performance. In: The domesttic rabbit: Potential, problems and Current Research. OSU Rabbit Research Centre, Corvillis, OR.

Hathout, M.K and H.M. El-Nouby (1990). Practical application of crop resdues treatment in Egypt . 3rd International Symposium on feed Manufac and quality control., pp, 337-347.

Hillyer, E.V. and Quesenberry, K.E. (1994). Ferrets, Rabbits and Rodents clinical medicine and surgery. Basic Approach to veterinary care Rabbits 165-166.

Jones, E. A and Bark, P.D. (1979). Chemical diagnosis of disease. Brown, S. S., F.L. Mitchell and D.S Young (Ed.), Elsevier, Biomedical Press, Biomedical, Press, Amsterdam, New York, Oxford, pp.325-363.

Khattab, H. M; M.A El-Serafy, A.S El-Shopokshy and M.A. El-Ashry (1977). Effeect of feeding urea with palm-date stines or molasses on the production performance of milking buffalo.5th conference of Animal Production Zagazig, Egypt, 1977

Khorshed, M.M.(2000) Different treatments for improving quality of some crop residues used in ruminant nutrition. Ph.D. thesis. Faculty of Agriculture, Ain Shams University.

Leveille, G. A and H. E. Sauberlich (1961). Influence of dietary protein level on serum compoents and cholerestol in the growing chick. J. Nutr., 74: 500-504.

Melby, E.C. and Altman , N.H. (1974). Biochemical constituents of serum in: Hand Book of Laboratory Animal Science E.C. Merck (1974).

N.R.C. National Research Council, (1977). Nutrient requirements of rabbits.National Academy of Science, Washington, D.C**.**

North, M.O. (1981). Commercial chicken. Production Annual. 2nd Edition, AV., publishing company I.N.C., Westpost Connicticut, USA.

SAS, (1998). SAS. Procedure Guide. Version 6.12 Ed. "SAS Institute Inc. Cary, NC.USA**.**

Table (١): Chemical composition of clover hay and palm tree leaves (PTL).

Items	On air dry basis		On dry matter basis	
	Clover hay	Palm tree leaves	Clover hay	Palm tree leaves
Moisture (%)	8.68	7.12	-	-
Dry matter (%)	91.32	92.88	100	100
Organic matter (%)	77.97	83.78	85.38	90.20
Crude protein (%)	12.72	6.52	13.93	7.02
Ether extract (%)	2.12	0.89	2.32	0.96
Crude fiber (%)	26.54	26.20	29.02	28.21
Total ash (%)	13.35	6.50	14.62	9.80
NFE (%)	36.59	50.17	40.11	54.02

Table (٢): Formulation and chemical analysis of the experimental diets.

Ingredients (%)	Palm tree leaves (PTL) in the diets			
	0.0%	**12.0%**	**24.0%**	**36.0%**
Clover hay	36.00	24.00	12.00	-
Yellow corn	20.25	18.10	16.00	15.00
Wheat bran	30.00	29.00	28.00	24.50
Palm tree leaves	-	12.00	24.00	36.00
Soybean meal (44% CP)	12.00	14.75	17.47	21.50
Limestone	1.00	1.40	1.75	2.19
Premix*	0.30	0.30	0.30	0.30
Common salt	0.30	0.30	0.30	0.30
DL-Methionine	0.15	0.15	0.18	0.21
Total	100.00	100.00	100.00	100.00
Chemical analysis (as fed basis)				
A- Determined analysis: -				
Dry matter (DM%)	92.80	92.88	93.00	93.40
Organic matter (OM%)	84.20	84.07	82.43	83.05
Crude protein (CP%)	16.52	16.61	16.75	16.72
Crude fiber (CF%)	13.85	13.92	13.90	13.80
Ether extract (EE%)	2.85	2.64	2.60	2.68
Nitrogen free extract (NFE%)	51.25	50.90	49.18	49.85
Crude ash (%)	8.60	8.81	10.57	10.35
B- Calculated analysis:-				
DE (kcal/kg)	2603	2602	2605	2616
Methionine + cystine (%)	0.67	0.65	0.65	0.65
Lysine (%)	0.81	0.79	0.76	0.76
Calcium (%)	0.91	0.92	0.91	0.93
Total phosphorous (%)	0.58	0.57	0.55	0.54

* One Kilogram of premix provides: 2000.000 IU vit. A, 150.000 IU vit. D, 8.33g vit. E, 0.33g vit K, 0.33g vit. B1, 1.0g vit. B2, 0.33g vit. B6, 8.33g vit. B5, 1.7 mg vit. B12, 3.33g Pantothenic acid, 33mg Biotin, 0.83g Folic acid, 200g Choline chloride, 11.7g Zn, 12.5g Fe, 16.6 mg Se, 16.6 mg Co, 66.7g Mg and 5g Mn.

