EFFECT OF SUBSTITUTING DIFFERENT LEVELS OF SUN DRIED *MORINGA OLIEFERA* LEAVES As A SOURCE OF PROTEIN IN EARLY WEANING RABBITS RATION ON PRODUCTIVE PERFORMANCE AND DIGESTION COEFFICIENTS AND SOME BLOOD CONSTITUENTS

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SUMMARY

A total number of one hundred early weaning New Zealand white rabbits (EWNZWR) were used at 25 days of age with an average of 580.5 g. Rabbits were divided into 4 groups (25 rabbits each). Four substitution levels of sun dried *Moringa oeliefera* leaves (SDMOL) were used (zero%, 25%, 50% and 75%) instead of sunflower meal. Chemical analysis of Sun dried *Moringa oliefera* Leaves was higher in CP, NFE, EE, and ash than sunflower meal. Most nutrients digestibility were improved (P<0.05) with replacing sunflower meal by Sun dried *Moringa oliefera* leaves at level 25, 50 or 75%. Also, using Sun-dried *Moringa oliefera* leaves in early weaning New Zealand white rabbits significantly (P<0.05) increased final body weight and daily body weight gain values. The tested diets have decreased significantly (P<0.05) meat content of DM (25.96, 25.80 and 24.86 vs 26.20), CP (20.74,20.89 and 21.02 vs 20.59) and EE (9.65,9.00,and8.73 vs10.15). Adding SDMOL to rabbit diets (P<0.05) decreased serum cholesterol and total lipids concentrate. Substitution of SDMOL improved the economic efficiency. It could be concluded that replacement up to 75% of sunflower meal in the early weaning New Zealand white rabbit's diet by Sun dried *Moringa oliefera* leaves could be recommended to improve rabbit growth performance parameters, feed efficiency and carcass characteristics, meat content of DM, CP ,EE and decreased serum cholesterol, total lipids concentrates.

Keywords*: sun-dried Moringa oliefera leaves, growth performance, digestion coefficients, carcass characteristics and blood constituents.*

INTRODUCTION

In developing countries such as Egypt, the shortage of feedstuffs and its high cost are major represents the main problems facing the development of animal productivity. Many efforts have been made to solve the feeds shortage by improving the productivity of conventional feed sources and search about new unconventional feeds for animal feeding.

Moringa oleifera was known as "The Miracle Tree", it is excellent source of nutrients for human and animal feeding. Moringa leaves have been reported to be a valuable source of protein, vitamins (A, B-complex, C, D and K) beside some important macro- elements as calcium, potassium. Zinc, iron, copper, and selenium (Singh *et al.*, 2007 and Fatima *et al.*, 2014). The advantages of using moringa for a protein resource are numerous and include the fact that it is a perennial plant that can be harvested several times in one growing season and also has potential to reduce feed cost. *Moringa oleifera* is in the group of high yielding nutritious browse plants with every part having food value (Duke, 1998) Moreover, it was reported that *Moringa oleifera* leaves prevent effectively morphological changes and oxidative damage in animals by

enhancing the activities of antioxidant enzymes, reducing the intensity of lipid peroxidation and inhibiting generation of free radicals (Sumner, 2002). There has been interesting in the utilization of moringa (*Moringa oleifera*) as a protein source for livestock (Sarwatt *et al.*, 2002). Moringa leaves have quality attributes that make it a potential replacement for soyabean in non-ruminant diets of which rabbit is one of them. Sarwatt *et al.* (2002) reported that *Moringa foliages* are potential inexpensive protein source for livestock feeding. Moringa leaves meal represents a potential ingredient for animal feed, due to its high protein content (20-29%) on dry matter basis (Safwat *et al.*, 2014). What's more, it has a decent amount of essential amino acids, fatty acids, vitamins and minerals (Odetola *et al.*, 2012). Hence, it has the efficiency of a replacement for soybean meal in rabbit diets as an untraditional protein source (Caro *et al.*, 2013). Ufele *et al.* (2013) reported that *Moringa oleifera* leaf meal is a potential protein source for rabbits feeding at the level of 20%. Also, (Nuhu, 2010) cited that the performance of the weaning rabbits improved by the inclusion of moringa leaf meal as a non-conventional protein source up to 20% in the diets. Moreover, it has a positive effect to reduce cholesterol level in blood and meat of rabbits. Regarding the supplementation of moringa in feeding of young post-weaning rabbits, Djakalia *et al.* (2011) showed that the addition of moringa at the level of 3% led to an improvement in productive performance and digestibility of protein. Zarkadas *et al.* (1995) showed that proteins of *Moringa oleifera* have high biological values and its all essential amino acids present in moringa are in a concentration greater than the one recommended by FAO/OMS (1991) mentioned in the feed reference that is soybean. Therefore, the main objective of the present investigation is to evaluate the effect of dietary substitution of 25, 50 and 75% of sunflower meal by Sun dried *Moringa oliefera* leaves on growth performance, nutrients digestibility and carcass characteristics of early weaning New Zealand white rabbits.

