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PARTIAL REPLACEMENT OF CLOVER HAY BY DISCARDED PALM FRONDS ON PERFORMANCE OF GROWING RABBITS.

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The objective of this study was to investigate the influence of using discarded palm fronds (DPF) and biologically treated discarded palm fronds (Bio-DPF) with effective microorganisms (EM_1) to replace 25 and 50 % of clover hay in growing New Zealand rabbit diets on growing rabbit performance. A total number of 60 unsexed, weaned of 6 weeks old rabbits were randomly divided into five experimental treatments (12 / treatments). Five pelleted diets were as follows: 1: A control without discarded palm fronds 2, 3 ,4 and 5: 25 or 50 of clover hay was replaced with DPF and Bio-DPF. The growth trail lasted 8 weeks. Results indicate that biological treatments improved chemical composition of discarded palm fronds, mainly CP content was markedly increased and CF was decreased. Final live body weight and total weight gain were significantly decreased with 50% DPF diet. Feeding on Bio-DPF diets improved final body weight and weight gain but not significantly affected by dietary treatments. Total feed intake did not significantly affected by dietary treatments. Total feed conversion was significantly improved with feeding on 25% Bio-DPF diet compared to other treatments. Also, 25% Bio-DPF group significantly had the highest relative growth rate compared to other treatments without holding significant difference with 50% Bio-DPF groups. Again, 25% Bio-DPF group showed ($P<0.05$) the highest performance index compared to other treatments which did not differ significantly. Digestibilities of CP and CF were significantly the best upon feeding rabbits on Bio-DPF diets followed by the control and 25% DPF which did not differ significantly compared to the 50% DPF group. Nutritive values in terms of DCP and TDN were significantly improved compared to the control. Also DE (Kcal / kg diet) significantly improved with 25% Bio-DPF diet compared to the control group. Dressing% was significantly improved with feeding on Bio-DPF diets and the least value was with feeding on 50% DPF diet. Blood total cholesterol and lipids were significantly affected by

dietary treatments in which the highest values were obtained with 25% DPF diet. Favorable TVFA was increased and unfavorable ammonia was decreased significantly with feeding Bio-DPF diets compared with the other treatments. Net monetary return was increased with feeding the rabbits on Bio-DPF diets.

***Conclusively,** it could be recommended to incorporate the Bio-DPF in growing rabbit diets up to 50% instead of clover hay without any adverse effects on growth performance of rabbits.*

Keywords: *Discarded palm fronds, biologically treatment, rabbits performance, digestibility and blood constituents.*

Fiber plays an important role in rabbit nutrition. It is one of the main components of rabbit diets, which usually contain 35 to 40% neutral detergent fiber **(**De Blas and Mateas, 1998). Berseem hay is the most common source of fiber used in feeds in Egypt. Dietary fiber helps to maintain a high passage rate, avoiding the accumulation of digesta in the caecum that reduce feed intake and impairs growth (De Blas *et al.*, 1999). Dietary fiber is a substrate for caecal microorganisms, it's fermentation produce mainly VFA's which may reduce the incidence of digestive disorders and mortality (Garcia *et al.,* 2000).

The degradation of organic matter in the digestive tract in rabbit involves number of hydrolytic reaction, which is catalyzed by enzymes of endogenous and microbial origin. Date fruit production yields several crop residues, including date palm leaves (fronds), leaf petioles, racemes (without the dates) and pedicels. These by-products are usually distributed to animals during winter, though they can also be used year round (Genin *et al.*, 2004). A date palm tree can produce 13.5-20 kg of dry fronds annually. Given that 1.15 million ha were planted with palm trees in Egypt (FAO, 2011) and assuming an average density of 100-125 trees/ha, it is estimated that 1.9-2.4 million tons of dry fronds are available each year (Genin *et al*., 2004). Although palm leaf is available in large amounts and has a great potential to be used as green feed livestock but its utilization as feed is still very limited because palm leaf is of low biological quality. El- Tahan *et al*., (2013) found that grinded palm fronds contain 3.25% CP, 42.14% CF, 0.77% EE, 69.35% NDF, 42.92% ADF and 10.61% ADL .

The high content of lignin cause low digestibility and palatability (Widjaja and Utomo, 2001). Therefore, methods like as physical, chemical, physicochemical and biological treatments are essential for improving digestibility of these agricultural wastes, it is important to breakdown the

linkages among cellulose, hemicellulose and lignin. Recently, the production of microbial protein from agricultural crop wastes received the attention of several works **(**El-Ashry *et al.,* 2003).