Table(3):Effect of palm tree leaves levels in rabbit diets on feed consumption and nutrients digestibility coefficients .

Items	Levels of palm tree leaves				Sig.
	0.0%	**12.0%**	**24.0%**	**36.0%**	
No. of Rabbits	15	15	15	15	
A-Daily feed consumption (g) from:					
5-9 weeks	96.19±1.72	92.57±0.60	92.38±0.83	92.61±5.3	NS
9-13 weeks	103.61±1.16	102.03±0.20	104.38±1.77	100.65±3.19	NS
5-13 weeks	99.90±1.32	97.30±0.20	98.38±0.95	96.63±4.08	NS
B-Nutrients digestibility coefficients:-					
Dry matter (DM)	61.75±1.18	63.86±0.38	61.02±0.92	61.17±0.63	NS
Organic matter (OM)	٦٢,٧٨±1.46	63.60±0.37	60.50±0.88	61.31±0.62	NS
Crude protein (CP)	66.64^{b}±2.1	71.66^{a}±1.1	67.86^{ab}±1.1	64.06^{b}±0.54	*
Ether extract (EE)	75.00^{b}±0.95	80.31^{a}±1.2	81.16^{a}±0.4	82.69^{a}±1.3	**
Crude fiber (CF)	19.93^{b}±1.32	25.19^{a}±0.9	20.42^{b}±0.7	20.22^{b}±0.7	**
Nitrogen free extract (NFE)	72.23±1.04	71.01±0.90	68.84±1.42	70.30±1.10	NS
C- Nutritive values					
DCP%	11.01^{b}±0.4	11.89^{a}±0.2	11.36^{ab}±0.2	10.71^{b}±0.1	*
TDN%	55.25^{ab}±1.31	56.41^{a}±0.4	53.51^{b}±0.6	53.85^{b}±0.8	*

Means within the same row with different superscripts are significantly different.
Sig =Significance NS = Not significant * (P≤0.05) ** (P≤0.01)

Table (4) : Effect of palm tree leaves levels in rabbit diets on blood constituents of rabbits.

Items	Levels of palm tree leaves				
	0.0%	12.0%	24.0%	36.0%	Sig.
Total proteins (g/dl)	7.61±0.27	7.68±0.19	8.14±0.57	7.40±0.25	NS
Albumin (g/dl)	3.87±0.13	4.11±0.26	4.53±0.42	4.06±0.25	NS
Globulin (g/dl)	3.74±0.19	3.57±0.14	3.61±0.16	3.45±0.06	NS
A / G ratio	1.04±0.05	1.16±0.11	1.25±0.07	1.21±0.08	NS
Total Lipids(mg/dl)	345.8^{a}±25.3	332.8^{a}±6.4	301.8^{a}±25.9	208.2^{b}±6.95	**
Cholesterol(mg/dl)	88.73±10.6	76.03±2.54	76.66±5.4	78.66±7.05	NS
GOT(μ/L)	38.10±0.96	34.33±0.16	33.23±1.71	34.53±1.85	NS
GPT(μ/L)	12.63^{a}±0.91	6.00^{c}±0.58	9.67^{ab}±1.2	9.33^{b}±0.88	**

Means within the same row with different superscripts are significantly different.
Sig =Significance NS = Not significant * (P≤0.05) ** (P≤0.01).

Table (5):Effect of palm tree leaves levels on rabbit performance.

Items	Levels of palm tree leaves				
	0.0%	12.0%	24.0%	36.0%	Sig.
Live Body weight (g) at:					
5 weeks	612.77±4.3	610.44±1.4	610.00±1.9	611.2±2.3	NS
9 weeks	1667.00^{b}± 31	1793.33^{a}±21	1782.11^{a}±10	1766.11^{a}±43	*
13 weeks	2311.11^{b}±7	2431.11^{a}±16	2412.33^{a}±29	2461.11^{a}±27	**
Daily weight gain (g) from:					
5-9 weeks	30.13^{b}±0.99	33.80^{a}±0.58	33.49^{a}±0.26	33.00^{a}±1.26	*
9-13 weeks	18.40±0.73	18.22±0.30	18.01±0.67	19.86±1.06	NS
5-13 weeks	24.26^{b}±0.13	26.01^{a}±0.22	25.75^{a}±0.40	26.43^{a}±0.41	**
Feed conversion ratio (FCR) from:					
5-9 weeks	3.20^{a}±0.05	2.74^{b}±0.05	2.76^{b}±0.03	2.81^{b}±0.09	**
9-13 weeks	5.65±0.27	5.60±0.09	5.81±0.18	5.11±0.43	NS
5-13 weeks	4.12^{a}±0.03	3.74^{b}±0.05	3.82^{b}±0.05	3.65^{b}±0.15	*
Mortality rate					
5-13 weeks	0.0	0.0	0.0	0.0	

Means within the same row with different superscripts are significantly different.
Sig =Significance NS = Not significant * (P≤0.05) ** (P≤0.01).

