

REPRODUCTIVE PERFORMANCE AND MILK YIELD OF NEW ZEALAND WHITE RABBITS AS AFFECTED BY FEEDING OLIVE CAKE OR DATE STONE CONTAINING DIETS

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The present work was designed to study the effect of feeding crushed date stone (DS) or olive cake (OC) as partial replacement of yellow corn on reproductive performance and milk yield of New Zealand White (NZW) does and bucks.

Three experiments were conducted. The first experiment was conducted to determine the suitable amount of OC or DS in rabbit diet by digestibility trial. The digestibility trial indicated that substitution of 6.25 % of OC or DS by the same ratio of yellow corn in the commercial diets gave better digestion coefficients than 12.5%.

In the second experiment, 21 NZW doe rabbits aged 4-5 months and weighed about 3.1 kg were divided to three equal groups. The first group was considered as control group and fed commercial diet, the second and third groups were fed diets containing 6.25% OC and 6.25% DS, respectively. This experiment continued for two consecutive parities.

The obtained results revealed that, conception rate, number of services per pregnancy and litter size at birth and at weaning were improved insignificantly in DS and OC fed groups compared to control. However, litter weight at birth and weaning and average bunny weight at birth increased ($P < 0.05$) in OC group. While, feeding DS did not affect litter weight and bunny weight appreciably. Bunny weight at weaning, bunny daily gain and viability rates did not differ due to different diets. Total milk yield (4 weeks) was better ($P < 0.05$) in OC and DS groups than control. The total milk yield averaged 109.55, 133.93 and 129.64 g/day/doe in control, DS and OC fed groups respectively.

In the third experiment, three males produced from litters of each group of the second experiment were randomly chosen after 2 months of

weaning and fed the same diet regimes. At about 4.5 months of age, semen was collected twice-weekly for 6 weeks. The results revealed that, bucks fed OC or DS showed quiet improvement ($P < 0.05$) in sexual desire, sperm motility, sperm cell concentration and semen ejaculate volume compared to control. Total motile sperm output averaged 329.21, 295.63 and 243.65 $\times 10^6$ /ml in OC, DS and control groups, respectively.

Conclusively, it could be concluded that feeding 6.25% crushed date stone or olive cake as partial replacement of yellow corn in commercial diets of New Zealand White rabbits gave better reproductive performance of does and bucks and milk yield of does.

Key words: Olive cake; Date stone; Reproductive; Milk Yield; Semen; Rabbits.

In Egypt, generally and in Sinai especially, there is wide gap between the available feedstuffs and farm animal requirements. The shortage of cereal grains for human and animal consumption makes it necessary to seek for alternative feeding sources. The incorporation of untraditional agro-industrial by-products such as olive cake (El-Sayed, 2010) and date stones (Abd-El-Hay *et al.*, 2012) may partially help in solving the problem of feedstuffs shortage for animals. On the other side, all reasonable options must be considered and evaluated to maximize feed production and utilization efficiency. Studies on different replacement ratios of olive pulp, olive cake or date stone meal had appreciable effects on reproductive efficiency of Californian and New-Zealand White rabbits (Abdel-Ghaffar, 2002). In addition, Soliman *et al.* (2012), reported that rabbits have some characteristics that make them suitable as meat-producing small livestock. The small body size, short generation interval, high reproductive potential, rapid growth rate, genetic diversity and the ability to utilize forages and by-products as major diet components, favour them for mentioned functions. Also, rabbit's meat is rich in protein (21.8%), vitamins (B_{12}) and minerals and poor of saturated fat (25%) and cholesterol (31%) and its nutritional ranking is best and consequently may help to solve the problem of animal protein shortage (Dal Bosco *et al.*, 2012).

Therefore, the present study was designed to figure out the effect of feeding crushed date stone or olive cake as partial replacement of yellow corn to commercial diets on reproductive performance of male and female NZW rabbits.

MATERIALS AND METHODS

The present study was carried out at the Rabbits Farm, Department of Animal and Poultry Production, Faculty of Environmental Agricultural Sciences, Suez Canal University, EL-Arish, North Sinai, during the period from June 2013 to February 2014.