Several works using biological treatments to improve nutritive value of by products by using EM_1 (EMRO Organization in Japan (EM_1 Research Organization, Inc., Takamiyagi Bldg. 2F, 2-9-2 Gameko, Ginowan-shi Okinawa, Japan) EM_1 is a combination of 70 to 80 different types of "good" and beneficial microorganisms contributing to the wide range of applications. The principal organisms of are usually five; photosynthetic bacteria (phototrophic bacteria), lactic acid bacteria, yeasts, actinomycets and fermenting fungi (Higa, 1993). Lactic acid bacteria produce lactic acid from sugars, and other carbohydrates produced by photosynthetic bacteria and yeast (Higa and parr, 1994). EM was successfully used in poultry units as feed constituent (Konoplya and Higa, 2000) to increase productivity in integrated animal units and poultry farms (Hanekon *et al*.,1999). EM may offer potential benefits to the poultry industry, such as improvements in body weight gain and feed conversion ratio (Wondmeneh *et al*., 2011). Abd-El Ghany *et al*., (2016**)** reported that replacing 15% and 30% of berseem hay by biological treated conocarpus with EM_1 in growing rabbit's diet resulted in better performance and decreased the anti-nutrition factors without any adverse effect on the rabbits. El- Faham *et al*., (2013) found that chicks achieved higher body weight when fed on mid rib of date palm as replacement of wheat bran at levels 7.5 and 15% during finishing period supplemented with enzyme mixture [200g ⁄ ton Allzyme which contain (Phytase, Beta-glucanase, Cellulase, Pectinase, Protease and Xylanase) and 0.5Kg⁄ton Zado] compared with un-supplemented diet.

Therefore, the objective of the present study was to investigate the effect of two replacement levels of clover hay by treated biologically (EM_1*)* discarded palm fronds on rabbits growth performance, digestibility, some blood parameters and economic profit.

MATERIALS AND METHODS

Growth trail was carried out at Sakha, Experimental Station, Animal Production Research Institute. The biological treatment, samples, discarded palm fronds, feces, caecal microbial activity were conducted at the laboratories of By-Products Research Department, Animal Production Research Institute, Giza, Egypt. Discarded palm fronds were obtained from Luxor Governorate, Egypt. The EM_1 is a product of EMRO Organization in Japan (EM_1

Research Organization, Inc., Takamiyagi Bldg. 2F, 2-9-2 Gameko, Ginowan-shi Okinawa, Japan).

Preparation of palm fronds

Palm fronds from each crop residue were sun dried until complete drying and finely five ground to pass through 0.1 mm screen was soaked in tab water until moisture content reached to 60-70% followed by soaking in boiled water for 2 hours according to Balasubramanya and Kathe (1996) to decrease contamination.

Biological treatment

100 kg of Palm fronds were cooled to room temperature and until moisture reached 65 -70% then 5% EM_1 and 5% El-mofeed was dissolved in 90 L of water and mixed with to Palm fronds under air condition and package into polyethylene bags and left for three weeks (Shahin *et al*., 2012).

Diets and treatments

Sixty weaned New Zealand White (NZW) rabbits, six weeks old with an average live body weight 622.8±4.75*g* were allotted randomly to receive five treatments with randomly to five groups (twelve rabbits /treatment in 3 replicates). Five pelleted experimental diets were formulated using linear programming, to be approximately iso-nitrogenous to cover the requirement of growing rabbits according to (Agriculture Ministry Decree, 1996). Feed and water were offered *ad libitum.* Five experimental diets were formulated; including the control diet without discarded palm fronds while the other four diets were represented 25 or 50 discarded palm fronds (DPF) and biologically treated discarded palm fronds (Bio-DPF) replacement of clover hay (7.50 or 15.00% in basal diet) as shown in Table 1. The chemical analyses of discarded palm fronds and clover hay presented in Table 2. The digestible energy (DE kcal /kg) of discarded palm fronds and clover hay were calculated according to the equation of Cheek (1987). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and detergent lignin (ADL) were determined by method of Van Socest (1991).

Growth performance traits

Feed intake and live weight were recorded weekly, while feed conversion was calculated as gram of feed per gram of gain, relative growth rate was calculated according to the following equation:

$$\text{Relative growth rate} = [(W_2 - W_1) \times 100] / [1/2 (W_2 + W_1)],$$

Where: W_1= Initial body weight (g), and W_2 = Final body weight (g).

Performance index (PI)= (Final live body weight (kg)/ Feed conversion ratio) × 100, according to North (1981).

Table 1. Ingredients and chemical composition of experimental diets**.**

Ingredients	Control	DPF		Bio-DPF	
		25%	50%	25%	50%
Clover hay (12%)	30.00	22.50	15.00	22.50	15.00
DPF	----------	7.50	15.00	-------	--------
Bio-DPF	---------	---------	----------	7.50	15.00
Barley	18.50	18.20	18.10	18.20	18.10
Wheat bran	10.46	10.25	10.00	10.25	10.00
Yellow corn	15.00	14.00	12.41	14.00	12.41
Soybean meal (44% CP)	20.00	21.10	22.64	21.20	22.64
Vit.&Min.*	0.25	0.25	0.25	0.25	0.25
Di calcium phosphate	1.40	1.40	1.80	1.40	1.80
Sodium Chloride (NaCl)	0.30	0.30	0.30	0.30	0.30
Limestone	0.70	1.00	1.10	1.10	1.10
DL-Methionine	0.34	0.35	0.35	0.35	0.35
Anticoccidia(Diclazuril)	0.05	0.05	0.05	0.05	0.05
Molasses	3.00	3.00	3.00	3.00	3.00
Total	**100**	**100**	**100**	**100**	**100**
Calculated analysis % **					
OM%	90.76	89.94	89.66	88.80	88.47
CP%	17.52	17.28	17.12	17.42	17.39
CF%	12.88	13.67	14.47	13.38	13.89
EE%	2.28	2.15	2.01	2.18	2.06
NFE%	58.08	56.84	56.06	55.82	55.13
Ash%	9.24	10.06	10.34	11.20	11.53
DE(kcal/kg)	2587	2569	2544	2578	2562
Calcium	1.10	1.11	1.10	1.11	1.19
Total phosphorus	0.65	0.63	0.69	0.63	0.70
Methonine +cycetine	0.60	0.60	0.60	0.60	0.60
Lysine	0.92	0.92	0.93	0.93	0.95

DPF**:** discarded palm fronds , Bio-DPF: Biologically treated discarded palm fronds.