Table (6): Effect of palm tree leaves levels on rabbit carcass traits.

Items	Levels of palm tree leaves				
	0.0%	12.0%	24.0%	36.0%	Sig.
No. of Rabbits	5	5	5	5	
Pre-slaughter weight (g)	2350.2±122	2426.7±97.4	2430.0±72.6	2400.0±149	NS
Dressed weight (g)	١٤٢٠,٥±٨٨.6	1469.3±85.0	1484.0±82.6	1475.2±83.2	NS
Dressing percentage %	60.38±1.51	60.39±1.05	60.93±1.66	61.58±1.13	NS
Carcass weight (g)	1181.7±74.6	1221.7±66.6	1237.5±65.0	1237.5±71.2	NS
%	50.21±1.26	50.23±0.77	50.82±1.27	51.62±0.72	NS
Giblets weight (g)	98.43±6.06	94.5±9.64	97.90±5.95	87.19±4.20	NS
%	4.19±0.18	3.87±0.24	4.02±0.16	3.66±0.23	NS
Liver weight (g)	72.95±5.32	68.80±8.70	71.28±4.63	63.83±3.21	NS
%	3.10±0.15	2.80±0.25	2.93±0.12	2.69±0.20	NS
Heart weight (g)	6.56±0.27	7.78±0.39	6.68±0.19	6.66±0.61	NS
%	0.28±0.01	0.32±0.02	0.28±0.01	0.28±0.02	NS
Kidneys weight (g)	17.08±0.67	15.43±1.00	18.30±1.28	15.11±0.50	NS
%	0.73±0.03	0.63±0.01	0.75±0.04	0.63±0.03	NS
Spleen weight (g)	1.84±0.10	2.50±0.39	1.64±0.26	1.59±0.38	NS
%	0.08±.0.01	0.10±0.01	0.07±0.01	0.07±0.01	NS
Head weight (g)	140.43±10.7	153.13±10.4	148.83±13.7	150.53±10.3	NS
%	5.97±0.31	6.29±0.24	6.09±0.39	6.28±0.26	NS
Blood weight (g)	70.00±5.3	81.68±9.64	87.50±4.79	82.50±8.78	NS
%	2.98±0.14	3.37±0.38	3.62±0.30	3.41±0.17	NS
Skin weight (g)	276.8±11.1	298.48±31.6	292.13±17.9	283.78±16.2	NS
%	11.85±0.55	12.18±0.79	12.02±0.59	11.87±0.53	NS
Total non-carcass fat (g)	24.91±2.96	29.78±10.07	28.04±6.87	19.79±2.79	NS
%	1.07±0.13	1.18±0.35	1.13±0.26	0.84±0.16	NS

Means within the same row with different superscripts are significantly different.
Sig =Significance NS = Not significant * (P≤0.05) ** (P≤0.01).

Table (7): Economic traits of NZW rabbits as affected by dietary levels of palm tree leaves.

Items	Dietary levels of palm tree leaves[#]				Sig.
	0.0%	12.0%	24.0%	36.0%	
Average of feed consumed (kg/rabbit)	5.967±0.74	5.450±1.52	5.510±5.29	5.413±2.29	NS
Price/kg feed (L.E)	1.10	1.03	0.96	0.92	
Total feed cost (L.E)	6.18^{a}±1.23	5.17^{b}±1.14	5.30^{bc}±5.08	4.96^{c}±2.09	**
Average weight gain (kg/rabbit)	1.698^{b}±0.93	1.821^{a}±1.52	1.802^{a}±2.77	1.850^{a}±2.89	**
Price/kg live body weight (L.E)	12.00	12.00	12.00	12.00	
Total return (L.E)	20.38^{b}±1.11	21.85^{a}±1.15	21.63^{a}±3.30	22.20^{a}±3.48	**
Net return (L.E)	14.20^{c}±3.03	16.23^{b}±1.86	16.33^{b}±3.11	17.24^{a}±3.55	**
Economic efficiency (EEf)	230.0^{c}±2.6	288.9^{b}±3.6	308.2^{b}±5.7	348.9^{a}±17.7	**
Relative economic efficiency(REEf)[+]	100.00	125.63	134.42	151.72	
Performance index	41.25^{b}±0.1	48.68^{a}±0.8	47.19^{a}±1.30	50.76^{a}±2.28	**

Means within the same row with different superscripts are significantly different. ** (P≤0.01)
Price / ton of palm tree leaves= 100 L.E
+ Assuming that the Relative Economical Efficiency of control diet equals 100.