

EFFECT OF SUBSTITUTION OF BARLEY GRAINS BY DISCARDED DATES ON REPRODUCTIVE PERFORMANCE OF NEW ZEALAND WHITE RABBIT DOES

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SUMMARY

The study was designed to investigate the reproductive performance of rabbit does fed different levels of discarded dates. The discarded dates were gathered, sun-dried and ground by hammer mill for proximate analysis and feed formulation. Four experimental diets were formulated to supply 18% crude protein and 2500 Kcal DE/kg. First diet was control, while discarded dates replaced barely grains at 25, 50, and 75% for the other three diets. A total number of 20 New Zealand White (NZW) rabbit does about 5 months of age, weighing about 2.827 ± 20.10 kg were randomly distributed into 4 experimental treatments (5 does/ treatment). Productive performance, blood constituents, thyroid activity, progesterone hormone assay and economic of efficiency were measured. Results indicated that: The gestation length, total feed intake, daily feed intake, mating weight, gestation and suckling weight, change in weight during gestation and suckling periods and total milk yield were not significantly affected ($P \leq 0.05$) by different treatments. The Litter weight at birth and kid weight at weaning were significantly increased ($P \leq 0.05$) for rabbits fed diets with 25% discarded dates as well as litter weight at weaning and kid weight at birth were significantly increased ($P \leq 0.05$) with rabbits fed diets containing 25 and 50% discarded dates. The catalase activity was significantly increased with rabbits fed diets containing discarded dates at levels 50 and 75%. Also, there were significantly decrease of glucose and lipid peroxides with rabbits fed diets containing discarded dates at 75% compared to those fed control diets. Progesterone hormone was significantly increased for rabbits fed diets with 25% discarded dates. Moreover, total triiodothyronine values (T_3) were significantly increased with rabbits fed diets containing 25 and 50% discarded dates compared with control group. However, total thyroxin (T_4) was not affected by different treatments. The groups fed the diets with 75% discarded dates achieved the highest economical efficiency followed by those fed diet contained 50% discarded dates. It was therefore concluded that discarded dates as source of energy could replace 75% of barely grains in the diets of rabbit does without adverse effect on their reproductive performance.

Keywords: rabbits; does; litter size; litter weight; discarded dates; milk yield; energy source

INTRODUCTION

Nowadays, rabbit farming is becoming more and more attractive to many animal breeders due to its high fecundity, high mothering ability, adaptability to a wide range of conditions, high genetic variability, high roughage utilization and low cost of production (Zarrouki *et al.*, 2004). The economical efficiency of a rabbitry depends mainly upon the reproductive performance of the doe, which in turn is affected by their fertility and prolificacy (Castellini *et al.*, 2003). Female reproduction is more interesting and attractive subject to study and preferred by many researchers and this is essential and more important and beneficial for successful rabbit breeding. Litter size, birth weight and conception rate are so important economic traits in any productive animal. The nutritional factors are one of these important factors which affect the economical intensive rabbit production, under the sub-tropical conditions of Egypt. The price of the main ingredients in poultry and rabbits diets is constantly growing. So, new unconventional local sources of low price ingredients need to be identified and validated. The feed cost of animal nutrition represents more than 70% of the total production cost. It is now urgent to look for alternative feedstuffs to compensate the high cost of the conventional feedstuffs. Rabbits are herbivores and consume high fiber diets. The digestive strategy of rabbits for the utilization of fibrous diets was described by Cheeke (1982). Grains, i.e. corn, barley, sorghum and oats are the primary courses of high energy feed for

livestock. Barley grains are the most important sources as carbohydrates for rabbit diets. Because of the shortage and high price of barley grains, one of the alternatives to solve this problem is using non-conventional ingredients as a partial replacement of barley grains in rabbit diets.

Dates (*Phoenix dactylifera L.*) are very popular in most of the Middle Eastern countries. Over 70% of the total world production are produced in this area and are considered an important national crop in some Arabian countries. A considerable amount (20%) of produced dates is inedible and is not beneficial for human consumption due to their poor quality. Dates are very rich in saccharides, their total sugars may reach up to 87% in the tamar stage and the monosaccharides content are mainly 44% glucose and 50% fructose and some other sucrose (Sawaya *et al.*, 1983). Date fruit can provide 2.67Mcal/kg of digestible energy. Dates contain approximately 78.5% dry matter, 2.2% crude protein, 0.5% fat, 2.3% crude fiber, 72.9% carbohydrate and 1.9% ash, so it can supply 87% of the digestible energy provided by the same unit of traditional grain feed (Alkhateeb and Ali-Dinar, 2001). Dates contain many important vitamins and minerals and their mineral content in dried dates can vary from 0.1 to 916 mg/100 g of date flesh (Khan *et al.*, 2008). Dates contain high levels of selenium, copper, potassium, and magnesium, in addition to moderate concentrations of manganese, iron, phosphorus, and calcium and small quantities of boron (Barreveld, 1993).