* Each 1kg contains:- Vit. A, 6000IU; Vit. D_3, 900 IU; Vit. E, 40mg; Vit. B_1, 2mg; Vit. B_2, 4mg; Vit. B_6, 2mg; Vit. B_{12}, 10mg; Niacin, 50mg ; Pantothenic acid, 10mg; Biotin, 50mg; Folic acid, 3mg ; Choline, 250 mg ; Zn, 50mg; Mn, 85mg; Fe, 50 mg; Cu, 5mg; I, 0.2 mg; Se, 0.1mg and Co, 0.1mg.

*******according to Feed composition for animal and poultry feed stuff used in Egypt (2001).*

The experimental period lasted for 8 weeks. At the end of the experimental period, a digestibility trial was conducted to determine the digestibility coefficient of the nutrients according to (Fekete, 1985).

Digestibility trial

A total number of 20 bucks (4 adult males in each group) was used in carrying the digestibility trial for determining nutrient digestibility of the tested diets. The rabbits were housed in metabolic cages where feces were

collected separately for 6 days as a collection period during which the feces were collected daily sprayed with 2% boric acid solution for trapping any ammonia released from feces. At the end of this period, the feces were dried at 60^{o} C for 48 hours (till constant weight), finely ground and thoroughly mixed to ensure sample uniformity and then stored until being analyses. Proximate analysis of the diets and feces were carried out according to the methods of AOAC (2000).

Carcass traits

At the end of the experimental period (14 weeks of age), four rabbits were randomly taken from each group and fasted for 12 hours before slaughtering to determined carcass characteristics according to Steven *et al*., (1981).

Caecum activities

Samples of caecum contents from the same slaughtered rabbits under 4 per treatment each treatment groups were taken and used immediately for the estimation of caecum pH, total volatile fatty acids according to Eadie *et al*., (1967) and ammonia was determined by applying Conway method (1958).

Blood parameters

Four blood plasma samples were taken after slaughter and collected in 5 ml. heparinized test tubes and centrifuged at 3000 r.p.m for 20 minutes then plasma were transferred and stored in deep freezer at approximately -20ºC till the time to determine blood parameters as total protein (Gornal *et al*.,, 1949), albumin (Doumas and Waston, 1971), transaminase (AST, aspartate aminotransferase and ALT, alanine aminotransferase, Reitman and Frankel (1975), total lipids (Zollner and Kirsch, 1962), cholesterol (Richmond, 1973), creatinine (Schirmeister, 1964) and urea (Fawcett and Scott, 1960).

Economic efficiency

The economic efficiency (EEF) was calculated according to the following equation: EEF = Net revenue / total costs Where the total cost calculated by Egyptian pound (L.E.) in the local market at the time of experiment.

Statistical analysis:

All data were subjected to analysis of variance using the General Linear Models (GLM) Procedure of SAS (2004) as the following model:

$$Yij = \mu + Ti + eij,$$

Where: μ= Overall mean of Yij, T = Effect of treatment, i = (1, 2…, etc) and eij= Experimental error.

The Significant differences between treatment means were separated using Duncan's multiple range test (1955).

RESULTS AND DISCCUSION

Chemical composition of DPF and Bio-DPF compared to clover hay.

Proximate chemical analyses of DPF and Bio-DPF compared to clover hay are shown in Table 2. The results showed that untreated or treated discarded palm fronds, in comparison to the clover hay could be recommended as a good alternate, where it contained close DE content (1648.8, 1768.01 *vs.* 1972.2 Kcal/kg) , lower crude protein (3.68, 5.47 *vs.* 12.00%), but higher crude fiber (40.21, 36.34 *vs.* 31.00) and NFE content (49.38, 49.96 *vs.* 44.84%), NDF (65.21, 59.23 *vs.* 55.11%), ADF (41.30, 31.54 *vs.* 42.00%), ADL (8.54, 8.03 *vs.* 18.43%). Hemi cellulose (23.91, 27.69 *vs.* 13.11%), cellulose (32.76, 23.51 *vs.* 23.57). Nitrogen free extract has markedly decreased while, ash content was increased pronouncedly. The chemical composition of untreated discarded palm fronds has similar trend that reported by El- Tahan *et al*., (2013) who found that grinded palm fronds contain 3.25% CP, 42.14% CF, 0.77% EE, 69.35% NDF, 42.92% ADF and 10.61% ADL Also Ibrahim *et al*., (2013) found that mid ribe of date palm contained 2.69% CP, 34.95% CF, 2.98% EE, 41.70% NFE, 4.31% ADL, 43.47% ADF and 57.82% NDF. El-Bordeny and Abdel-Azeem (2007) found that palm tree leaves contained 7.02% CP, 0.96% EE, 28,21% CF, 54.02% NFE and 9.80% Ash.