MATERIALS AND METHODS

Experimental site

The present experiment was carried out at the private farm of Kaluobia governorate, Egypt during November and December (2016). The chemical analysis was conducted at the laboratories of the Faculty of Agriculture and Natural Resources - Aswan University.

The Present study aimed to investigate the possibility of using SDMOL as an untraditional protein source in rabbit rations and their effect on performance, digestibility, carcass characteristics, and blood constitute of growing New Zealand white rabbits.

Preparing the leaf meals and Experimental Diets:

Moringa oleifera fresh leaves were harvested from trees growing at the university farm, under the conditions of Aswan. The new leaves were collected from trees and were separated after that washed and dried under shade for 3 days. The dried leaves were grounded to use in the experimental diets.

Animals:

A total number of one hundred early weaning New Zealand white rabbits (EWNZWR) aged 25 days, weighing about 580.5 g were randomly distributed into four experimental treatments (25 Early Weaning rabbit each treatment). Every twenty-five Early Weaning rabbits were housed in five pens (galvanized wire cages measuring 100 × 70 × 30 cm (LWH)) (5 rabbits per pen). All animals were kept under the same management system and provided with fresh water and pelleted diets. All the experimental diets were formulated to be iso-nitrogenous and iso-caloric and to meet the nutrients requirements of rabbits according to NRC (1977). The chemical analysis of SDMOL and SFM is presented in Table (1).

Four experimental diets were formulated, the first used as control diet (without SDMOL), while the other three diets were containing SDMOL at levels in diet replacing (25, 50, and 75% of sunflower meal as shown in Table (2), and were fed to early weaning new Zealand white rabbits once daily at 8:00 h, animals were fed rations ad libitum, Clean fresh water was available for all rabbits by nipple drinker all time and the experimental period lasted for 56 days. Initial and weekly individual body weights were recorded.

Table (1): Chemical Composition of Sun Dried *Moringa oleifera* Leaves (SDMOL) and Sunflower Meal (SFM) .

Component	SDMOL	SFM
Dry Matter(DM) %	91.00	92.11
Moisture content%	9.00	7.89
Organic Matter(OM)	91.00	92.50
Crude Protein (CP)	28.83	25.57
Ether Extract (EE)	6.00	4.43
Crude Fiber (CF	9.24	23.64
Nitrogen Free Extract (NFE)	46.93	38.47
Ash	9.00	7.50

Table (2): Ingredients and chemical composition of the experimental diets.

Ingredient	experimental diet			
	T0	T25	T50	T75
Alfalfa hay	46.30	46.30	46.30	46.30
Barley	17.00	17.00	17.00	17.00
Wheat bran	24.00	24.00	24.00	24.00
Soybean meal(44%CP)	5.00	5.00	5.00	5.00
Sunflower meal	3.20	2.40	1.60	0.80
SDMOL	0.00	0.80	1.60	2.40
Limestone	1.497	1.497	1.497	1.497
Premix and vitamins	0.003	0.003	0.003	0.003
Salt	1.50	1.50	1.50	1.50
Dicalcium phosphate	1.50	1.50	1.50	1.50
Total	100	100	100	100
Chemical analysis (% as DM basis)				
CP	16.212	16.238	16.264	16.290
CF	16.828	16.712	16.597	16.482
EE	2.405	2.429	2.454	2.479

[1]Premix and vitamins provided per kilogram of the diet Trace mineral (mg/kg of diet:Mn:80 mg,Zn:60 mg,Fe:35mg,Cu:8mg and Se:0.1 mg) .Vit.A:6000 IU, Vit.E:10 IU. Vit. D3:2000 IU ,riboflavin: 2.5 mg, calcium pantothenate:10 mg, vit.B6:4mg ,and choline chloride:300 mg.

