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RESEARCH PAPER

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BIOTIC AND ECONOMIC INDICATORS OF ABOU-DELIK SHEEP RAISED IN HALAIEB–SHALATEEN–ABOURAMAD TRIANGLE OF EGYPT

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ABSTRACT

Abou-Delik is a low producing native mutton sheep thriving primarily on range grazing on inadequate and nutritionally impoverished forages in rain sparse and drought prone Halaieb-Shalateen-Abouramad Triangle in Egypt. This study was focused on characterization of biological and economic indicators of Abou-Delik ewes raised exclusively on range grazing compared to ewes subjected to intra-vaginal prostaglandin implantation (for estrus synchronization) either alone or in conjunction with flushing. Thirty three Abou-Delik ewes with average live body weight of 25.4 ± 0.5 kg aged between 2–4 years were used in this experiment. Ewes were randomly allotted to three groups (G1, G2 and G3) with equal number of animals (n = 11) in each group balanced for age and live body weight. Ewes of G1 group served as control and were maintained under subsistent range grazing protocol. Ewes of G2 group were administered Prostaglandin (PGF 2α) pessaries (p.p.) for 10 days and ewes of G3 group were flushed for two weeks along with administration of p.p. for 10 days before mating season. Lambs were weaned at 120 days of age. The duration of experiment was 288 days. The results showed that treatment package did not significantly (P<0.05) affect the biological indicators in three groups during the experimental period assessed in terms of live body weight changes. Reproductive traits of G3 with respect of conception rate (100%), lambing rate (100%) and average litter size/100 ewes (109) were the highest in G3 group followed by G2 and G1 ewes in chronological order. Percentage of lambs weaned was the highest in G3 ewes (109 ± 0.13 %) followed by G2 and G1 ewes in chronological order that was significantly higher (P<0.05) than G1 ewes. Kg of lambs weaned/ewe joined in G3 ewes (18.8 ± 0.78 kg) was sequentially and significantly (P<0.05) higher than G2 and G1 ewes. Productive traits such as birth weight (3.02 ± 0.08 kg) and weaning weight (17.19 ± 0.87 kg), were the highest in G3 ewes followed by G2 and G1 ewes in sequence, while average daily gain was almost similar among the studied groups, (0.113 ± 0.0068, 0.117 ± 0.0075, and 0.118 ± 0.0068 kg) for G1, G2, and G3, respectively. Feed conversion ratio expressed as DMI (kg) required to produce one kg of weaned lambs was the lowest (5.3 kg) in G3 ewes followed by G2 (6.77 kg) and G1 (9.2 kg). The economic indicators concerning revenues/group and Benefit/Cost ratio were the highest for G3 with estimate of **LE** 13423.8 and 1.7, respectively, while the cost of feed required to produce one kg of weaned lamb was the lowest (**LE** 37.95) in G3 ewes followed by G2 and G1 ewes in sequence. It is inferred that more income can be generated from Abou-Delik sheep raised on natural vegetations on range dominated by *Panicum turgidum* (5.5%–5.65% CP) along with estrus synchronization with Prostaglandin (PGF 2α) pessaries (p.p.) in conjunction with flushing with concentrate supplementation (17.38% CP).

KEY WORDS

Abou-Delik sheep, Biologic Indicator, Economic Indicator. Estrus Synchronization, Flushing

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INTRODUCTION

Egypt has a vast terrain of more than 10 million hectares of range land, but provides a meager 5% of the total animal feed requirement due to low productivity of forages (FAO, 2010). The main areas of rangelands are distributed over the North Western Coastal Zone (NWCZ), the Sinai Peninsula and the Halayeb-Shalateen region in the South East corner of Egypt bordering the Red Sea. Halayeb-Shalateen region rangeland spreads over 600,000 hectares of land (Hegazi et al., 2005). Halaieb-Shalateen-Aburamad Triangle lies between the Nile Valley in the West and the Red sea in East shaping as a triangle with its base at the Sudanese borders.