Biological treatment had positive effects on improving the nutritive value of discarded palm fronds since the protein content was increased. This result is confirmed by Villas-Boas *et al.,* (2002) who reported that biological treatment is used for increasing the nutritional value of many by-products because they have significant concentrations of simple carbohydrates such as mono and disaccharides. While, crude fiber content was reduced because microorganisms depend on this material as carbon source for growth and formation of the microbial protein. Increasing ash content may be attributed to the growth or degradation of organic matter of palm fronds grinded by microorganism. Reduction in NFE could be related to the consumption of carbohydrates by the microorganism as energy sources for their growth and multiplication. These results are in a good agreement with those reported by El-Tahan *et al.*, (2013) found that treated grinded palm fronds with *plureuerotus Ostreatus* increased CP content from 3.25 to 5.85% and decreased CF content from 42.14 to 37.64 and decreased fiber fractions and

Table 2. Chemical analysis of (DPF) or (Bio-DPF) compared to clover hay (on DM basis).

Items	DPF	Bio-DPF,	Clover hay
DM%	89.03	89.74	83.62
Chemical analysis% (on DM basis)			
OM%	94.13	92.97	88.94
CP%	3.68	5.47	12.00
CF%	40.21	36.34	30.00
EE%	0.85	1.20	2.10
NFE%	49.39	49.96	44.84
Ash%	5.87	7.03	11.06
DE(kcal/kg)*	1648.8	1768.01	1972.2
Cell wall constituents:			
NDF	65.21	59.23	55.11
ADF	41.30	31.54	42.00
ADL	8.54	8.03	18.43
Hemicellulose	23.91	27.69	13.11
Cellulose	32.76	23.51	23.57

DPF**:** discarded palm fronds , Bio-DPF: Biologically treated discarded palm fronds.
* DE (kcal/g) = 4.36 -0.0491x NDF, Where NDF% = 28.924+0.657x CF% (according to Cheeke, 1987).
NDF: Neutral detergent fiber, ADF: Acid detergent fiber, ADL: Acid detergent Lignin
Hemi cellulose: NDF-ADF; Cellulose: ADF-ADL..

NFE content. Also, Abdel-Aziz *et al.*, (2014) found that biological treatments are paralleled with decreased crude fiber and fiber fractions content with increased crude protein content.

Growth performance traits

Results presented in Table 3 showed the effect of DPF and Bio-DPF on growth performance traits of growing rabbits. It showed final body weight was significantly (P<0.01) higher with rabbits fed on Bio-DPF diets as compared to rabbits fed on 50% DPF diets. On the other hand feeding on Bio-DPF diets improved final body weight and weight gain but not significantly affected by dietary treatments compared with control and 25% DPF diets. Despite, final live body weight and total weight gain were significantly decreased with 50% DPF diets. Daily weight gain was significantly (P<0.01) higher with rabbits fed on Bio-DPF during 6-10 weeks of age period compared to 50% DPF also, during the whole growing period with rabbits fed on Bio-DPF diets as compared to rabbits fed diets

Table 3. Growth performance of growing rabbits fed on experimental diets during 6 to 14 weeks of age.

Items	Control	DPF		Bio-DPF		SEM	Sig.
		25%	50%	25%	50%		
Initial body weight(g)	615	629	623	620	627	4.75	NS
Final body weight (g)	1715^{ab}	1756^{ab}	1666^{b}	1953^{a}	1888^{a}	24.49	**
Daily weight gain (g)							
6-10 weeks of age	17.47^{ab}	17.62^{ab}	15.36^{b}	20.17^{a}	19.58^{a}	0.61	**
10-14 weeks of age	18.77	19.66	17.65	22.17	21.37	1.03	NS
6-14 weeks of age	19.64^{ab}	21.12^{ab}	18.62^{b}	23.80^{a}	22.51^{a}	0.60	**
Daily feed intake(g)							
6-10 weeks of age	60.49	64.46	56.62	62.00	69.21	2.55	NS
10-14 weeks of age	81.34	84.77	78.90	84.54	90.63	1.85	NS
6-14 weeks of age	77.04	82.04	73.71	80.89	85.85	1.90	NS
Feed conversion ratio							
6-10 weeks of age	3.46	3.65	3.68	3.07	3.53	0.09	NS
10-14 weeks of age	4.33	4.31	4.47	3.81	4.24	0.12	NS
6-14 weeks of age	3.92^{a}	3.88^{a}	3.95^{a}	3.39^{b}	3.81^{a}	0.05	*
Relative growth rate (%)	94.42^{b}	95.71^{b}	91.13^{b}	103.61^{a}	100.27^{ab}	1.50	**
Performance index (%)	43.75^{b}	45.25^{ab}	42.17^{b}	57.61^{a}	49.55^{ab}	2.02	**

DPF**:** Discarded palm fronds , Bio-DPF: Biologically treated discarded palm fronds.
a and b .. Means in the same row with different superscripts are significantly different (P <0.05)
** *P*<0.01 , NS: Not significant.

containing 50% DPF. While, during 10-14 week of age period, there was no significant effect on weight gains. The improvement in daily live weight gain was accounted to be 21.76 and 17.28% with rabbits fed on Bio-DPF diets respectively, when compared rabbits fed on 50% DPF diets. Total Feed conversion ratio was significantly (P<0.05) improved with rabbits fed on 25% Bio-DPF diets compared to other treatment during the whole growing feed conversion ratio. While, during 6-10 and 10-14 week of age period, there was no significant effect among treatment groups on feed conversion ratio. Although, feed intake did not significantly affected by dietary treatments all the growth period.

