

Technical and Economic efficiency of the ruminants feed on Date Seed in Matrouh Governorate

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Abstract— Ruminants occupies an advanced rank between farm livestock,, due to its suitability to life under difficult environmental conditions, especially in Egyptian desert governorates .

The high cost of sheep and goat nutrition lead to low the animal meat unit productivity, and low the producer's profit, which facing many investors in the field of sheep and goat breeding in the Egyptian desert governorates. The problem of the study is the high cost of ruminants nutrition (around 60% from the variable total costs), despite there are many high nutrition values of agriculture residues which can enter in the composition of nutrition diet for sheep and goat.

The research aims identify the optimal diet for fattening ruminants in order to maximize the productivity of sheep on one side and on other hand to minimize the cost of sheep nutrition. The research was based on the results of the experiment, that was carried out during the period from April 2017 to March 2018 at Matrouh Resource Development Center, that belongs to the Desert Research Center. The main result is that date seeds as a cheap source of energy, might be used successfully and economically in small ruminant rations during different physiological stages without adverse effects, due to estrogen-like compounds, on their productive and reproductive performance.

Keywords— Ruminants feed, date seed, Matrouh, Technical efficiency, Economic efficiency.

I. INTRODUCTION

Small ruminants (goats and sheep) are a major component of the economic activity and social system of the people of the desert areas of the Arab Republic of Egypt. These animal species are distributed as animals adapted to the natural ecosystem and are the main source of human food (milk and meat). These animals have the appropriate development of their potential as other farm animals, due to their association with dry natural pasture areas in Egypt.

Small ruminants suffer from nutritional, reproductive and health problems in these areas, resulting in low productivity, poor disease resistance and high mortality in their young ones, which hinders the development of their production of milk, meat, leather, wool, wool, hair and other products of great importance to the people of the desert areas.

Owing to the shortage and high costs of animal feeds, especially the grains where a large proportion of it is imported to the country, it becomes necessary to use the industrial or agricultural by-products as a compensatory feeds in animal feeding. The gap between the availability and requirements of feeds is wide and the estimated shortage tended to increase from 3.1 (Abou-Akkada, 1988) to 4.92 million tons TDN by the year 2000 (El-Shazely, 1988). Several efforts were carried out to use local by-products (such as date seeds) in animal feeding as an attempt to solve feed shortage problems.

Dates *Phoenix dactylifera* L. are very popular in most of the Middle Eastern countries. Over 70% of the total world production is produced in this area. Egypt is the second important country in date world production which produces 1,166,182 tons (FAO, 2004), where the seeds represent

about 20.8 % (Kholif, 1997). One hundred and twenty thousand tons of seeds may be used as a feedstuff which is very rich in carbohydrates and amino acids (El-Boushy, 1990). Date seeds had a higher TDN value and contained relatively high percent of fat with a high coefficient of digestibility (Abou El-Naser, 1985). Many workers had reported that date seeds could be used economically and successfully for ruminants' nutrition; they could be used as an energy source to replace a part of concentrates in the ration (Al-Dabeeb, 2005). Date seeds supplemented diets might improve animal performance due to growth stimulating hormones (as estrone, 1.9 mg/kg) that were found in date seeds (Barreveld, 1993).

Research Objectives

- Determine the estrogen-like compounds concentrations in the date seeds and their effects on estrus cyclicity, hormonal profiles and reproductive performance as well as productive efficiency of Barki ewes when fed on date seeds.
- Determine the optimum diet in order to maximize the productivity of small ruminants
- Reduce the cost of nutrition, allowing small-scale farmers to continue to produce optimal production, particularly in desert areas of relative importance in the production of these ruminants.

II. METHODOLOGY

The physiological experiment was conducted to determine estrogen-like compounds concentrations in the date seeds and their relation to estrus cyclicity, hormonal profiles and reproductive performance as well as productive efficiency of small ruminants (Barki ewes) fed the date seeds as a partial or full replacer of yellow corn in the concentrate ration by either 50% or 100% over full reproductive cycle.

The research was based on descriptive analysis; Also use the nutrition problem model (using linear programming method) as one of the methods of process research for the formation of homozygous in the field of small ruminants.