Experimental design:

Three experiments were carried out to study possibility of using olive cake or crushed date stone to feed NZW rabbits, through partial substitution of yellow corn in commercial diets and study their effects on reproductive, productive and milk yield performance.

First experiment:

The first experiment was designed to determine the suitable amount of olive cake or date stone in feeding diets using digestibility trials. This was performed by replacing quarter (6.25%) or half (12.5%) the ratio of yellow corn (25 kg/100 kg) in the commercial rabbit diet by olive cake or crushed date stone. Fifteen NZW bucks aged seven months of nearly equal weights (3.250 kg) were divided randomly into five equal and similar groups (three bucks in each). The bucks were fed different five diets as illustrated in Table (1) and the chemical analysis in Table 2.

According to Perez *et al.* (1995), Rabbits were individually housed in metabolic cages supported by feces collection wire nets. All tested diets were offered *ad libitum*. Fresh water was provided all the time. The total period of digestibility trial was three weeks, the first two weeks was considered as a preliminary period followed by 7 days collection period. The feces were dried at 60°C for 48 hours. At the end of collection period, all collected feces for each rabbit were weighed, pooled and stored at 2-5 °C for chemical analysis.

The chemical analysis of the experimental samples were conducted according to AOAC (1995). Digestion coefficients were estimated and the nutritive values as digestible crude protein (DCP %) and total digestible nutrients (TDN %) were calculated according to classic formula as described by Cheeke *et al.* (1986).

Table 1. Ingredients of experimental diets used in digestibility trial.

Ingredients	Dietary groups				
	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Yellow corn	25	18.75	12.5	18.75	12.5
Soya bean	20	20	20	20.5	21
Olive cake	-	6.25	12.5	-	-
Date stone	-	-	-	6.25	12.5
Wheat bran	26	26.5	26.5	26	26
Clover straw	9.6	9.1	9.1	9.1	8.6
Hejaz clover hay	15	15	15	15	15
Di calcium	1.5	1.5	1.5	1.5	1.5
Lime stone	2	2	2	2	2
Sodium chloride	0.5	0.5	0.5	0.5	0.5
Premix*	0.3	0.3	0.3	0.3	0.3
Anti-fungi**	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100

Diet 1: Control group (0%), **Diet 2:** Olive cake (6.25%), **Diet 3:** Olive cake (12.50%), **Diet 4:** Date stone (6.25%), **Diet 5:** Date Stone (12.50%).

* **One kilogram of premix contain:** Vit. A 12000 000 IU, Vit. D3 2200 00 IU, Vit. E 1000 mg, Vit. K₃ 2000 mg, Vit. B₁ 1000 mg, Vit. B₂ 4000, Vit. B₆ 100 mg, Vit. B₁₂ 10 mg, Pantothenic acid 3.33 g, Biotin 33 mg, Folic acid 0.83 g, Choline chloride 200 g, Zn 11.79 g, Mn 5 g, Fe 12.5 g, Cu 0.5 g, I 33.3 mg, Se 16.6 mg and Mg 66.7 g.

** **Produced by:** The Egyptian French Factory.

Table 2. Chemical analysis (%) of olive cake, date stone and the experimental diets.

Ite ms	Dry matter	% On dry matter basis					ASH
		Organic matter	Crude protein	Ether Extract	Crude Fiber	Nitrogen Free Extract	
Olive	93.27	72.87	9.49	8.83	20.43	34.12	27.13
Date	88.04	91.99	8.90	7.39	6.01	69.60	8.01
Di	90.16	88.3	18	3.30	13.31	51.72	11.70
Di	89.93	90.47	18.04	3.75	14.36	51.06	10.53
Di	89.8	88.35	18.3	4.33	15.55	52.14	11.65
Di	90.86	93.48	18.05	3.15	13.66	54.91	6.52
Di	90.39	92.71	18.09	3.70	14.00	55.41	7.29

Diet 1: Control group (0%), **Diet 2:** Olive cake (6.25%), **Diet 3:** Olive pulp (12.50%), **Diet 4:** Date stone (6.25%), **Diet 5:** Date Stone (12.50%).