Performance index and relative growth rate (%) increased significantly (P<0.0.01) in rabbits fed on Bio-DPF diets compared to fed on DPF diets. Group fed on 25% Bio-DPF diets significantly had the highest relative growth

rate compared to other treatments without holding significant difference with 50% Bio-DPF groups. Again 25% Bio-DPF group showed ($P<0.05$) the highest performance index compared to other treatments which did not differ significantly. This may be due to the improvement of digestibility and caecal fermentation of 50% Bio-DPF. In this connection, El-Bordeny and Abdel-Azeem (2007) reported that using of palm tree leaves as a replacer of 33.33, 66.66 or 100% of clover hay in growing rabbit diets increased significantly live body weight and daily weight gain through the whole experimental period. Also, they reported that feed conversion ratio was improved with feeding palm tree leaves as a replacer of 33.33, 66.66 or 100% of clover hay in the rabbit diets compared to control diet. However, they found that insignificant differences were observed in feed consumption between the different experimental groups through all the experimental periods. El- Faham *et al*., (2013) found that chicks had achieved higher body weight when fed on Mid rib of date palm as replacement of wheat bran at levels 7.5 and 15% during finishing period supplemented with enzyme mixture (200g ⁄ ton Allzyme and 0.5Kg ⁄ ton Zado) compared with un-supplemented diet. Also, Ibrahim *et al*., (2013) found that replacing of wheat bran by midrib date palm at 7.5 or 10% levels had slightly increased but non significance both body weight and body weight gain compared to the other treatments (2.5 or 5%).On the other hand, El-Faham *et al*., (2005) found that body weight and body weight gain in broilers were not affected by replacing wheat bran by date palm waste (midrib and pinne of date palm) in different growth period. Abd-El Ghany *et al*., (2016) found that rabbits fed diets contained treated conocarpus replacement of berseem hay at levels 15% and 30% with EM_1 had significantly ($P\leq 0.05$) higher live body weight and daily gain compared with the untreated one. El-Tahan *et al*., (2013) found that live body weight in lambs fed ration contain 60% or 50% treated grinded palm fronds higher than those fed grinded palm fronds and also, found no significant differences in daily feed intake, weight gain and feed conversion. Increasing of weight gain and feed efficiency for rabbits fed diets containing treated discarded palm fronds may be due to treated discarded palm fronds was high content of exogenous enzymes, amino acids, and other secondary metabolites, like vitamins as a result of microorganism activity (El-Badawi *et al*., 2007).

Digestibility coefficients and nutritive value of the diets

Results in Table 4 indicated that apparent digestibility of DM, OM and NFE were not significantly affected by different treatments. On the other hand, digestibilities of CP and CF were significantly the best upon feeding rabbits on Bio-DPF diets compared to 50% DPF. Also, digestibility

Table 4. Digestibility coefficients of nutrients and nutritive values% of diets as affected by experimental diets.

Items	Control	DPF		Bio-DPF		SEM	Sig.
		25%	50%	25%	50%		
DM	63.00	63.50	60.20	67.04	64.17	0.89	NS
OM	60.29	62.86	60.16	65.65	65.23	1.32	NS
CP	65.11^{ab}	71.47^{ab}	62.47^{b}	76.87^{a}	74.39^{a}	1.89	**
CF	30.87^{ab}	31.92^{ab}	26.84^{b}	36.17^{a}	35.18^{a}	1.21	**
EE	69.63^{ab}	69.71^{ab}	65.59^{b}	73.37^{a}	70.36^{ab}	0.99	**
NFE	72.42	73.13	70.76	78.72	75.08	1.27	NS
DCP	11.30^{b}	12.45^{a}	10.69^{b}	13.28^{a}	12.85^{a}	0.26	**
TDN	51.12^{b}	56.00^{ab}	53.12^{ab}	60.21^{a}	58.11^{a}	1.02	**
***DE kcal/k**	2266.46^{b}	2480.8^{ab}	2353.21^{ab}	2667.30^{a}	2574.27^{ab}	52.90	**

DPF**:** Discarded palm fronds , Bio-DPF: Biologically treated discarded palm fronds.
a and b .. Means in the same row with different superscripts are significantly different (P <0.05)
** *P*<0.01 , NS: Not significant.
*DE = TDN x 44.3 (Schneider and Flatt, 1975).