Sampling and Data collection

The research was based on the results of the experiment, that was carried out during the period from April 2017 to March 2018 at Matrouh Resource Development Center, that belongs to the Desert Research Center. Seventy five Barki ewes (2.0-2.5 years old and 37.8 ± 0.63 kg average body weight) were assigned into three groups (25 each). First group (G1) was served as control (0.0% date seeds) and fed a concentrate ration consisted of 43% yellow corn, 22%

cotton seed meal, 20% wheat bran, 12% rice bran, 1.5% limestone, 1% sodium chloride and 0.5% minerals mixture. Date seeds were used as a partial or full replacement of the yellow corn in the concentrate ration by either 50% (G2) or 100% (G3). All ewes groups were offered barseem (*Trifolium alexandrinum*) hay ad libitum, as a basal roughage diet, and rations were adjusted monthly to cover their requirements during their physiological status according to Kears (1982). Water was available to all groups twice daily. Animals were kept in semi-open pens roofed with wood, and were clinically healthy and free from internal and external parasites. Mating season started in June and lasted for 51 days (equal to 3 estrous cycles). Five fertile rams were allowed to rotate among different ewes groups to avoid sire/group confounding effect. Rams were fed the control concentrate ration and removed from the ewes groups at early morning before offering rations.

Once lambing took place, the born lambs were earing tagged and weighed to record their birth weight. Lambs were left with their dams till 3 months (90 days), then weaned and weaning weight was recorded and adjusted for 90 days.

Statistical analysis

First the Technical Experience: Data of estrus activity was analyzed using "all or non traits" according to **Snedecor and Chocran (1980)**, while continuous data were subjected to an analysis of variance utilizing GLM model of SAS for repeated measurements and means were compared using Duncan Multiple Range Test. Model 1 (for birth, weaning and marketing weights)

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

Where:

Y_{ij} = Trait

μ = Mean

T_i = Effect of treatment, i, 1-3 (1 = 0% date seeds, 2 = 50% date seeds, 3 = 100% date seeds)

e_{ij} = Experimental error

Model 2 (for blood parameters and milk constituents)

$$Y_{ijk} = \mu + T_i + S_j + TS_{ij} + e_{ijk}$$

Where:

Y_{ijk} = Trait

μ = Mean

T_i = Effect of treatment, i, 1-3 (1 = 0% date seeds, 2 = 50% date seeds, 3 = 100% date seeds)

S_j = Effect of stage, j, 1-3 (1 = early, 2 = mid, 3 = late)

TS_{ij} = The interaction between treatment and stage

e_{ijk} = Experimental error

Second the economic evaluation: A linear programming model to suggest optimum diet for fattening lambs in the study area.

$$\text{Min. } G_1 = \sum_j X_j P_j$$

Subject to

$$\sum_j a_{ij} X_j \geq C_j \quad (\text{m inequalities in n variables})$$

And $X_j \geq 0$

m: Number of nutrients

n : Number of feed varieties

a_{ij}: number of kilograms of nutrient i in one unit of food j.

C_j: The minimum number of kilograms of food element i required in one day.

P_j: The cost of one unit of food j.

X_j: The number of units of feed category j consumed in one day.

III. RESULTS AND DISCUSSION

Body weight changes of ewes and growth performance of lambs

Ewes of the different experimental groups gained weight during the five months of gestation period with mean values being 5.3, 6.7 and 7.6 kg for G1, G2 and G3, respectively, with favor to date seed groups (Table 1), indicating better nutritional management during the different physiological stages and proved that date seeds have potentiality to incorporate into feed mixture for ruminant.

Table.1: Body weight changes (kg) of the different experimental groups during gestation period

Item	G1	G2	G3
Initial body weight	37.90	37.70	37.90
Weight just before lambing	55.50	55.70	56.60
Weight just after lambing	43.20	44.40	45.50
Weight gain during pregnancy period	5.3	6.7	7.6
Conceptus weight	12.30	11.30	11.10

G1; the control concentrate ration (0.0% date seeds), G2; 50% date seeds, G3; 100% date seeds as a partial or full replacer of corn in the concentrate ration.

On the other hand, productive parameters in terms of birth weight, weaning weight and marketing weight did not differ significantly (Table 2) and indicate better performance of the two date seed groups compared to control one. The decrease in post-weaning average daily gain might be attributed to decreased digestibility coefficients as a result of the relative increase in crude fibers as well as low protein content as reported by **Khamis et al. (1989)**.