Second experiment:-

The second experiment was carried out to investigate the influence of feeding diets containing 6.25% olive cake or date stone (Table 1) instead of yellow corn (as control group) on reproductive performance and milk yield of rabbits. Twenty-one NZW does, aged 4-5 months and weighed about 3.1 kg, were divided randomly to three equal comparable groups (7 each). The data of two consecutive parities (the second and the third parity) from each group were collected and analyzed together.

Females were kept in individual cages with nest boxes (38×28×25 cm) for parturition. Cages had galvanized sheet walls and double wire floor and manual closure to allow for programmed suckling. The sexually receptive does were introduced to fertile buck for natural mating. The pregnancy was diagnosed by abdominal palpation after ten days of mating. Those who failed to conceive were re-mated. Milk yield was estimated by the difference in weight of the bunnies after and before suckling. Reproductive parameters were recorded as follows:

Number of services per conception (NSC) at a given doe was considered as the total recorded number of services of this particular doe until conception.

Gestation period (GP) in days was calculated from date of fertile mating to delivery.

Pregnancy rate (PR %): (Number of pregnant does/number of mated does) $\times 100$.

Litter size at birth (LSB): Number of offspring on the 1st day of delivery.

Litter size at weaning (LSW); Number of offspring at weaning and it was recorded for each doe.

Viability rate (VR); Number of alive offspring up to weaning.

Third experiment:

After 2 months of weaning, three males produced from each group of the second experiment were chosen, allocated in three equal groups and were continuously fed three different diets containing olive cake or date stone (6.25% replacement of yellow corn) compared with commercial diet. The pelleted diets were covering the nutritional requirements of the growing and pubertal phase of rabbits according to NRC (1977). At about 4.5 months of age, semen was collected twice a week for 6 weeks, using an artificial vagina and immediately evaluated. Semen ejaculate volume, sperm motility (%), sperm cell concentration and reaction time (RT) for each buck were recorded according to Fallas-López *et al.* (2011) and Abd El-Azim and El-kamash (2011).

Statistical analysis:

Data were analyzed using the General Linear Model (GLM) procedure of SAS software (SAS Institute Inc., 2004, SAS/STAT[®] 9.1, NC). The application of means significance tested for the differences among the different groups or sampling times were done according to Duncan (1955). The completely random design was performed to estimate the frequencies and performance index according to Snedecor and Cochran (1989). Pregnancy rates were compared amongst groups using Chi square analysis.

RESULTS AND DISCUSSION***First experiment***

Digestibility coefficients and nutritive values of the experimental rabbit diets are shown in Table 3. The results showed that diets contained 6.25% olive cake (OC) as a partial replacement of yellow corn resulted in a significant ($P<0.05$) increase in digestibility coefficients of crude fiber (CF), crude protein (CP), ether extract (EE), digestible crude protein (DCP) and total digestible nutrients (TDN) as compared to 12.5% OC replacement. Also 6.25% OC diet gave higher values ($P<0.05$) of TDN and CF as compared to control diet values. The digestibility coefficients of organic matter (OM), crude protein (CP) and DCP were insignificantly higher in 6.25% OC diet group than that in control.

Concerning the diet containing 6.25% DS (Table 3), TDN was ($68.6\pm 0.37\%$) improved significantly ($P<0.05$), while the other parameters did not change appreciably comparing with control group. Nevertheless, there is a significant improvement ($P<0.05$) in CP, EE digestibility and nutritive values (DCP and TDN) in comparing with 12.5% DS diet (Table 3). Generally, data in Table (3) illustrated that, feeding rabbits by diets containing 12.5% DS decreased significantly ($P<0.05$) CP, EE, CF and DCP values as compared to control. However, TDN values in 12.5% DS group did not change significantly as compared to control.