***Chemical analysis**:*

Proximate chemical analysis of the diets and feces were carried out according to the methods of AOAC (2002). Samples of meat were taken individually from each slaughtered rabbit and chemical composition of meat was determined according to AOAC (1995).

Digestibility traits:

Digestibility trials were carried out using five rabbits from each experimental group at the last week of the experiment. Rabbits had free access to feed as well as to water.

Five rabbits for each group were housed in metabolism cages where feces and urine were collected separately for 7 consecutive days as the main period (Perez *et al.*, 1995).

***Blood samples and carcass traits* :**

At the end of the experimental period, five rabbits were randomly taken from each group and fasted for 12 hours before slaughter according to Blasco *et al.* (1993). Fasted rabbits were housed in separate cages and kept under the same managerial and hygienic condition.

Blood samples were collected at slaughtering in non-heparinized glass tubes (5 samples per each treatment group. Blood serum was separated by centrifugation at 3000 rpm for 15 minutes. The collected serum was stored at -20 °C until assay. Values of total protein, albumin, total lipids, total cholesterol, and creatinine concentration were estimated by using commercial Kits. The globulin values were obtained by subtracting the values of albumin from the corresponding values of total proteins. Transaminase enzyme activities (AST and ALT) were determined by using kits. After blood samples were taken, the carcass traits

were estimated. Rabbit meat samples were prepared for chemical analysis in duplicate for moisture, protein, fat and ash content.

Statistical analysis:

The data were statistically analyzed as a completely randomized design using SAS (2004). The statistical models used in this study were as follows:

$$Yij = \mu + T_i + E_{ij}$$

where *Yij* is the observed response, μ is the overall mean, *Ti* is the effect of treatment (SDMOL), and E_{ij} is the experimental error. The differences ($P < 0.05$) among different groups were tested by the least significant differences (LSD) procedure of SAS which considered statistically significant.

RESULTS AND DISCUSSION

Proximate analysis of sun dried Moringa oleifera leaves and experimental rations:

The chemical analysis of sun dried *Moringa oleifera* leaves (SDMOL) and Sunflower meal (SFM) are presented in Table (1) show that the sunflower meal(SFM) had lower DM, OM, CP and NFE than SDMOL. These values are within the previously published data by (Singh *et al.*, 2007) and Olugbemi *et al.*, 2010) who found that *Moringa oleifera* leaves is an excellent source of protein (22-36%) and minerals. The chemical analysis values of SDMOL in the present study were in harmony with Makkar and Becker (1996) and El-Desoky *et al.* (2017). In addition, Aye and Adegun (2013) found that percentages of DM of *Moringa oleifera* leaves meal(MOLM) to be 93.63±0.01, ash (7.96±0.03), CP (22.23±0.25), CF (6.77±0.01), EE (6.41±0.01), NFE (40.28+0.25) and gross energy was (14.790 MJ/kg). The CP content of *Moringa oleifera* leaves (MOL) was comparable to those reported by Makkar and Becker (1996) , Sarwatt *et al.* (2002) and Fahey (2005). These results indicate that nutrient composition of MOLM differs according to location and possibly stage of harvesting of moringa leaves.

Feed consumption:

Data in Table (3) showed that the mean feed consumption among the different experimental treatments through the experimental period (56 days) were ($P<0.05$) decreased with increasing levels SDMOL in diets, this observation agreement with Abu Hafsa *et al.* (2016) who reported that the increase in levels SDMOL in diet cause a decrease in feed intake, also, reported that rabbits fed on low protein diet and low Sulphur amino acids raise feed intake.