coefficients of EE significantly ($P \leq 0.001$) increased with fed on 25% Bio-DPF diets compared to fed on 50% DPF diets. However, digestibilities of CP, CF and EE did not differ significantly with fed on DPF diets compared to control diet. Nutritive values in terms of DCP and TDN were significantly improved compared to the control. Also, DCP was significantly improved with 25% DPF compared to the control and 50% DPF diets. There were significantly improved in DE (Kcal ⁄ kg diet) with 25% Bio-DPF diets compared to the control group. Although, there were did not differ significantly in DCP, TDN and DE with fed on 50% DPF diets compared to control diet. In agreement, El-Bordeny and Abdel-Azeem (2007) stated that replacing 12 % of the clover hay by palm tree leaves in rabbit diets increased the CP and CF digestibility coefficient compared to the other groups which received diets containing 24 or 36% palm tree leaves and control group. Also using 12, 24 and 36% palm tree leaves instead of clover hay increased EE digestibility coefficient compare to control group. Also they reported that group which received 12% of clover hay as palm tree leaves showed higher TDN and DCP values compared to the other groups were received diets containing 24 or 36% palm tree leaves and control group. in this respect, Abd- El Ghany *et al*., (2016) reported that replace of berseem hay by 15% and 30% conocarpus treated with EM_1 in rabbit diet significantly ($P\leq 0.05$) increased digestion coefficients of CP, CF, EE and nutritive values of diets compared with control and untreated diets. These results may be related to improving the digestion coefficients of nutrients

and nutritive values of diets by palm fronds treatment. That's improving soluble fiber has high water holding capacity, readily forms gel, increases luminal viscosity, and is easily degraded by micro- flora in the large bowel.

On the contrarily, insoluble fiber has little water holding capacity, decreases transit time, is only partially degraded by micro- flora, and increases fecal bulk (Swanson *et al*., 2001).

Carcass characteristics

Effect of different treatments on some carcass traits is showed in Table 5. Results indicated that carcass weight and dressing percentages were significantly improved with feeding on Bio-DPF as compared to rabbits fed on 50% DPF and the least value was with feeding on 50% DPF diet. While, carcass weight and dressing percentages were no significant affected with fed on DPF diet as compared to control diet. There were insignificantly affected by different treatments in edible giblets (liver, heart, kidneys and spleen percentages). El-Bordeny and Abdel-Azeem (2007) found that no significant differences in carcass weight, dressing percentage, liver, heart, kidneys, spleen percentages when using palm tree leaves as replacement at levels 12, 24 and 36 % of the clover hay in growing rabbit diets. Ibrahim *et al*., (2013) found that replacing of wheat bran by midrib data palm at 10% level slightly increased dressing% compared to control group. El-Faham *et al*., (2013) found no adverse effects on dressing percentages, liver, heart, gizzard and breast percentages when chicks were fed mid rib of date palm at levels 7.5 and 15% replacement of wheat bran during finishing period supplemented with enzyme mixture (200g ⁄ ton Allzyme and 0.5Kg ⁄ ton Zado). Abd- El Ghany *et al*., (2016**)** found that rabbits fed 15% and 30% berseem hay replaced by conocarpus treated with EM_1 rations were significantly ($P \leq 0.05$) increased in carcass weight, dressing percentages and giblets percentage to compared with control group.

Blood constituents

Blood constituents of growing rabbits fed the experimental diets are shown in Table 6. Total protein, albumin, AST, creatinine and urea values were not affected by different treatments. However, there were significantly decreased in ALT with 25% Bio-DPF compared with other treatments and there were significantly ($P<0.01$) decreased in cholesterol and total lipids with 50% Bio-DPF as compared to rabbits fed control group. While, there were no significant difference decreased in cholesterol and total lipids with DPF and 25% Bio-DPF compared with control group.

Table 5. Carcass traits of growing rabbits fed on experimental diets.

Items	Control	DPF		Bio-DPF		SEM	Sig.
		25 %	50%	25%	50%		
Carcass %	54.46^{ab}	54.56^{ab}	52.60^{b}	56.46^{a}	56.04^{a}	0.52	**
Edible giblets,%	3.60	3.51	3.30	3.87	3.81	0.11	NS
Liver, %	2.67	2.70	2.57	2.90	2.85	0.08	NS
Heart, %	0.30	0.37	0.26	0.40	0.38	0.03	NS
Kidneys ,%	0.41	0.45	0.46	0.51	0.49	0.05	NS
Spleen, %	0.08	0.08	0.06	0.09	0.09	0.007	NS
Dressing, %	58.16^{ab}	57.97^{ab}	55.9^{b}	60.33^{a}	59.85^{a}	0.58	**

DPF**:** Discarded palm fronds , Bio-DPF: Biologically treated discarded palm fronds.
a and b .. Means in the same row with different superscripts are significantly different (P <0.05)
** *P*<0.01 , NS: Not significant.

Table 6. Blood parameters of growing rabbits fed on experimental diets.