The data in Table (3) showed that using 6.25 % OC were insignificantly differ with 6.25% DS in all measurements except CF. Also the results of 12.5% OC or DS were almost the same. The obtained results from 6.25% OC or DS diets were higher than that of control or 12.5% in most measurements.

Table 3. Means \pm SE of digestion coefficients and nutritive values of the experimental diets (on dry matter basis).

Items	Experimental diets ^(*)				
	CTRL*	Olive Cake		Date Stone	
		6.25 %	12.50 %	6.25 %	12.50 %
OM	70.58 ^{ab} \pm 1.07	71.08 ^a \pm 0.53	69.14 ^{ab} \pm 0.40	70.39 ^{ab} \pm 0.39	68.25 ^b \pm 1.10
CP	65.45 ^a \pm 0.47	66.03 ^a \pm 0.38	60.01 ^b \pm 0.77	66.02 ^a \pm 0.45	60.98 ^b \pm 1.04
EE	70.20 ^a \pm 0.77	69.60 ^a \pm 0.30	65.82 ^b \pm 0.57	70.98 ^a \pm 0.27	67.33 ^b \pm 0.74
CF	33.33 ^b \pm 0.68	41.49 ^a \pm 2.06	31.47 ^{bc} \pm 0.98	31.82 ^{bc} \pm 1.09	24.88 ^c \pm 2.01
NFE	81.56 \pm 1.55	80.68 \pm 1.67	84.43 \pm 0.70	80.70 \pm 0.27	81.29 \pm 1.17
DCP	11.78 ^a \pm 0.08	11.91 ^a \pm 0.08	10.98 ^b \pm 0.14	11.92 ^a \pm 0.08	11.03 ^b \pm 0.19
TDN	65.22 ^b \pm 0.97	67.57 ^a \pm 0.47	64.65 ^b \pm 0.36	68.60 ^a \pm 0.37	66.39 ^{ab} \pm 1.01

^(*)CTRL, The basic control diet; 6.25 % and 12.50 % refer to the replacement percentage of olive cake or date stone with yellow corn in commercial base diet.

a, b, and c :Means within the same row with different superscripts differ significantly (P<0.05).

The present results are in agreement with EL-Sayed (2010) who found that digestion coefficients values of DM, OM and CP were 67.05, 68.28 and 71.38% respectively, using groups fed on olive cake meal. In addition, present results are in general agreement with other researchers (Abd El-Galil, 2001; Abd El-Rahman *et al.*, 2003 and Mustafa *et al.*, 2009), who reported that the nutrient digestibilities were decreased with increasing olive pulp inclusion in the diet. Similarly, Tortuero *et al.* (1989) reported that digestibility coefficient of crude protein for New Zealand white rabbits fed diet containing 30% olive pulp were on average of 66.1%. Moreover, Attia (1994) found that the nutritive values as starch value and TDN of rabbit ration contained DS were decreased by increasing DS levels in tested ration. Increasing of DS in rabbit diets up to 25% decreased significantly the digestibility coefficient of CP, consequently digested crude protein and the digestible energy (kcal/kg) than in the control (Soliman *et al.* 2012). Similarly, Chaabane *et al.*, 1997 reported that increasing olive cake up to 30% in diets for 16 week-old Hyla rabbits resulted in lower digestibility of DM, OM, CF and total nitrogen with diets containing olive cakes than in the control. The reduction in nutrient digestibility by increasing olive pulp (OP) levels in rabbit diets explained by Mustafa *et al.* (2009) to be probably due to the negative effect of more

complex tannins in OP, high content of lignin and other poorly digested components, most of total nitrogen in OP is linked to lingo-cellulose compounds and the high content of acid detergent lignin and acid detergent fiber in OP. In additions, Aguilera (1987) reported that the decrease in digestibility of CP and CF may be attributed to the relatively high lignin content of olive pulp and the fact that most of its total nitrogen is linked to lignocelluloses which are the two main factors limiting the digestive utilization of olive residues.