***Growth performance*:**

Data in Table (3) show that replacing sunflower meal by sun dried *Moringa oleifera* leaves meal in growing New Zealand white rabbit rations up to 75% increased ($P<0.01$) the final body weight, daily weight gain and total weight gain in comparison with the control group (T0). The values were 1874.12 vs. 2708.49 g; 23.10 vs. 38.00 g and 1293.6 vs. 2128 g, for T25, T50, and T75 respectively. However, the differences in the final body weight, daily weight gain, and total weight gain values were not significant between rabbits groups fed T50 and T75 sun dried *Moringa oleifera* leaves meal diets as replacing of sunflower meal.This results in agreement with Ibrahim *et al.* (2014) and Kasolo (2010) found some compounds in moringa that increase growth of growing rabbits**.**

The daily dry matter feed intake (g/d), feed conversion ratio (g feed /g gain) and total feed intake (kg /56 days) values were ($P<0.05$) better with early weaning New Zealand White rabbit fed diets containing 75% of sun dried *Moringa oleifera* leaves than those of the control group and the other levels. The obtained values were 80.00 vs. 99.00,87.00 g and 84.00 ;2.10,3.00, and 2.44 g feed/g gain vs.4.28 and 4.48 ,4.87 and 4.70 g vs 5.54, respectively. Generally adding sun dried *Moringa oleifera* leaves to early weaning New Zealand White rabbit diets in substitution with levels 0, 25, 50 and 75% of sunflower meal improved the growth performance of early weaning New Zealand White rabbits ,this observation agreement with Talha (2013) who noticed that weaned rabbits fed a diet containing 0.3% moringa leaf meal significantly ($P<0.05$) increased daily weight gain. Ufele *et al.* (2013) found that *Moringa oleifera* leaf meal is non-toxic to rabbits at the 20% level of inclusion and finally moringa leaf meal could be used to replace soybean meal completely in rabbits' diets as a non-conventional protein source. Also, Caro (2014) observed that the

inclusion of forage meal of the *Moringa oleifera* in the growing rabbits diets increased final live weight and weight gain.

Table (3): Growth Performance of early weaning New Zealand white rabbits fed different levels of sun dried *Moringa oleifera* leaves

	Sun Dried *Moringa oleifera* Level			
Item	T0%	T25%	T50%	T75%
No. of animals	25	25	25	25
Initial weight (g)	580.52	580.45	580.55	580.49
Final Weight (g)	1874.12^{c}	2204.45^{b}	2504.71^{a}	2708.49^{a}
Total weight gain (g)	1293.6^{c}	1624^{b}	1924.16^{a}	2128^{a}
Daily weight Gain(g)	23.10^{c}	29.00^{b}	34.36^{a}	38.30^{a}
Daily Dry Matter Feed intake(g/d)	99^{a}	87^{b}	84^{b}	80^{c}
Feed conversion ratio (g feed/g gain)	4.28^{a}	3.0^{b}	2.44^{b}	2.088^{c}
Total feed intake (kg) (56days)	5.544^{a}	4.872^{b}	4.704^{b}	4.480^{c}
Total feed cost (56d)(L.E)/Total gain	22.176	20.891	21.525	21.790
Feed Cost/ kg gain (L.E)	17.142	12.864	11.186	10.239

a,b,c and d: Means in the same row followed by different superscripts are significantly different at (P<0.05) ;SEM= standard error of means.

Nutrients digestion coefficients:

Data of digestion coefficients are presented in Table (4) showed that the substitution SFM by different levels of SDMOL increased (P<0.05) values of DM, CP, CF and EE digestibility in comparison with the control treatment. The highest value for all nutrient digestibility was recorded for the treatment received 75% followed by the treatment received 50% ,then 25% SDMOL, while the lowest value (P<0.05) was recorded for the control treatment. On the other hand, concerning SDMOL, Makkar and Becker (1999) found that up to 75% SDMOL in rabbit ration did not affect digestibility of NFE % and EE%, while CP %, OM % digestibility were higher with 50%SDMOL than those supplemented with T0 and T25. These results are supported by those reported by El-Badawi *et al.* (2014) who found that feeding rabbits on diets supplemented with moringa dried leaves up to 0.3% was associated with significant (P<0.05) increases of nutrients digestibility and dietary nitrogen utilization. Also, these results are in agreement with those results reported by De-Blas *et al.* (1986) and Dougnon *et al.* (2012). All of their studies indicated that the increase in the level of SDMOL in rabbit diet resulted in an increase in nutrients digestion coefficients.

Table (4): Nutrients digestive coefficients for early weaning rabbits fed different levels of sun dried *Moringa oleifera* leaves .