Table.2: Some productive traits (mean ± SE) of the different experimental groups

Item	G1	G2	G3
Average birth weight (kg)	3.89 ± 0.11	3.93 ± 0.09	3.70 ± 0.09
Average weaning weight (kg)	20.9 ± 0.93 ^B	22.4 ± 0.78 ^A	23.7 ± 0.83 ^A
Average daily gain from birth to weaning (g/h/d)	188 ± 10.36 ^C	207 ± 10.26 ^B	221 ± 10.36 ^A
Average marketing weight (kg)	45.4 ± 2.62	44.7 ± 2.49	46.6 ± 2.62
Daily gain from weaning to marketing (g/h/d)	136 ± 20.54	124 ± 20.45	127 ± 20.45
Total milk yield (ml/h/d)	441 ± 21.2 ^C	495 ± 21.2 ^B	585 ± 21.2 ^A

G1; the control concentrate ration (0% date seeds), G2; 50% date seeds, G3; 100% date seeds as a partial or full replacer of corn in the concentrate ration.

Weaning age = 3 months, Marketing age = 9 months

Different superscripts (A, B, C) in a row indicate significance (P< 0.05).

Growth rate, particularly in growing animals, is an important measure for the evaluation of new feed resources because it represents the total effect of most feed properties.

Date seed groups showed a better maternal and mothering abilities reflected on the pre weaning average daily gain where they scored 207 and 221 g/day for G2 and G3,

respectively as compared to control one that scored the lowest value (188 g/day). These values were coincided with higher milk yield reported for the same respective groups (495 and 585 ml/head/day) compared with control one (441 ml/head/day). Thus, weaning weight at 90 days old was

found to be heavier in both G2 (22.4 kg) and G3 (23.7 kg) as compared to G1 (20.9 kg). However, weaning weights recorded for the three ewe groups were in accordance with that (22.3 kg) recorded by **Abdel-Aziz (2004)** and above that (18.5 kg) reported by **Maharemet al. (2003)**.

Table.3: Analysis of variance of litter weight at birth, weaning and marketing of different experimental groups

Source		Mean Squares		
S.O.V	DF	Birth Weight	Weaning weight	Marketing weight
TR	2	0.03509174	24.12626774	67.74801421
S	1	0.45958563	26.48193775	192.93750000
TR x S	2	0.12247546	7.67202758	4.01753122
Error	30	0.24963459	20.75400959	29.80148810

TR; treatment, S; sex

Economic evaluation

The simple economic evaluation of the three diets are summarized in Table (4). Date supplementation in diets reduced the feeding costs during the whole fattening period by about 22.7 and 30.6% at level of 50 and 100% date seeds group, respectively. The diet supplemented with 100% was higher in economic efficiency by about 40% relative to control diet.

Table.4: Simple economic evaluation of incorporation of date seeds in the concentrate rations

Item	G1	G2	G3
Weight gain (from weaning to marketing)	24.5	22.3	22.9
DMI (kg/head/180days)			
Roughage	92.0	86.0	83.5
Concentrate mixture	121.5	106.2	114.0
TDMI	213.5	192.2	197.5
Feed conversion efficiency (Kg DM/kg gain)	8.7	8.6	8.6
Roughage cost (LE/ton)	800	800	800
Conc. mixture cost (LE/ton)	1200	950	750
Total Feeding Costs (LE)	219.4	169.7 (22.7%)	152.3 (30.6%)
Fixed costs / head (LE)	55	55	55
Total costs (LE)	274.4	224.7	207.3
Selling income (LE)*	465.5	423.7	435.1
Net income (LE)	191.1	199	227.8
Economic efficiency	69.6	88.6	109.9
Relative economic efficiency	100	127.3	157.9

*, 1kg= 19.0 LE

G1; control concentrate ration (0% date seeds), G2; 50% date seeds, G3; 100% date seeds. TDMI; total dry matter intake.

There was a general trend from the literature cited that inclusion of date seeds in the concentrate with different levels, in sheep, goats and cattle rations, tended to reduce feed costs with values ranged from 67%. The tendency of decreasing feed costs with date seeds in the concentrate mixture proved the success of such by product in ruminant rations without adverse effects on their reproduction and/or fattening performance.