Based on results of the present experiment, it could be reported that substitution of 6.25% of olive cake or crushed date stone instead of the same percentage of yellow corn gave good digestibility and nutritive value and could be used to feed rabbits. Therefore, in the present work, 6.25 % partial replacement of yellow corn by OC or DS as industrial by-products was used in the subsequent two experiments to study their effect on some productive, reproductive traits and milk yield.

Second experiment:-

Reproductive performance traits of doe rabbits (Tables 4,5 and 6) as affected by feeding different diets, showed that averages of mating weights and gestation lengths were in normal ranges of NZW rabbits and were almost similar. Service numbers per pregnancy in treated groups were almost the same as compared to control one, However, Conception rate was insignificantly better (85.7%) in OC group than the DS or control (78.5%) as illustrated in Table (4). These results were agreed with the findings of Mahmoud *et al.* (1998), Salwa *et al.* (1999), Bassuny (1999) and Soliman *et al.* (2012).

The mean litter size at birth and weaning were insignificantly better in treated groups than in control group (Table 5). However, litter weight at birth and at weaning increased significantly ($P<0.05$) due to feeding OC diet and insignificantly in DS group as compared to control. Abdel Ghaffar (2002) demonstrated that supplementation of rabbits with olive pulp increased ($P<0.05$) litter size at birth, 21 days and at weaning by 21.7, 36.4 and 37.8% in Cal rabbit and 21.4, 29.3 and 37.5 % in NZW rabbits, respectively. Similarly, litter weight at birth, 21 days and weaning increased ($P<0.05$) due to treatment of heat stressed Cal and NZW does with olive pulp by 71.9, 62.3 and 91.9 % and 68, 78.3 and 90.3%, respectively. On contrarily, feeding DS did not affect litter weight at birth appreciably in comparing with control group. Moreover, there is significant increase ($P<0.05$) in litter weight at weaning and it may be due to the increase of does milk yield as shown in Table 7. Elgasim *et al.*

Table 4. Means \pm SE of mating weights, number of services per pregnancy, conception rates and gestation lengths of NZW does rabbit fed three different diets.

Parameters	Treatments		
	Control	Olive cake	Date stone
Mating Weight (kg)	3.127 \pm 0.029	3.120 \pm 0.031	3.102 \pm 0.033
NO. of Services/Conception	1.29 \pm 0.16	1.21 \pm 0.11	1.21 \pm 0.11
Conception Rate %	78.57 \pm 0.11	85.71 \pm 0.10	78.57 \pm 0.11
Gestation Length (day)	31.14 \pm 0.23	31.50 \pm 0.20	31.57 \pm 0.33

Table 5. Effect of experimental diets on litter size and litter weight of NZW does rabbit (Means \pm SE).

Parameters		Treatments		
		Control	Olive cake	Date stone
Litter Size at Birth	Total	6.64 \pm 0.25	7.07 \pm 0.20	6.93 \pm 0.20
	Live	6.50 \pm 0.29	7.00 \pm 0.21	6.93 \pm 0.20
Litter Size at Weaning	Total	6.14 \pm 0.33	6.71 \pm 0.19	6.71 \pm 0.24
	Live	5.93 \pm 0.25	6.57 \pm 0.17	6.43 \pm 0.23
Litter Weight at Birth (g)	Total	296.43 ^b \pm 15.40	337.86 ^a \pm 10.76	320.71 ^{ab} \pm 12.13
	Live	291.07 ^b \pm 16.82	334.64 ^a \pm 11.30	320.71 ^{ab} \pm 12.13
Litter Weight at Weaning	Total	2226.07 ^b \pm 84.25	2494.64 ^a \pm 98.93	2600.71 ^a \pm 120.18
	Live	2195.64 ^b \pm 87.22	2482.86 ^a \pm 99.64	2560.57 ^a \pm 127.71

a, b, and c :Means within the same raw with different superscripts are significantly different (P<0.05).

(1995) reported that date pits contain estrogenic-like compounds. Also, Aldhaferi *et al.* (2004) and Ali *et al.* (1999), indicated that the estradiols concentration in serum of rats decreased significantly (P<0.05) as the percentage of date pits increased. The reduction of estradiol levels may contribute to gonadotrophic hormones levels and consequently ovulation rates.