Parameter	Sun Dried *Moringa oleifera* Level			
	T0%	T25%	T50%	T75%
Dry matter(D M)%	65.22^{c}	65.62^{c}	69.76^{b}	70.50^{a}
Crude protein (CP)%	66.10^{d}	72.97^{c}	75.77^{b}	79.43^{a}
Crude Fiber (CF) %	53.66^{c}	54.00^{b}	54.65^{b}	55.32^{a}
Ether Extract (EE)%	69.21^{c}	69.99^{c}	71.85^{b}	73.62^{a}

a,b,c and d: Means in the same row followed by different superscripts are significantly different at (P<0.05) .

Carcass Traits:

Data concerning carcass traits are presented in Table (5) significant effects (P<0.05) showed that the slaughtered animals which had been fed onT75 diet were higher in hot weight compared with control. Data show that carcass weight (P<0.05) increased with replacing 25, 50 and 75% sunfower meal by sun dried *Moringa oleifera* leaves compared to the control group. The values of dressing % were also (P<0.05) increased with substitution level 75%in comparison with the control group. Due to the increase in live weight by increasing moringa levels, the weight of slaughter increased due to the increase in the percentage

of dressing. This results in agreement with El Tazi (2012) who found that inclusion of moringa leaf meal in broiler diets at 5 and 7% significantly (P<0.05) improved hot carcass weight, dressing percentage, breast and drumstick percentages, tenderness and juiciness scores for both breast and thigh meat.

Chemical composition of rabbit meat:

Data illustrated in Table (6) shows meat composition; moisture, CP and EE contents were affected significantly by substitution of *Moringa oleifera* leaves at different levels in the rabbit's diet. Lower lipid content was recorded for rabbits fed 75% SDMOL from protein sources compared with fed 0% SDMOL. Meat composition as CP and moisture were (P<0.05) increased by 2.09% and 1.79% respectively, while EE was (P<0.01) decreased by 13.99% as the level of SDMOL increased from 0% to 75% of protein source in the early weaning New Zealand white rabbit diets. Improvements in carcass weight and dressing percentage may be due to improvements in body weight and daily gain. These results were agreement with Safwat *et al.* (2014) who observed an improvement in dressing percentage when rabbits fed diets contained 15 % moringa leaves meal (MLM). Regarding to the chemical composition of meat, the increasing in CP content may be due to high biological value of MLM protein. Also, these results were agreement with Nuhu (2010) who found a reduction in ether extract of meat of growing rabbits fed a diet containing 50 % of moringa leave meal when compared to those fed the control diet. Additionally, the decreasing of EE in meat may be due to high bioactive substances in SDMOL which reduce fat deposition in body and increase fat metabolism rate.

Table (5): Carcass measurements and meat composition of early weaning Rabbits fed sun dried *Moringa oleifera* leaves meal.

Item	Sun Dried *Moringa oleifera* Level			
	T0%	T25%	T50%	T75%
No .of animals	5	5	5	5
Live Weight(g)	1874.12^{c}	2204.45^{b}	2504.71^{a}	2708.49^{a}
Slaughter Weight (g)	1801.22	2130.07	2420.42	2617.00
Slaughter weight after bleeding (g)	1731.22^{b}	2050.07^{ab}	2338.92^{ab}	2534^{a}
Empty body weight (g)	1627.12	1964.45	2270.71	2489.49
Hot Carcass Weight +head (g)	1011.22^{b}	1240.50^{ab}	11453.20^{ab}	1640.40^{a}
Dressing %	62.147^{b}	63.147^{ab}	63.997^{ab}	65.893^{a}
Liver weight (g)	40	42	42	44
Kidney Weight(g)	18	18	17.6	17.8
Heart Weight(g)	6	7	8.5	8
Meat Composition %				
Moisture %	73.8^{b}	74.04^{ab}	74.20^{ab}	75.12^{a}
DM %	26.2^{a}	25.96^{ab}	25.8^{ab}	24.88^{b}
Crude Protein %	20.59^{b}	20.74^{b}	20.89^{b}	21.02^{a}
Ether Extract %	10.15^{a}	9.65^{a}	9.00^{b}	8.73^{b}

a,b,c and d: Means in the same row followed by different superscripts are significantly different at (P<0.05) .