Effect of feeding date seeds on milk production and composition:

Incorporation of date seeds in the concentrate diets of small ruminant tended to increase significantly ($P < 0.05$)

milk production. Ewes fed on either complete (100%) or partially (50%) date seeds supplementation in the concentrate ration scored higher milk yield (585.2 and 495.1 ml/head/day), over 3 months lactation period, as

compared to the control one (441.1 ml/head/day) (Table 5). Milk production increased by 32.7% in G3 (100% date seeds) followed by 12.2% in G2 (50% date seeds). The superiority of both date seed groups might explained the higher pre-weaning growth rate and the better mothering ability of their dams, and confirmed the above mentioned results concerning milk production.

Similar results were reported by **El-Shaeret al. (1986) and Khamiset al. (1989)**. They demonstrated that lactating ewes fed date seeds as a whole diet (100%) after grazing produced high milk yield than those fed olive pulp, but the percentage of milk fat and protein were higher with ewes fed olive pulp diet. In consistency with **Abo El-Nor and kholif (1999)** on Baladi goats, they found that milk yield was significantly higher in 100% date stone compared to either 50% date stone in the concentrate feed mixture or control group (100% corn) with values being 793, 737 and 713 g/head/day for the three groups, respectively. Likewise, **Khattabet al., (2000)** found that milk yield was insignificantly increased with ration contain 13% date stone.

Furthermore, up to 25% date seeds in the ration of lactating cows did not affect the daily milk yield (**Mohamed 1987**). **Sabbahet al. (1997)** observed no marked effect on daily actual or 4% fat corrected milk yield and composition when substituting yellow corn in the concentrate mixture by 50 and 100% date seeds. **Salamaet al. (1993)** on grazing pregnant and lactating sheep and goats in Sinai, found that milk yield increased insignificantly in both sheep and goats fed rations contained 40% date stone, 40% olive pulp and 20% concentrate mixture as compared with control group (65% berseem hay and 35% concentrate mixture).

On the other hand, milk production tended to increase during early and mid stages of lactation (8 weeks)

then declined steadily up to the end of lactation period (12th week) for all ewe groups. Such changes in milk yield within lactation period seemed to be logic since the peak milk yield was recorded during the 6th week (mid lactation stage) then declined (**El-Sherif and Assad 2001**) reflecting the hyper metabolic activity during pregnancy and lactation to save the higher demand of proper nutrition rich in energy, date seeds seemed to be a suitable alternative due to higher carbohydrate content and may play an important role in improving body condition score of the dams and growth performance of their lambs which are in accordance with other reports in the literature.

Concerning plant steroid effects, milk yield of Comisana ewes, fed on subterranean clover (0.2% phytoestrogens on DM basis) compared with control group which fed Italian ryegrass hay, had increased insignificantly (**Orruet al., 2005**). They also added that these results support the hypothesis that the phytoestrogens could play a role on lipid and carbohydrate metabolism and on blood glucose level which might explain the increased milk production in date seed groups.

Milk composition of the different experimental groups as well as the analysis of variance of factors affecting milk production are presented in Tables (6 and 7). Although milk yield was affected significantly by inclusion of date seeds in the concentrate ration, milk composition was not affected among the different experimental groups. This result agreed with the previous results reported by **Khattab (1976) and Allamet al. (1997)** that the average of milk fat and protein were slightly increased ($P < 0.05$) as the levels of date seeds increased in rations. These increases may be due to the high content of crude fiber in the diets containing date seeds as reported by (**Kholif and Abo El-Nor 1998**).

Table.5: Effect of treatment on milk yield and composition of experimental groups

Variables	G1	G2	G3
Milk yield	441.14±21.17 ^C	495.07±21.17 ^B	585.16±21.64 ^A
Milk composition (%)			
Fat (F)	2.48±0.14 ^A	2.63±0.15 ^A	2.58±0.15 ^A
Protein (P)	4.11±0.06 ^A	4.19±0.06 ^A	4.27±0.06 ^A
Lactose (La)	4.59±0.05 ^A	4.53±0.05 ^A	4.64±0.05 ^A
Total solids (TS)	13.52±0.18 ^A	13.43±0.18 ^A	13.60±0.18 ^A
Solids not fat (SNF)	11.03±0.10 ^A	10.80±0.10 ^A	11.01±0.11 ^A

G1; the control concentrate ration (0% date seeds), G2; 50% date seeds, G3; 100% date seeds as a partial replacer of corn in the concentrate ration.