Palm fruit has high content of phytonutrients with antioxidant properties. So, there is possibility that palm fruit offers some health advantages by reducing lipid oxidation, oxidative stress and free radical damage (Wattanapenailboon and Wahlqvist, 2003) For this reason, dates that are not suitable for human consumption are considered a good source of energy for animals and poultry.

In addition, significant amounts of cull dates (which are unstable for human consumption) are available in Egypt which can be utilized as a cheap non-conventional ingredient in rabbit diets. The annual production of dates in Egypt is estimated by 1.113.270 ton (FAO, 2011). Moreover, the quantity of cull dates is estimated by about 20% of all dates produced (Al-Yousef *et al.*, 1994). AL-Dobaib *et al.*, (2009) found no significant differences in milk yield from goats does fed diet with 30% discarded dates. El-Shora *et al.*, (2014) found that yield as actual milk were higher ($P<0.05$) for cows fed 66% discarded dates than those of control. Cows fed 66% discarded dates recorded the highest ($P<0.05$) percentages of fat, protein, and total solids in milk.

It has been found that published researches regarding use of discarded dates in rabbit does diets are limited almost, there is no available data on the effect of discarded dates on the reproductive performance of the rabbits. Therefore, the present study aimed to investigate the effect of partial replacement of barely grains by discarded dates on reproductive performance, and economical efficiency of New Zealand White (NZW) rabbit does.

MATERIALS AND METHODS

This study was carried out at Poultry Research Station, in Kafr EL- Sheikh Governorate, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. Discarded dates were obtained from Luxor Governorate, Egypt, and were ground by hammer mill and kept for chemical analysis before mixing into the experimental diets.

The experimental design

In this study, four experimental diets were formulated; the first used as control diet without discarded dates while the other three diets were containing discarded dates at 7.80, 15.60 or 23.40 % levels in the diet replacing (25, 50 or 75% of barely grains) of rabbit does diets as shown in Table (1) . A total number of 20 New Zealand White (NZW) does aged 5 months, weighing about 2.827 ± 20.10 kg were randomly distributed individually into 4 experimental treatments (5 does/ treatment). Does were housed separately in individual wired-cages as replicates. Mating was achieved by 4 adult New Zealand White bucks aged 6 months with 3.0 kg average body weight, with good fertility records. Bucks were fed *ad-libitum* on the gestating control diet. All animals were kept under the same management system and provided with fresh water and pelleted diets, *ad-libitum* all over the experimental period under natural light system. All the experimental diets were formulated to be iso-nitrogenous and iso-caloric, and to meet all the essential nutrient requirements of rabbit does according to NRC (1977). The chemical analysis of the experimental samples of diets, discarded dates and barely grains were done according to the conventional methods of A.O.A.C (2000). Chemical analyses of discarded dates and barely grains are presented in Table (2). The digestible energy (DE kcal /kg) of discarded dates and barely grains were calculated according to the equation of

Cheeke (1987). Amount of feed consumed was calculated weekly. Gestation length was calculated as period between kindling and post partum. The change in live body weight during gestation period was calculated as the difference between the live body weight at kindling and body weight at post partum, while the change in live body weight during suckling was calculated as the difference between the live body weight at the end of suckling period (at weaning) and the body weight at post partum, in which the kids became four weeks of age.

Table (1). Ingredients and chemical composition of experimental diets (on DM basis).