Items	Control	DPF		Bio-DPF		SEM	Sig.
		25%	50%	25%	50%		
Total protein (g/dl)	6.19	6.26	6.12	6.52	6.32	10.2	NS
Albumin (g/dl)	2.32	2.37	2.05	2.76	2.37	0.11	NS
ALT(U/L)	46.91^{a}	46.69^{a}	38.30^{ab}	22.67^{b}	35.34^{ab}	3.32	**
AST(U/L)	28.39	36.41	36.67	22.37	24.44	3.20	NS
Cholesterol (mg/ dl)	184.46^{a}	172.00^{ab}	161.36^{ab}	166.03^{ab}	158.26^{b}	3.63	**
Creatinine (mg/ dl)	1.87	1.86	1.93	1.59	1.85	2.72	NS
Urea-N (mg/ dl)	24.84	26.00	28.98	32.47	29.19	1.20	NS
Total Lipids(mg/dl)	343.67^{a}	307.27^{ab}	295.33^{ab}	301.24^{ab}	249.80^{b}	11.80	**

DPF: Discarded palm fronds , Bio-PFG: Biologically treated discarded palm fronds.
a and b .. Means in the same row with different superscripts are significantly different (P <0.05)
** *P*<0.01 , NS: Not significant.

Higher decreasing in cholesterol with Bio-DPF may be associated with a reduction in cholesterol biosynthesis this interpretation is in accordance with Mousa *et al*., (2011) found that administration of EM_1 in rat diet produced a significant decreased in cholesterol, triglycerides, levels of alloxan-induced diabetic rats and Cenesiz *et al*., (2011) reported that administration of EM_1 in chicken diet decreased cholesterol levels may be associated with both a reduction in cholesterol biosynthesis in the liver and an increase in degradation of bile acids by Lactobacillus species. El-Bordeny and Abdel-

Azeem (2007) found that replacing clover hay by palm tree leaves at levels 12, 24 and 36% in rabbit diets caused no significant increase in total serum proteins and albumin concentrations than the control. 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. Moreover, El-Bordeny and Abdel-Azeem (2007) found rabbits group received a diet with 36% palm tree leaves recorded the lowest value ($P \leq 0.05$) of total lipids concentration compared to the other experimental groups which received 12 or 24% palm tree leaves. Also, they found insignificant differences were observed in total cholesterol and AST between the different experimental groups, control group recorded the highest value ($P \leq 0.05$) of ALT activity followed by the group received 24% then 36% palm tree leaves, while the lowest value was that of the group received 12% palm tree leaves. Abd- El Ghany *et al*., (2016**)** found that cholesterol and total lipid were significantly ($P \leq 0.05$) lower with rabbits fed biologically conocarpus with EM_1 at levels 15 or 30% as compared with untreated one.

Microbiological assay

Caecum content of PH, total volatile fatty acids and ammonia concentration at the end of the study are presented in Table 7. Analysis of variance revealed that feeding on 25% Bio-DPF diet significantly increased the value of PH . Total volatile fatty acid was increased and unfavorable ammonia was decreased significantly with feeding on Bio-DPF diets compared with 50% DPF diets. However, there were no significant difference with fed on DPF diet compared to control diet. This result confirmed with Abd- El Ghany *et al*., (2016) who found that production total volatile fatty acid significantly increased while, ammonia concentration of caecum wa significantly decreased ($P \leq 0.05$) in rabbits fed on diets containing 15% and 30% berseem hay replaced by conocarpus treated with EM_1 rations.

Economic efficiency

Data presented in Table (8) show that rabbits fed the diet contained biologically treated discarded palm fronds (Bio-DPF) diets at level 25% achieved the highest economic efficiency followed by that fed 50% Bio-DPF) and relative economic efficiency (125.42and 112.99) followed by a decreasing order by groups fed 50% discarded palm fronds (DPF**)**. And the least value was shown with group fed 25% DPF.

Table 7. Caecum content of growing rabbits fed on experimental diets**.**

Items	Control	DPF		Bio-DPF		SEM	Sig.
		25%	50%	25%	50%		
PH caecum	6.36^{ab}	6.53^{ab}	6.16^{b}	6.90^{a}	6.76^{ab}	0.10	**
***TVFA (mg/100ml)**	3.29^{ab}	3.79^{ab}	3.00^{b}	4.54^{a}	4.49^{a}	0.22	**
Ammonia (mg/100ml)	9.97^{ab}	9.62^{ab}	10.87^{a}	9.11^{b}	9.34^{b}	0.22	**

DPF: Discarded palm fronds , Bio-DPF: Biologically treated discarded palm fronds.
a and b .. Means in the same row with different superscripts are significantly different (P <0.05)
** *P*<0.01 , NS: Not significant.
* TVFA : Total Volatile Fatty Acids.

Table (8). Economic efficiency of using the diets.

Items	Control	DPF		Bio-DPF	
		25%	50%	25%	50%
Total weight gain (kg)	1.100	1.127	1.043	1.333	1.261
Price of 1kg body weight	45	45	45	45	45
Selling price/rabbit (LE) (A)	49.50	50.71	46.93	59.98	56.74
Total feed intake	4.31	4.59	4.13	4.52	4.81
Price/kg feed(LE)	4.15	4.12	3.93	4.12	3.93
Total feed cost/rabbit (LE)(B)	17.88	18.91	16.23	18.62	18.90
Net revenue(LE)[1]	31.62	31.80	30.70	41.36	37.84
Economic efficiency[2]	1.76	1.68	1.89	2.22	2.00
Relative Econ. Eff.[3]	100	94.91	106.77	125.42	112.99

DPF: discarded palm fronds , Bio-DPF: Biologically treated discarded palm fronds.
(1) Net revenue = A – B.
(2) Economic efficiency = (A-B/B x 100).
(3) Relative Economic Efficiency= Economic efficiency of treatments other than the control/ Economic efficiency of the control group.