Mean bunny weight at birth increased (P<0.05) significantly in olive cake group compared to control group (Table 6). Date stone group did not differ significantly with control. In addition, the mean of bunny weight at weaning, bunny daily gain and viability rates did not differ significantly due to the two treatments compared to control. The insignificant increase of bunny weight gain may be due to the does milk yield (Table 7).

Table 6. Means \pm SE of bunny weight, daily gain and viability as affected by olive cake and date stone containing diets.

Parameters		Treatments			
		Control	Olive cake	Date stone	
Bunny Weight (g)	Birth	44.64 ^b \pm 1.19	47.83 ^a \pm 0.88	46.28 ^{ab} \pm 1.10	
	Weaning	380.01 \pm 15.19	379.54 \pm 10.69	403.94 \pm 10.25	
Bunny Daily Gain (g/d)		11.98 \pm 0.54	11.85 \pm 0.36	12.78 \pm 0.34	
Viability (%)	Birth	97.62 \pm 1.62	98.98 \pm 1.02	100	
	Weaning	97.39 \pm 1.82	98.21 \pm 1.79	96.17 \pm 2.13	

a, b, and c :Means within the same raw with different superscripts are significantly different (P<0.05).

The present results were partially agreed with Abdel Ghaffar (2002) who showed that bunny weight gain improved (P<0.05) as a function of olive pulp meal. Also, treatment heat stressed rabbits with olive pulp increased (P<0.05) bunny weight mean at birth, 21 days and weaning in California and New Zealand White does with 40.9, 26.2 and 38.2 % and 38.1, 36.4 and 33.7 %, respectively. Number of rabbits died at 21 days and weaning were not affected significantly by olive pulp, compared with control group. Regarding this concern, increasing date stone meal in doe rabbit diets (Soliman *et al.*, 2012) up to 25% showed no bad effects on the productive traits of the offspring. Meanwhile, present results are within the normal range of NZW rabbits which obtained by many authors (Nasr 1998; Bassuny, 1999; and Marai *et al.*, 2001).

Results in Table (7) demonstrated that olive cake or date stone containing diets resulted in significant increase in total milk yield in all measured intervals from birth to weaning compared to control group. The significant increase of milk yield may be attributed to the improvement of nutrient digestibility as resulted in the first experiment (Table 3). Also may attributed to that olive cake and date stone are rich in antioxidant and minerals and it could be considered as anti-stressors agent. The current results are in agreement with Abdel Ghaffar (2002) who showed that total milk yield from (birth-10), (birth-21) and (birth-28) increased (P<0.05) due to using olive pulp in feeding Cal and NZW does that increase was 45.4, 34.4 and 41.2 % and 73.1, 47.7 and 53.5 %, respectively. While, in Egyptian buffaloes Mustafa *et al.* (2008) reported insignificant differences among treatments for milk yield between rations containing olive pulp compared to the control. In addition, Sabri *et al.* (2010)

Table 7. Effect of olive cake and date stone containing diets on milk yield of NZW doe rabbits (Means \pm SE).

Treatments	Milk Yield (g/ week /doe)				Total milk yield (g)	Milk yield (g/day/doe)
	First Week	Second Week	Third Week	Fourth Week		
Control	630.00 ^b ± 36.51	765.00 ^b ± 34.19	882.50 ^b ± 25.73	790.00 ^b ± 32.96	3067.50 ^b ± 127.50	109.55 ^b ± 4.55
Olive cake	745.00 ^a ± 31.23	912.50 ^a ± 31.02	1037.50 ^a ± 21.89	935.00 ^a ± 27.56	3630.00 ^a ± 108.43	129.64 ^a ± 3.87
Date stone	780.00 ^a ± 26.82	947.50 ^a ± 33.52	1057.50 ^a ± 27.50	965.00 ^a ± 32.96	3750.00 ^a ± 116.77	133.93 ^a ± 4.17

a, b, and c :Means within the same column with different superscripts are significantly different ($P < 0.05$).

demonstrated that lactating Damascus goats could be fed with 10% olive cake (OC) diets without any negative effects on milk composition and yield. Also usage of olive cake was recommended in goat diets because of its low cost. Increasing of date stone meal in rabbit rations up to 25% (Soliman *et al.*, 2012) gave less milk yield (2.013-3.115 kg/doe) than that obtained in the present study (3.750 kg/doe) during suckling period (28 days).