Ingredient	Control	Discarded dates		
		25%	50%	75%
Soybean meal (44% CP)	21.00	22.00	23.50	25.00
Discarded dates	-----	7.80	15.60	23.40
Barely grains	31.20	23.40	15.60	7.80
Wheat bran	13.90	13.90	13.90	13.90
Clover hay	27.15	26.15	24.65	23.15
Lime stone	0.70	0.70	0.70	0.70
Di calcium phosphate	2.20	2.20	2.20	2.20
Sodium Chloride (NaCl)	0.30	0.30	0.30	0.30
Vit.& min. Mix ^{1*}	0.30	0.30	0.30	0.30
DL-Methionine	0.20	0.20	0.20	0.20
Anticoccidia (<u>Diclazuril</u>)	0.05	0.05	0.05	0.05
Molasses	3.00	3.00	3.00	3.00
Total	100	100	100	100
Chemical analysis%				
DM%	89.40	88.90	90.20	90.74
Chemical analysis% (on DM basis)				
OM%	89.79	89.57	88.95	88.35
CP%	18.50	18.30	18.25	18.20
CF%	12.79	12.90	12.87	12.85
EE%	2.14	2.25	2.38	2.46
NFE%	56.36	56.12	55.45	54.84
Ash%	10.21	10.43	11.05	11.65
**DE kcal/kg	2527.24	2523.69	2524.66	2525.30
Calculated analysis%				
Calcium	1.249	1.246	1.236	1.228
Total phosphorus	0.849	0.830	0.810	0.792
Methonine	0.467	0.477	0.489	0.502
Lysine	0.979	1.03	1.09	1.15

* Each per 1 kg diet: 6000 IU vit. A; 900 IU, vit. D₃; 40 mg, vit. E; 2.0 mg, vit. K₃; 2.0 mg vit., B₁; 4.0 mg , vit. B₂; 2.0 mg, vit. B₆; 0.010 mg, vit. B₁₂; 5.0 mg, vit. PP; 10.0 mg vit., B₅; 0.05 mg, B₈; 3.0 mg, B₉; 250 mg, choline; 50.0 mg, Fe; 50.0 mg, Zn; 8.5 mg Mn; 5.0 mg Cu; 0.20 mg I, and 0.01 mg Se.

**DE (kcal/g) = 4.36 - 0.0491 * NDF, Where NDF% = 28.924 + 0.657 * CF% according to Cheeke (1987)

The milk yield of each doe was recorded at the 7th, 14th, 21st, 28th days after kindling using the weight-suckle-weight technique described by McNitt and Lukefahr (1990). In this method, the kids of each doe were separated from their dams by closing the gates between the nest box, and the doe's cage was allowed to suckle them by opening the gate. In the next morning, the members of each litter were weighed (in grams) and returned again to the nest box, and the doe to suckle them by opening the gate. The litter after suckling was weighed again and milk yield was determined and recorded as the difference in the weight pre-and post suckling. Weekly milk yields (at 7 days (MY7), 14 days (MY14), 21 days (MY21) and 28 days (MY28) were calculated as the mean of milk amount estimated in this week, and them multiplied by 7 to get the weekly milk yield. Total milk yield (TMY) of the first three weeks of suckling (TMY 21) was calculated as the mean of the milk amount of each week multiplied by 3 to get

the total milk yield from birth up to 21 days. Body weight and weight gain of kids were measured at birth and at weaning. Mortality rate (MR) for kids during lactation were calculated as:

$$\text{MR of kids} = \frac{\text{Number of the kids born alive} - \text{Number of the kids at weaning}}{\text{Number of the kids born alive}} \times 100$$

Blood parameters

Individual blood samples were taken at 9.00 am from the marginal ear vein 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 -20°C till the time of chemical analysis. Chemical analyses of the blood plasma were carried out for quantity determination of blood as total protein (Gornal *et al.*, 1949), albumin (Doumas and Waston, 1971), transaminases (AST, aspartate aminotransferase and ALT alanine aminotransferase, Reitman and Frankel, 1957), Catalase (Aebi, 1984), Glucose (Trinder, 1969), Lipid Peroxides (Malondialdehyde), (Satoh, 1978), plasma progesterone (Bojanic *et al.*, 1991) The concentrations of triiodothyronine (T3, ng/ml) and thyroxin (T4, ng/ml) in plasma were determined according to Barker and Silverton (1982) by using commercial kits supplied by Monobind Inc.

The economical efficiency of experimental diets was calculated as the ratio between net revenue and cost of feed consumed according to Soliman *et al.* (2012).