Table (6): Effect of different levels of sun dried *Moringa oleifera* leaves on blood parameters for early weaning New Zealand white rabbits.

Parameter	Sun Dried *Moringa oleifera* Level			
	T0%	T25%	T50%	T75%
Total Protein (g/dl)	6.30^{b}	7.22^{ab}	7.36^{ab}	7.70^{a}
Albumin(g/dl)	3.50^{b}	3.69^{b}	3.80^{a}	4.01^{a}
Globulin(g/dl)	2.80^{b}	3.53^{ab}	3.56^{ab}	3.69^{a}
Creatinine (mg/dl)	1.10	0.91	0.81	0.89
Total cholesterol(mg/dl)	125.5^{a}	101.14^{ab}	99.62^{ab}	95.15^{b}
Total Lipids(mg/dl)	270.1^{a}	211.33^{ab}	200.34^{b}	199.51^{b}
ALT(IU/I)	24.41	24.13	24.00	24.10
AST(IU/I)	20.11	20.02	19.85	19.80

a,b,c and d: Means in the same row followed by different superscripts are significantly different at (P<0.05) .

Biochemical parameters of blood serum:

Results in Table (6) showed significant effect on serum total protein, albumin, globulin, and cholesterol concentration. Blood cholesterol was affected by the different experimental diets, however, rabbits fed diets with different levels of SDMOL recorded significantly (P<0.01) lower serum cholesterol levels as compared to those fed diet control. Serum cholesterol and total lipids were decreased by 24.18 and 26.13% as the level of SDMOL increased from 0% to 75%SDMOL, respectively. This results in agreement with El-rayes *et al.* (2012) and Osman *et al.* (2012**)** they found that cholesterol was decreased for rabbits fed sun dried *Moringa oleifera* leaves (SDMOL) diets. The decreasing in concentration of serum cholesterol may be due to bioactive substances in SDMOL that able to decomposition of these compounds, these results were cited by (Nuhu, 2010).

With respect to lipids, there was a significant effect due to diet composition where rabbits fed diets supplemented with different levels of SDMOL recorded the lowest lipids as compared to those fed control diet, these results in agree with Mehta *et al.* (2003). The serum enzymes activities assessed (ALT and AST) and creatinine concentration of rabbits fed moringa were within the normal range reported by CCAC (1980). This results agrees with Ewuola *et al.* (2012) and Ghasi *et al.* (2000) they reported that crude extract from moringa leaves was found to be a potent hypocholesterolemia agent.

Economic efficiency:

Input and output analysis was carried out to determine the economic efficiency of the dietary treatments (Table 7). The cost of the experimental diets was determined assuming that the prices were as follows:For rabbit ration 4000 L.E/ton, for *Moringa olifera* 40 L.E/kg.

Table (7): Economic efficiency as affected by substitution of different levels of sunflower meal by *Moring oleifera* leaves in diets of early weaning rabbits.

Item	Sun Dried *Moringa oleifera* Level			
	0%	25%	50%	75%
Price of diet/ L.E kg	4.00	4.288	4.576	4.864
Total feed intake (g)	5544	4872	4704	4480
Total weight gain(g)	1293.6[c]	1624[b]	1924.16[a]	2128[a]
Total feed cost(L.E)	22.176	20.891	21.525	21.790
Price of kg live weight	25	25	25	25
Total Revenue(L.E)[1]	32.34	40.6	48.104	53.200
Net revenue (L.E)[2]	10.16	19.709	26.579	31.41
Economic efficiency[3]	45.81	94.342	123.479	144.148
Relative economic efficiency(%)[4]	100	205.937	269.545	342.465

a,b,c and d: Means in the same row followed by different superscripts are significantly different at (P<0.05) Where:
*[1]Total Revenue=total weight gain *Price of kg live weight.*
[2]Net revenue = Total revenue – Total feed cost.
*[3]Economic efficiency = Net revenue/total feed cost *100.*
[4]Relative economic efficiency (%) assuming the control treatments equal 100%.