Third experiment:

Table (8) showed that sexual desire expressed as reaction time (RT) was improved ($P < 0.05$) in treatment groups compared to control. The averages of reaction time were 11.66, 6.80 and 6.93 seconds for control, olive cake and date stone groups, respectively. In general, the results obtained in this study were in average range and agreed with most literature reviewed as (Fallas-López *et al.* (2011). The difference between control group and olive cake or date group was few seconds and in practice, it is not large difference.

Feeding olive cake or date stone supplemented diets by the suitable mentioned ratio increased ($P < 0.05$) each of individual motility and sperm cell concentration ($\times 10^6$). Semen ejaculate volume without gel material and total motile sperm per ejaculate recorded slightly improvement in treated groups with no significantly differences comparing with control group. However, there was a significant increase observed in total motile sperm per milliliter due to olive cake or date stone. Using olive cake meal or date stone in rabbit diets had good effects on reaction time and physical semen characteristics, since the rations may fulfill some traces of minerals, vitamins or other metabolites, which increase the spermatogenesis. In addition, the improvement in male reproductivity due to olive cake treatments might be attributed to that the olive cake had high amount of unsaturated fatty acids, which stimulate

Table 8. Sexual desire and semen characteristics as affected by olive cake and date stone containing diets (Means \pm SE).

Items	Treatments		
	Control	Olive Cake	Date Stone
Reaction time	11.66 ^b \pm 1.42	6.80 ^a \pm 1.00	6.77 ^a \pm 1.06
Ejaculate Volume (ml)	Total	0.62 ^b \pm 0.04	0.61 ^b \pm 0.05
	Gel	0.07 \pm 0.04	0.03 \pm 0.02
	Without gel	0.55 \pm 0.03	0.58 \pm 0.05
Initial Motility %	65.18 ^b \pm 1.04	72.14 ^a \pm 0.94	73.28 ^a \pm 0.83
Sperm Cell Concentration (X10 ⁶)	347.20 ^b \pm 48.63	434.29 ^a \pm 48.79	392.41 ^a \pm 45.92
TMSEJ (X10 ⁶) *	138.69 \pm 21.08	188.94 \pm 23.80	194.80 \pm 25.19
TMSML (X10 ⁶) **	243.65 ^b \pm 35.40	329.21 ^a \pm 39.40	295.63 ^{ab} \pm 33.72

* Total motile sperm per ejaculate ** Total motile sperm per ml.
a, b, ... means within the same raw with different subscripts differ significantly (P<0.05).

steroid hormone secretion. All values obtained in this study were in normal ranges and agreed with Roca *et al.* (2005) and (Fallas-López *et al.* (2011). Regarding using olive cake or date stone and their impact on reproductive efficiency of rabbit bucks, there is a lack in literatures. Nevertheless, many authors (Nasr, 1998; Daghash *et al.*, 1999 and El-Nattat and El-Kady, 2007) studied the using of Agro-industrial by-products and observed improvement in semen characteristics of rabbit bucks. Including of the diets with the level of 6.25% olive cake or crushed date stone might be useful in feeding rabbits. Increasing the levels of these agro-industrial by-product might affect adversely digestibility coefficients, productive and reproductive performance of male and female rabbits.

Conclusively, it could be concluded that, replacing 6.25% yellow corn by olive cake or crushed date stone to feed NZW rabbits gave better productive and reproductive performance.