Data from all response variables were analyzed using General Linear Models (GLM) procedure of SAS Institute (2004). The statistical model used was:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where: μ = overall mean of Y_{ij} , T_i = effect of treatment, $i = (1, \dots, 4)$, e_{ij} = experimental random error. Variables having a significant F-test were compared using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition:

As shown in Table (2), chemical analyses of discarded dates compared with barely grains revealed that, CP was (5.12 vs. 12.40), CF (9.18 vs. 5.72), EE (4.43 vs. 2.60), NFE (67.73 vs. 76.74), ash (13.54 vs. 2.54) and DE (2647 vs. 2758). In this respect, Abd el-Rahman *et al.* (2012) found that cull dates contain 87.15, 4.89, 3.60, 3.34 and 10.23% as DM, CP, CF, EE and ash, respectively. AL-Dobaib *et al.* (2007) found that discarded dates contained CP (3.8%), CF (2.8%), EE (3.4%) ash (10.4%), Calcium (0.17) and phosphorus (0.03%) .

Table (2). Chemical composition of discarded dates and barely grains (on DM basis).

Item	Chemical analysis% (on DM basis)							
	DM%	OM%	CP%	CF%	EE%	NFE%	Ash%	*DE (Kcal/kg)
Discarded dates	85.26	86.46	5.12	9.18	4.43	67.73	13.54	2643.89
Barely grains	88.20	97.46	12.40	5.72	2.60	76.74	2.54	2755.50

*DE (kcal/g) = 4.36 - 0.0491x NDF, Where NDF% = 28.924 + 0.657x CF% according to Cheeke (1987).

Performance of rabbit does during gestation period:

The gestation length, total feed intake, daily feed intake, mating weight, gestation weight and the change in body weight doe at mating and kindling are presented in Table (3). Results showed that gestation length, total feed intake, daily feed intake, mating weight, gestation weight and the change in body weight doe at mating and kindling were not affected significantly ($P \leq 0.05$) by different treatments. Values of daily feed intake for does fed diets discarded dates were ranged between 162.66 to 177.33 g vs. 154.56 g/day for the control diet. Change in weight were ranged between +135.00 to +148.00 g vs.

+113.00g for the control diet. Mating weight were between 2817.00 to 2851.00 g vs. 2808.00g for the control diet. Gestation weight recorded 2979, 2965.00 and 2986.00 g with groups fed 25, 50 and 75% discarded dates, respectively versus 2921.00g for those fed control diet. The regular increase in body weight at this phase could be due to the active growth of the embryos at this stage. These results revealed that does can tolerate using discarded dates in the diet up to 75% substitution for barely grains during the gestation period (30 days) without adverse effects. In this respect, Defang *et al.* (2012) observed no significant difference ($P>0.05$) for mating weight, gestation weight, average weight gain, feed consumption during gestation period and gestation length with rabbit fed diets containing 100% sweet potato concentrate meal instead of maize. Ajayi *et al.* (2005) found that change in body weights of the rabbit does did not differ during gestation period when rabbit doe were fed un autoclaved maize-milling waste at levels 25, 50 and 75%. However, significant differences ($P<0.05$) were observed in does relative change in body weight during gestation period when rabbit does were fed autoclaved maize-milling at levels 25, 50 and 75% compared to control group. The consumption of dates by women human before and after delivery can act as a tonic to strengthen the uterine muscles. Dates not only help in activating the delivery process but may also prevent the post delivery bleeding due to the presence of some constricting substances (Ali *et al.*, 2013)

Table (3). Performance traits of rabbit does as affected by different treatments during gestation period.

Item	Control	Discarded dates %			SEM
		25%	50%	75%	
Gestation length (days)	30.33	30.00	30.33	30.00	0.21
Total feed intake(kg/doe)	4.688	5.320	5.283	4.880	0.18
Daily feed intake ((kg/doe)	154.56	177.33	174.18	162.66	6.47
Mating weight* (g) doe	2808.00	2833.00	2817.00	2851.00	20.10
Gestation weight** (g) doe	2921.00	2979.00	2965.00	2986.00	20.93
Change in weight*** (g)	+113.00	+146.00	+148.00	+135.00	15.45

Difference within the same row were not significantly different ($p \leq 0.05$).

*Mating weight (g) doe is live body weight at post partum.