The results showed that the economic efficiency values of all treatments under study were better than that of T0 although experimental rations have higher price by28.8, 57.5 and 86.4 piaster for T25, T50 and T75, respectively because the prices of used materials (i.e. sunflower meal) was lower than SDMOL, therefore increasing level of SDMOL in the diets followed by increase in its cost. Data presented in Table (7) revealed that economic efficiency was higher with using SDMOL at all levels, and T75 recorded the best relative economic efficiency followed by T50 followed by T25 when compared with the control T0, this results in agreement with Owen *et al.* (2013). These results may be due to increasing the weight gain for rabbits fed different levels of SDMOL when compared with control diet. Substitution of SDMOL improves animal performance as reported by several researchers (Aziagba (2013), Caro (2014) and Safwat *et a.l* (2014)

Data presented in Table (7) indicate that replacing sun dried *Moringa oleifera* leaves instead of sunflower meal at different levels of 25, 50 and 75%, in early weaning New Zealand white rabbit diets increased the net revenue and consequently improved the economic efficiency compared to control group, Results showed that the net revenue values were 10.16,19.709,26.579 and 31.41 L.E, respectively. The

obtained values economic efficiency were 45.81, 94.342, 123.479 and 144.148, as the level of SDMOL increased from 0% to 75%SDMOL as percent of sunflower meal, respectively. The relative economic efficiency was improved by 314.734, 269.545, and 205.937% rabbit fed diet T75, T50 andT25 respectively compared control T0.

CONCLUSION

SDMOL can be used as a source of protein to replace sunflower meal in early weaning New Zealand white rabbits without any adverse effect on the rabbit's performance and carcass characteristics. It can be useful in reducing rabbit feed cost by increasing total gain and improve meat rabbits quality by reducing fat cotent.

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تـأثيرأحلال نسب مختلفة من أوراق المورينجا أوليفيرا المجففة شمسياً كمصدر للبروتن في علائق الارانب المفطومة مبكراً علي أدائها الانتاجي ومعاملات الهضم وبعض مقاييس الدم

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أستخدم في هذة الدراسة عدد100 أرنب نيوزيلاندي ابيض حديث الفطام عندعمر 25 يوم، بمتوسط وزن 580.5 جم ، قسمت عشوائيا إلي اربعة مجموعات متساوية (25 أرنب في كل معاملة) لدراسة تاثير إحلال أوراق المورينجا أوليفيرا المجففة شمسيا محل كسب عباد الشمس بنسب مختلفة علي معدلات النمو ومعاملات الهضم وبعض مقاييس الدم وصفات الذبيحة ، وغذيت الحيوانات علي عليقة أساسية (كنترول) بينما المعاملة الثانية والثالثة والرابعة غذيت علي العليقة الاساسية مضافاً اليها اوراق المورينجا أوليفيرا المجففة شمسيا بنسبة 25 %،50%،75% من مصدر بروتين العليقة المقارنة (كسب عباد الشمس) علي التوالي .

- أظهرت نتائج الدراسة زيادة الوزن النهائي ومعدل النمومعنوياً (عند مستوي معنوية 5%) مقارنة بالعليقة الكنترول.

- كما أدت زيادة نسبة الاحلال في العليقة الي زيادة معدل التحويل الغذائي والعائدي الاقتصادي .

- أدت أيضاً زيادة نسبة احلال أوراق المورينجا أوليفيرا المجففة شمسيا الي العليقة الكنترول الي زيادة معدلات الهضم لكل العناصر الغذائية .

- بزيادة نسبة احلال أوراق المورينجا المجففة شمسياً أدت الي ارتفاع معنوي في محتوي سيرم الدم من البروتين الكلي والالبيومين وانخفاض معنوي في محتوي سيرم الدم من الكوليسترول والليبيدات الكلية بينما لم تتأثر أنزيمات الكبد بزيادة نسبة احلال أوراق المورينجا أوليفيرا المجففة شمسياً.

- بزيادة نسبة احلال اوراق المورينجا اوليفيرا المجففة شمسياً أدت الي زيادة وزن الذبيحة وكذلك زيادة نسبة التصافي.

- يمكن التوصية باحلال أوراق المورينجا المجففة شمسياً محل مصدر البروتين بعلائق الارانب حديثة الفطام بنسبة 75% حيث يؤدي الي زيادة معدلات النمو وانخفاض نسبة الكوليسترول في الد م وتقليل نسبة دهون لحومها .