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الأداء التناسلي وإنتاج اللبن للأرانب النيوزيلندي الأبيض المغذاة على تفل الزيتون ونوى البلح

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تم تصميم هذا العمل لدراسة تأثير التغذية على نوى البلح (DS) أوتفل الزيتون (OC) كإحلال جزئى محل الذرة الصفراء على الأداء التناسلي وإنتاج اللبن في الأرانب النيوزيلندي الأبيض (NZW). وقد أجريت ثلاث تجارب في هذه الدراسة، التجربة الأولى

لتحديد كمية الاحلال المناسبة لكل من OC أو DS بدلاً من الذرة الصفراء (YC) وذلك من خلال تقدير القيمة الغذائية ومعاملات الهضم للعلائق. أوضحت نتائج تجارب الهضم أن لنسبة إحلال ٦.٢٥ % لكل من OC أو DS بدلاً من YC فى العلائق التجارية أعطت معاملات هضم أفضل من نسبة احلال ١٢.٥ % .

فى التجربة الثانية استخدم ٢١ أنثى أرنب NZW متوسط أعمارها ٤-٥ أشهر ومتوسط الوزن ٣.١ كجم قسمت إلى ثلاثة مجاميع متساوية. المجموعة الأولى غذيت على عليقة تجارية واعتبرت كمجموعة ضابطة (Control) والمجموعة الثانية والثالثة تم تغذيتها على عليقة تحتوي على تفل الزيتون OC ونوى البلح DS بنسبة احلال ٦.٢٥ % من الذرة الصفراء، على التوالي. واستمرت التجربة لولادتين متتاليتين.

أوضحت النتائج إلى أن معدلات الحمل وعدد التلقيحات اللازمة للحمل وعدد المواليد لكل أم عند الميلاد وعند الفطام قد تحسنت قليلاً ولكن بفروق غير معنوية مقارنة بالمجموعة الضابطة. ومع ذلك فإن وزن المواليد والفطام لكل أم ومتوسط أوزان المواليد وقت الميلاد عند التغذية على OC قد تحسنت ($P < 0.05$) معنوياً. بينما لم تؤثر مجموعة DS معنوياً من حيث متوسط وزن المواليد لكل أم. متوسط وزن المواليد عند الفطام ومعدل نموها اليومي ونسبة النفوق لم تختلف في كلا المجموعتين عن المجموعة الضابطة. إنتاج اللبن الكلي (في ٤ أسابيع) كان أفضل ($P < 0.05$) في مجموعتي OC و DS عن مجموعة المعاملة. حيث كان متوسط إنتاج اللبن ١٠٩.٥٥، ١٣٣.٩٣ و ١٢٩.٦٤ جم / أم /يوم في المجموعة الضابطة و DS و OC على التوالي.

فى التجربة الثالثة تم استخدام ثلاثة ذكور عشوائياً من أمهات المجموعات الثلاثة السابقة بعد شهرين من الفطام وتم تغذيتها على علائق تحتوي على ٦.٢٥ % من تفل الزيتون أو نوى البلح بالإضافة للمجموعة الضابطة التي غذيت على عليقة تجارية تناسب مرحلة النمو من حيث كمية الطاقة والبروتين. وعند عمر ٤.٥ شهر تم جمع عينات السائل المنوي مرتين أسبوعياً واستمر الجمع لمدة ٦ أسابيع. وأشارت النتائج إلى أن تغذية الذكور على OC أو DS أدى الى تحسن ($P < 0.05$) فى الرغبة الجنسية، نسبة الحيوانات المنوية المتحركة، عدد الحيوانات المنوية المتحركة وحجم القذفة مقارنة بالمجموعة الضابطة. كان متوسط تركيز الحيوانات المنوية المتحركة فى مجموعة OC 329.21×10^6 وفي مجموعة DS كان 295.63×10^6 مقارنة بـ 243.65×10^6 حيوان منوي/مل فى مجموعة المقارنة.

التوصية: وبذلك يمكن القول بأن التغذية على ٦.٢٥ % تفل الزيتون أو نوى البلح محل نفس النسبة من الذرة الصفراء فى العلائق التجارية كان له تأثير جيد على الأداء التناسلي فى كل من الذكور والاناث وأيضاً زيادة إنتاج اللبن فى إناث الأرنب النيوزيلندى الأبيض.