**Gestation weight (g) doe is live body weight at kindling.

***Change in weight (g) = Gestation weight (g) - Mating weight (g).

Performance of rabbit does during suckling period:

Results in Table (4) indicated that total feed intake, daily feed intake, suckling weight, change in weight of the doe between kindling and weaning of kids and total milk yield were not significantly affected by the different treatments. Daily feed intake was ranged between 222.82 to 245.89g vs. 217.50 g/day for the control diet. Feed intake recorded highest value with rabbits fed 25% discarded dates diet followed by rabbits fed diets containing 50 and 75%. While, the lowest value was occurred with rabbits fed control diet. Feed intake increased with discarded dates may be due to the positive palatability effect of dates. However, feed intake decrease with increasing levels of dates may due to increase of neutral detergent fiber (NDF) and acid detergent fiber (ADF) by increased dates in diets. This interpretation is in accordance with Khattab (2013) who stated that increased neutral detergent fiber (NDF) and acid detergent fiber in sheep diets with increasing levels of dates led to decrease intake of OM and NFE in sheep. Change in weight of the does due to treatments ranged between -76.33g to -82.00.g vs.-69.00 g for the control diet. The negative weight gain observed during the lactating phase could be due to the mobilization of body reserve to synthesize milk for kids. These results were in agreement with Effiong *et al.* (2016) who found that rabbit does fed diets containing 60% orange pulp not significantly differ in their mean daily feed intake during gestation and lactation periods. However, Defang *et al.* (2012) observed that there were significant difference for feed consumption during lactation period. While, no significant difference for meeting weight, suckling weight and average weight gain during lactation period there were observed with rabbit fed diets containing 100% sweet potato concentrate meal instead of maize. In this respect, AL-Dobaib *et al.* (2009) found no significant differences in milk yield from goats does fed diet with 30% discarded dates. While, Milk obtained from does receiving discarded dates was

significantly higher in protein, solids-not-fat contents, casein nitrogen and non-casein nitrogen than those fed the control diet. El-Shora *et al.* (2014) found actual milk yield were higher ($P < 0.05$) for cows fed 66% discarded dates than those fed the control. Cows fed 66% discarded dates recorded the highest ($P < 0.05$) percentages of fat, protein, and total solids in milk. Increased milk yield with does receiving discarded dates may be due to potassium, glycine, and threonine content of dates that are thought to activate the production of milk hormone (prolactin). Small quantities of oxytocin have also been detected in dates and therefore dates can act as lactagogue if used in the daily meal plan of a woman during her lactation period (Ali *et al.* 2013).

Table (4). Performance traits of rabbit does as affected by different treatments during suckling period.

Item	Control	Discarded dates %			SEM
		25%	50%	75%	
Total feed intake(kg/doe)	6.091	6.885	6.576	6.239	0.15
Daily feed intake ((kg/doe)	217.5	245.89	234.85	222.82	5.55
Mating weight (g) doe	2808.00	2833.00	2817.00	2851.00	20.10
Suckling weight (g) doe	2739.00	2751.34	2734.67	2774.67	19.80
Change in weight (g)	- 69.00	- 81.66	- 82.33	-76.33	2.41
Total milk yield (kg/doe) (4 weeks)	2.08	2.38	2.25	2.17	0.09

Difference within the same row were not significantly different ($p \leq 0.05$).

**Mating weight (g) doe is live body weight at post partum.*

***Suckling weight (g) doe is live body weight at the end of suckling period.*

****Change in weight (g) = Suckling weight (g) - Mating weight (g).*

Productive traits of kids:

Productive traits of kids as affected by different treatments are presented in Table 5. The litter weight at birth, total gain of litter, daily kids weight gain, total kids weight gain and mortality of kids were not affected by different treatments. However, Litter weight at birth and kid weight at weaning were significantly increased ($P \leq 0.05$) with rabbits fed diets containing 25% discarded dates and litter weight at weaning and kid weight at birth were significantly increased ($P \leq 0.05$) with rabbits fed diets containing 25 and 50% discarded dates. These results suggests that the discarded dates at levels 25, 50 and 75% provided sufficient amount of necessary nutrients of many potential health benefits that enabled the rabbits to produce quality milk for the kids (Iyeghe-Erakpotobor *et al.* 2008). These results were in agreement with those reported by Defang *et al.* (2012) who observed that litter weight at 21 days post-partum (milk yield) was significantly higher for does fed diet containing sweet potato concentrate meal. Also, they found that no significant difference in litter size at birth and litter size at weaning, litter weight at birth and at weaning. These results were in disagreement with Effiong *et al.* (2016) who found using orange pulp to replace of 60% instead of maize in rabbit does diets had significant higher litter size at birth and litter size at weaning. They found that average mortality ranged from 28.30% in rabbits fed 60% orange pulp to 34.25% for those fed control diet. The variation in average mortality was not significant. The authors observed an increase in litter size with higher levels of the fibrous digesta in the diets. The dietary fiber has positive effect on the gut health, welfare and reproductive performance of rabbit, especially during pregnant period. The observed in this current study improvement in reproductive performance for 25, 50 and 75% discarded dates may be attributed to the higher unsaturated fatty acids in dates as presented by Al-Shahib and Marshall (2003) who found that the flesh of date contains 0.2-0.5% oil, and seeds contain 7.7-9.7% oil with high content of unsaturated fatty acids which including palmitic, oleic, and linoleic and linolenic acids.