F; Fat, P; Protein, La; Lactose, TS; Total solids, SNF; Solid not fat

Table.6: Analysis of variance of factors affecting milk production yield in experimental groups

Source Of Variance	DF	Mean Square
Treatment (T)	2	277409.4**
Lactation stages (LS)	2	751310.6**
LS X T	4	33058.1
Error	114	17292.7

**, P<0.01

Table.7: Analysis of variance of milk composition

S.O.V	DF	Mean squares				
		Fat	Protein	Lactose	Total solids	Solids not fat
Lactation stage	2	5.17**	36.85**	19.29**	3.71	0.66
Treatments	2	0.23	0.25	0.10	0.25	0.62
LS x T	4	2.07	0.17	0.43*	1.82	0.88
Error	112	0.85	0.14	0.10	1.32	0.45

**, P<0.01

The most traditional and non-conventional feedstock's in the study area:

Table 5 shows the most important traditional and non-traditional feedstuffs (peeled husk, non-peeled cotton gain, sesame, nougat-bale, olive oil, soybeans) available in the study area, their food content, the prevailing price at the time of the research, (Weight at the beginning of fattening 30 kg, daily increase 120 g / head).

Variables	Feed type	dry matter * kg DM	protein * digested kg DP	total digested food * kg TDN	Current price of feed ton / pound ***
X ₁	Barley straw	1,069845	-	0,6	900
X ₂	Wheat straw	1,07088	0,0069	0,5612	900
X ₃	Driss Bresse	1,04857	0,09315	0,6486	1450
X ₄	Yellow corn	1,03914	0,07475	1,0511	2350
X ₅	Barley	1,038105	0,07935	0,9683	2400
X ₆	non-peeled cotton cake	1,04627	0,2185	0,7682	2350
X ₇	Sesame cake	1,04857	0,48645	0,9683	1500
X ₈	Peel bean	1,035	0,069	0,644	2500
X ₉	Date seeds	1,081	0,08395	0,897	1200
X ₁₀	Olive cake	1,012	0,10925	0,391	200
X ₁₁	Soybean cake	1,0005	0,506	0,8625	300
Lowest daily needs per kg **		1,15	0,062	0,72	

** Leonard C. Kearl, 1982, "Nutrient Requirements Of Ruminants In Developing Countries", International Feedstuffs Institute, UTAH Agricultural Experiments Station, UTAH Univ., Logan UTAH.

IV. CONCLUSION

Productive parameters in terms of birth weight, weaning weight and marketing weight did not differ significantly and indicated better performance of the two date seed groups compared to the control group. The decrease in average daily gain post-weaning might be attributed to decreased digestibility coefficients as a result of the relative increase

in crude fibers as well as low protein content in the date seeds comparing with the control diet. Lambs birth weight of the different ewe groups was found to be 3.89, 3.93 and 3.70 kg for G1, G2 and G3, respectively with differences being insignificant, while weaning weight was significantly (P<0.05) different with favour to date seed groups compared to the control group. Date seed groups showed a

better maternal and mothering abilities reflected on the pre-weaning average daily gain, where they scored 207 and 221 g/day for G2 and G3, respectively as compared to the control group that scored the lowest value (188 g/day). Feed intake of concentrated rations relatively decreased in response to increase date seeds in the ration of lambs and this may be attributed to the highest content of crude fiber in G2 and G3 rations. Date seeds supplementation in the diets tended to reduce feeding costs by about 22.7 and 30.6 % at level of 50 and 100% date seed groups, respectively comparing with the control diet. The diet supplemented with 100% date seeds was higher in economic efficiency by about 57.9 % relative to control diet. Over 3 months lactation period, ewes fed on either complete (100%) or partially (50%) date seeds in the concentrate ration scored higher milk yield (585.2 and 495.1 ml/head/day, respectively) as compared to the control group (441.1 ml/head/day). In other words, milk production increased by either 32.7% in 100% date seeds group or 12.2% in 50% date seeds group as compared to the control group.

It could be concluded that date seeds as a cheap source of energy, might be used successfully and economically in small ruminant rations during different physiological stages without adverse effects, due to estrogen-like compounds, on their productive and reproductive performance.

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