It is drought prone since the annual rainfall of this area ranges between 80 mm and 100 mm (November to March). The wettest month with the highest rainfall in Shalateen region is November (9 mm), while the driest months with no rainfall (0 mm) are January, February, March, May, June, July, August and September. The rainfall in April is merely 1 mm, while it is 2 mm in October and December (https://www.weather-atlas.com/en/egypt/shalateen-climate).

Sheep represent 52% of the total livestock, followed by camels (26%) and goats (22%) in this region. The common sheep breeds of the region are Kanzi, Abou-Delik and Maenit. Abou-Delik is a native mutton sheep in Halayeb-Shalateen Triangle territory characterized by long tail, and thick body coat containing rough hairs of different hues (Figure-1). They are usually shorn once a year (April-May) for harvesting hair and wool and to provide protection to the animal from skin diseases and ectoparasites (Badawy et al., 2008).

Figure-1: Abou Delik Sheep in Halaieb–Shalateen–Abouramad Triangle of Egypt.

Generally, desert zones are dominated by small ruminant livestock such as sheep and goats, and are raised under extensive production system. The forage qualities of these zones are poor due to consistent exposure to harsh climatic conditions owing to long stretch of dry spells and intermittent drought that ultimately affect the productivity of the range animals. The sheep reared under rural subsistence smallholder production system are often under fed as they depend mostly on self growing local grasses for grazing culminating in low productivity (Khan and Usmani, 2005). Therefore, the existing extensive production system is being switched over to intensive production system due to increased demand for animal products (FAO, 2003).

Animal feed is the most important component constituting 73.6 % of the total operational cost in sheep (Raineri et al., 2015). Thus, focusing on reduction of feed costs together with enhancement of reproductive performance might improve the production efficiency of small ruminant livestock like sheep and goats. The reproductive performance of the breeding flock is a critical component in enhancing income generation, since it is affected not only by the absolute number of females that conceive, but also by the timing and distribution of the pregnancies.

The optimization of the cost of raising ewes with supplementation of flushing diets for two weeks before mating imparts positive impact on the lambing rate to an extent of 90% and twinning rate to an extent of 10% on account of increase in ovulation rate, because nutritional effects are considered as 'short-term' or 'dynamic' effects that change the body condition of ewes following flushing treatment, which is supported with the finding of approximately 2% enhancement in ovulation rate for every kilogram increase in live body weight at mating (Islam et al., 2007; Naqvi et al., 2011).

The current research was initiated to characterize the biotic and economic indicators of Abou-Delik sheep treated with Prostaglandin (PGF 2α) pessaries (p.p.) for estrus synchronization along with supplementary feeding (flushing) of ewes for two weeks prior mating season, since few researches have been conducted in this regard for that breed.

MATERIALS AND METHODS

The Study Area: The current research was carried out at Shalateen Research Station of Desert Research Center, Ras Hederba Valley, located some 1300 km South East of Cairo, at latitude 22º,00,720 N and longitude 36º,48,955 E. The area is bordered by Sudan to the South and the Red Sea to the East. It is an arid region with average annual precipitation of only 58.5 mm mostly as erratic showers in November and December. The average ambient air temperatures of the study area are 35°C and 22°C, and humidity values are 37% and 43% for the summer (dry) and winter (wet) seasons, respectively as per the report of EMA (1991). Water sources are meager and available only to nomadic inhabitants and their animals from shallow wells. Therefore, sedentary agricultural activities are absent and livestock grazing on range is being adopted in the traditional manner as the only option of livelihood for the farmers.

Only three plant species viz., *Panicum turgidum*, *Lycium* shawii, and *Acacia tortilis* are found in this region. The prevalence of *P. turgidum*, *L. shawii*, and *A. tortilis*, in the wet and dry seasons have been envisaged as 95.9% and 97.7%, 3.7% and 1.4%, and 2.6% and 2.4% respectively, while plant densities are 0.455 and 0.296, 0.007 and 0.003, and 0.004 and 0.003 plant/m^2, respectively. *Panicum turgidum* is the dominant plant species in the study area both in wet and dry seasons (Raef, 2012).