Blood constituents:

Data explain the effect of different levels of discarded dates on total protein, albumin, glucose, catalase, lipid Peroxides (Malondialdehyde) (MDA), alanine aminotransferase (ALT, aspartate and aminotransferase (AST) are shown in Table (6). Insignificantly could be noticed differences in concentration of plasma albumin, total protein, ALT and AST for rabbits fed different tested treatments compared to control group.

However, catalase was significantly increased with rabbits fed diets containing discarded dates at levels 50 and 75% compared to those fed control diet. There were significantly decrease of glucose and lipid peroxides for rabbits fed on diets containing discarded dates at 75%. In this respect, El-Shora *et al.* (2014) found that lactating Friesian Cows fed 66% discarded dates had the highest concentrations of total proteins, globulin,

Table (5). Productive traits of kids as affected by different treatments.

Item	Control	Discarded dates %			SEM
		25%	50%	75%	
Litter size at birth (total born)	7.24	7.97	7.74	7.55	0.35
Litter size at birth (total alive)	6.09	6.90	6.63	6.57	0.43
Litter size at weaning	4.30	5.04	4.80	4.63	0.39
Litter weight at birth (g)	345.54 ^b	464.33 ^a	418.63 ^{ab}	390.33 ^{ab}	16.25
Litter weight at weaning (g)	2220.0 ^b	2774.3 ^a	2612.7 ^a	2475.0 ^{ab}	78.15
Total gain of litter (kg) / doe	1.556	1.673	1.602	1.577	0.04
Kids weight at birth (g)	56.73 ^b	67.29 ^a	63.14 ^a	59.41 ^b	1.26
Kids weight at weaning (g) (28 day)	516.27 ^b	550.36 ^a	544.31 ^{ab}	534.55 ^{ab}	5.45
Kids weight gain (daily) (g)	16.41	17.25	17.18	16.96	0.29
Kids weight gain (Total) (g)	459.54	483.06	481.17	475.14	21.01
Mortality % of kids (from birth till weaning)	29.39	26.95	27.60	29.52	0.65

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

Table (6). Blood constituents of rabbits does fed different experimental diets.

Item	Control	Discarded dates %			SEM
		25%	50%	75%	
Glucose mmol/l	74.14 ^a	70.12 ^{ab}	68.68 ^{ab}	66.19 ^b	1.21
Total protein, g/dl	5.00	5.27	5.59	5.62	0.11
Albumin, g/dl	3.55	3.57	3.89	3.93	0.06
AST(U/L)	54.10	52.92	47.14	44.02	1.80
ALT(U/L)	60.76	57.13	57.13	52.83	1.92
Lipid Peroxides (Malondialdehyde) (MDA) nmol/ml	9.11 ^a	8.36 ^{ab}	8.33 ^{ab}	7.76 ^b	0.18
Catalase (U/l)	744.96 ^b	756.66 ^b	777.33 ^a	786.73 ^a	5.52

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

glucose and the lowest concentrations of albumin and total lipids in blood plasma. The obtained results are in agreement with those reported by AL-Dobaib *et al.* (2007) who found that total proteins, albumin, globulin, total lipids, were not differ for rabbits fed diets containing 15 and 30% of discarded dates while, significant decrease in cholesterol level was observed for rabbits fed diet containing 30% discarded dates. Also, Olorede and Longe (2000) found that there were no significant difference ($p < 0.05$) in total protein, Albumin while, there were significant decrease in concentration of glucose in blood plasma of laying hens fed 10 and 20% palm kernel cake. In contrary, Abdel-Fattah *et al.* (2012) found that partial substitution of ground yellow corn in concentrate feed mixture with ground date palm at 50% weight by weight slightly increased ($P < 0.01$) blood total protein than control group of growing Barki lambs. Increasing of catalase and decreasing of lipid peroxides may be due to that dates containing an antioxidant substance. This interpretation is in accordance with Amoros *et al.* (2009) who reported that palm date and its fibers have several nutritional values such as antioxidant activity. The antioxidant activity could be due to its lignin content in dates, since lignin has been shown to possess an antioxidant and antimicrobial activities (Brunow, 2006).