These results were in agreement with El-Tahan *et al*., (2013) who found that sheep ration containing palm fronds grinded with or wihout fungi treatment appeared to have higher net revenue and econimical efficiency. Abd- El Ghany *et al*., (2016) found that the better economic efficiency (EE) was found with rabbits fed diets containing treated concarpus with EM_1 at levels 15 or 30% than those fed the control diet.

Conclusively, it could be recommended to incorporate the Bio-DPF in growing rabbit diets up to 50% instead of clover hay without any adverse effects on growth performance of rabbits.

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الأحلال الجزئى لدريس البرسيم بجريد النخيل المجروش على الأداء الأنتاجى للأرانب النامية.

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أجريت هذه الدراسة بغرض معرفة تأثير إستخدام جريد النخيل المجروش الغير معامل و المعامل بيولوجيا بمستحضر Effective microorganisms (EM_1)كبديل لدريس البرسيم بنسبة (٥٠ أو ٢٥%) فى علائق الأرانب النيوزيلاندى النامية على الأداء الأنتاجى للأرانب النامية. تم إستخدام ٦٠ أرنب غير مجنس أبيض نيوزيلاندى عمر 6 أسابيع وقسمت عشوائيا الى خمس مجاميع (١٢ أرنب لكل مجموعة) .تم تركيب وإعداد ٥ علائق تجريبية كالتالى: العليقة الأولى وهى عليقة كنترول بدون جريد النخيل المجروش،عليقة التانية, الثالثة ,الرابعة و الخامسة تحتوى على ٢٥ او ٥٠% جريد نخيل مجروش الغير معامل ومعامل بيولوجيا محل دريس البرسيم . إستمرت التجربة لمدة ٨ أسابيع.

أظهرت النتائج أن المعاملة البيولوجيه حسنت من التركيب الكيميائي لجريد النخيل المجروش حيث حدث إرتفاع فى محتواه من البروتين الخام و إنخفاض الآلياف الخام . وجد نقص معنوي فى وزن الجسم والزيادة الوزنية اليومية مع العلائق التى تحتوى على ٥٠% جريد النخيل المجروش. الأحلال بجريد النخيل المجروش المعامل بيولوجيا (٢٥ أو ٥٠%) من الدريس أدى الى تحسن غير معنوى فى وزن الجسم والزيادة الوزنية اليومية . لم يلاحظ أى فروق معنوية فى إستهلاك الغذاء بين المجموعات المختلفة وكذلك تحسنت كفاءة التحويل الغذائى تحسنا معنويا مع التغذية على ٢٥% جريد النخيل المجروش المعامل بيولوجيا مقارنة بالمعاملات الأخرى . وأيضا حققت المجموعة التى غذيت على ٢٥% جريد النخيل المجروش المعامل بيولوجيا أعلى تحسن معنوى فى معدل النمو النسبى مقارنة بالمعاملات الأخرى. و بدون اى فرق معنوي مع المجموعة التى غذيت على ٥٠% جريد النخيل المجروش المعامل و أظهرت المجموعة التى غذيت على ٢٥% جريد النخيل المجروش المعامل بيولوجيا أعلى تحسنا معنويا لدليل النمو بالمقارنة بالمجاميع الأخرى التى لم تختلف معنويا فيما بينها .

كما وجد تحسن معنوى فى معاملات هضم البروتين و الألياف مع التغذية على جريد النخيل المجروش المعامل بيولوجيا يلبه المجموعة التى غذيت على عليقة الكنترول و٢٥% جريد النخيل مجروش بدون اى أختلافات معنوية مقارنة بالمجموعة التى غذيت على ٥٠% جريد النخيل المجروش . وجد تحسن معنوى فى قيم البروتين

المهضوم ،المركبات الكلية المهضومة مقارنة بالكنترول. وجد أيضا تحسن معنوى فى الطاقة المهضومة مع التغذية على ٢٥% جريد النخيل المجروش المعامل بيولوجيا مقارنة بمجموعة الكنترول . وجد تحسن معنوى فى النسبة المئوية للتصافى مع التغذية على جريد النخيل المجروش المعامل بيولوجيا وكانت أقل قيمة مع التغذية على عليقة التى تحتوى على٥٠% جريد النخيل المجروش .. وجد تأثير معنوى فى اللبيدات الكلية والكوليسترول مع المجموعات المختلفة مقانة بالكنترول. أظهرت النتائج زيادة معنوية فى قيم الأحماض الدهنية الكلية ولكن وجد انخفاض معنوى فى قيم الأمونيا مع التغذية على جريد النخيل المجروش المعامل بيولوجيا مقارنة بالمعاملات الأخرى. وجد زيادة فى صافى العائد المادى عند تغذية الأرانب على العلائق المحتوية على جريد النخيل المجروش المعامل بيولوجيا.

التوصية: انه بإمكان إحلال جريد النخيل المجروش المعامل بيولوجيا محل دريس البرسيم حتى مستوى ٥٠% في علائق الارانب الناميه دون أي تأثيرسلبى على الأداء الانتاجي للأرانب.