Progesterone hormone, total triiodothyronine (T_3) and total thyroxin (T_4)

Results of progesterone, total triiodothyronine (T_3) and total thyroxin (T_4) values as affected by different treatment are shown in Table (7). Results indicated that progesterone hormone were

significantly increased for rabbits fed diets containing 25% discarded dates. Also, total triiodothyronine (T_3) were significantly increased with rabbits fed diets containing 25 and 50% discarded dates. However, total thyroxin (T_4) was not affected by different treatments. Hashem (2014) stated that rams fed 50% ground discarded dates in concentrate feed mixture had significant effect on T_3 and T_4 compared with control rams. Similar results were reported by Abdel-Fattah *et al.* (2012) on Barki lambs which fed ground date palm at Siwa Oasis appeared to have a positive correlation between thyroid hormones (T_3 and T_4) and both the age of animal and body weight gain ($P < 0.01$). Also, Mousa and Al-Saiady (2002) found that there was a positive correlation between thyroid hormones levels in serum and body weight during the growing period of Somali camels fed different levels of commercial feeds. The presence of steroid compounds in date pits, notably estrone, progesterone and estriol, had been known, though the actual effects of these compounds on sheep growth and reproduction have yet to be clearly demonstrated (Barreveld, 1993; El-Gasim *et al.*, 1995, El-Din and El-Hameed, 2001). Date palm pollen grains have been shown to regulate the sexual hormonal balance in rats (Reshod and Al-Shagrawi, 1998). The date pollens yield an estrogenic principle, estrone that has been shown to have a gonadotropic effect in young rats (El-Moughy *et al.* 1991).

Table (7). Progesterone, total triiodothyronine (T_3) and total thyroxin (T_4) as affected by different treatments.

Item	Control	Discarded dates %			SEM
		25%	50%	75%	
Progesterone (ng/ml)	0.676 ^b	0.935 ^a	0.828 ^{ab}	0.743 ^{ab}	0.039
T_3 (ng/ml)	0.45 ^b	0.70 ^a	0.65 ^a	0.49 ^b	0.020
T_4 (ng/ml)	5.24	6.34	5.85	5.68	0.31

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

Economic efficiency:

The economical efficiency of the different formulated diets as affected by different treatments is shown in Table 8. The economical efficiency of the present study was calculated based upon input-output analysis of the total feeding cost/doe and the prevailing selling price of the litter/doe at weaning. The results indicated that the lowest total feed cost /doe (LE) (27.35 LE) was observed with rabbits fed the diets containing 75% discarded dates followed by those fed 50% discarded dates (30.59 LE). Results indicated that group fed the diets contained 75% discarded dates achieved the highest economical efficiency (1.3700) followed by diets contained 50% discarded dates (1.196). The corresponding values of relative economical efficiency of diets contained 75% and 50% discarded dates were (175.88) and (153.54), respectively.

Generally, The results of this study demonstrate that discarded dates can be used as a replacement for barely grains in rabbit diets at levels 50 and 75%. Moreover, the 75% had the best economical return over other treatments one. These results are in agreement with Khattab (2013) who found that replacement of corn grain with 100% dates can reduce the cost of concentrate mixture components of lactating ewes diet by about 24%. Also, El-Shora *et al.* (2014) reported that lactating Friesian cows fed 66% discarded dates showed the lowest feed cost/ kg and the best economical efficiency followed by those fed 100% discarded dates compared with control group.

It could be noticed that using discarded dates as a source of energy to replace barely grains in rabbit does ration tended to improve reproductive performance. This may be due to date palm possesses several highly beneficial properties such as antiviral, antifungal, antioxidant, antihyperlipidemic activity and hepatoprotective activity (Al-Farsi and Lee, 2008). These are attributed to the rich contents of antioxidants in date fruit such as the coumaric acid and ferulic acid. Moreover, it contains flavonoids, sterols, procyanidins, carotenoids, anthocyanins, sugar (glucose, sucrose and fructose), dietary fibers, less protein and fats, vitamins such as riboflavin, biotin, thiamine, ascorbic and folic acids, and minerals for example calcium, iron, copper, cobalt magnesium, fluorine, manganese, phosphorus, potassium, sodium, boron, sulfur, zinc and selenium within the date palm (Anjum *et al.* 2012).

Table (8). Effect of discarded dates on economical efficiency of rabbit does.

Item	Control	Discarded dates		
		25%	50%	75%
Price/kg diet	3.14	2.72	2.58	2.46
Total feed consumed doe/gestation period/kg	4.688	5.320	5.283	4.880
Total feed consumed doe/suckling period/kg	6.091	6.885	6.576	6.239
Total feed cost /doe (LE)	33.84	33.19	30.59	27.35
Litter size at weaning	4.30	5.04	4.80	4.63
Total revenue/ Litter at weaning (LE) ¹	60.20	70.56	67.20	64.82
Net revenue/doe (LE) ²	26.36	37.37	36.61	37.47
Economical efficiency (LE) ³	0.7789	1.1259	1.196	1.370
Relative economical efficiency	100	144.55	153.54	175.88

¹Total revenue = Litter size x14, assuming that the selling price of each rabbit at weaning was LE (14).

²Net revenue/ rabbit doe (LE) = Total revenue/ Litter at weaning- Total feed cost / rabbit doe.

³Economic efficiency = Net revenue/ rabbit doe/ Total feed cost / rabbit doe (LE).

CONCLUSION

It is concluded that discarded dates is a good sources of energy for breeding rabbit does. Does fed diets containing discarded dates at levels 25, 50 and 75% had better reproductive performance and economical efficiency compared with control diets. Moreover, using 75% discarded dates had the best net revenue, economical and relative economical efficiency.

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تأثير إستبدال حبوب الشعير بالبلح الفرز على الأداء التناسلي لأمهات الأرانب النيوزلاندى الأبيض.

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صمم هذا البحث لدراسة الأداء التناسلي لأمهات الأرانب المغذاة على مستويات مختلفة من البلح الفرز. فى البداية تم تجميع البلح الفرز وتم تجفيفه بالشمس وطحنه بالمطحنة قبل التحليل الكيماوى وتكوين العلائق. كونت 4 علائق تجريبية بها 18% بروتين و2500 طاقة مهضومة. العليقة الأولى هى عليقة الكنترول بينما فى الثلاثة العلائق الأخرى تم إستبدال حبوب الشعير بالبلح الفرز بنسبة 25، 50 و 75%. وزعت 20 أم نيوزيلندي أبيض عمر 5 اشهر وزن 27 ± 2.8 20. 12 كجم عشوانيا على أربع معاملات (5 أم لكل معاملة). تم تقدير الأداء التناسلى، مكونات الدم، نشاط الدرقية، تقدير هرمون البروجستيرون. أشارت النتائج الى:

- 1- لم يحدث أى تأثير معنوى بين المعاملات المختلفة فى طول فترة الحمل، المأكول اليومى والكلى، ووزن الأم عند التلقيح، ووزن الأم أثناء فترة الحمل والرضاعة والتغيير فى الوزن أثناء فترة الحمل والرضاعة ووجود زيادة غير معنوية فى كمية اللبن.
 - 2- وجد زيادة معنوية فى حجم الخلفة عند الميلاد ووزن الصغار عند الفطام مع الأرانب التى غذيت على 25% بلح فرز ووجد زيادة معنوية فى حجم الخلفة عند الفطام ووزن الصغار عند الميلاد مع الأرانب التى غذيت على 25 و 50% بلح فرز.
 - 3- وجد زيادة معنوية فى نشاط الكتاليز مع الأرانب المغذاة على 50 و 75% بلح فرز. ووجد أيضا نقص معنوى فى الجلوكوزو اللبيد بيروكسيد مع التغذية على 75% بلح فرز بالمقارنة بمجموعة الكنترول.
 - 4- أظهرت النتائج وجود زيادة معنوية فى هرمون البروجستيرون عند تغذية الأرانب على 25% بلح فرز. ولوحظ وجود فروق معنوية فى هرمون تريودوثيرونين عند نسبة 25 و 50% بلح فرز فى العليقة بالمقارنة بمجموعة الكنترول. ولكن لا يوجد أى فروق بين المعاملات المختلفة فى هرمون الثيروكسين.
 - 5- أظهرت النتائج ان المجموعة التى غذيت على 75% بلح فرز أعلى كفاءة إقتصادية يليها المجموعة التى غذيت على 50% بلح فرز
- الخلاصة: يمكن إستخدام البلح الفرز كمصدر للطاقة بدلا من الشعير بنسبة تصل الى 75% فى علائق أمهات الأرانب دون أى تأثير جانبي على الكفاءة التناسلية.