Experimental Design: A total number of 33 Abou-Delik ewes were used in the present research with an average live body weight of 25.4 ± 0.5 kg and aged ranging between 2 – 4 years. Experimental ewes were randomly distributed into three groups of even size (n = 11) in each group, balanced for age and live body weight. The first treatment group (G1) served as the control. Ewes of the second group (G2) were treated with Prostaglandin (PGF 2α) Pessaries (p.p) for 10 days for estrus synchronization and the third group of ewes (G3) were treated with p.p, for 10 days, along with flushing for two weeks before mating season. Each group was housed in separate shaded mating pens. All the ewes were fed on a traditional feeding regime from the start of the mating season until the end of the experiment that lasted for 288 days.

Management Practices and Feeding Schedule: Thirty three Abou-Delik ewes were maintained under free range grazing conditions with natural vegetations dominant in the area (Panicum). The scheduled grazing time was 06:00 to 12:00 h in the morning and 15:00 to 17:00 h in the afternoon. Then, they move back to the barns and offered concentrate feed mixture containing 43% yellow corn, 22% cotton seed meal, 20% wheat bran, 12% rice bran 1.5% limestone, 1% sodium chloride and 0.5% mineral mixture at the rate of 250 g/ head/ day to meet their maintenance requirement of energy during the flushing period and breeding season in terms of dry matter intake (DMI) per ewe. The dry matter contents and chemical composition of *Panicum turgidum* and concentrate supplement (%, DM basis) are presented in Table-1. During the mid pregnancy period over late pregnancy and in the lactation period which extended 120 days, each ewe consumed average dry matter of 0.45 kg per day as a supplemented concentrates for all treatment groups representing 2.1% of their average live body weight (27.5 kg) as per Kearl (1982).

Table-1: DM contents and Chemical Composition of *Panicum turgidum* and Concentrate Supplement (%, DM basis).

Constituents	*Panicum turgidum*		Concentrate Supplement
	Summer (Dry)	Winter (Wet)	
Dry matter	57.1	44.2	94.5
Organic matter	88.6	93.6	91.0
Crude protein	5.65	5.50	17.38
Ether extract	1.20	1.82	2.26
Neutral detergent fiber	88.0	89.7	47.5
Acid detergent fiber	54.2	46.9	14.5
Acid detergent lignin	19.8	14.6	5.62
Acid insoluble ash	7.72	2.82	1.08

Source: Askar et al. (2014)

Breeding: The experimental ewes were given natural service once a year in autumn season on 15th of September, and the breeding season lasts 34 days (2 estrus cycles). Ewes in each group were assigned with fertile breeding rams. Throughout the experimental period, ewes in each group were individually weighed monthly, before morning feeding. Changes in live body weight were recorded throughout the study period. Average dry matter intake per ewe of each group was calculated during the experimental period. After parturition, newborn lambs were weighed at birth and biweekly thereafter up to weaning (120 days).

Biotic Indicators: Reproductive performance in terms of conception rate, lambing rate, average litter size and weaning % in addition to, number of kilograms weaned per ewe joined were considered. Productive traits viz., birth weight, weaning weight and average daily gains in body weight between birth and weaning were estimated. Feed conversion ratio was expressed as kg (DMI) required for production of one kg of weaned lambs.

Economic Indicators: The partial farm budget was adopted as a tool to determine the profitability of the current and the proposed changes in management practices. The partial farm budget compares the positive and negative effects of specific management on economic indicators of sheep enterprise. Feeding costs contribute the main components of variable costs. Therefore, to facilitate comparison among the treatment groups, feeding costs needed to produce one kilogram of lambs weaned and Benefit/Cost Ratio were used as economical indicators of the relative profitability of the three treatment groups. In the present study, variable costs included feed costs only, while revenues included the monetary value generated from selling lambs weaned of each group. Current farm gate prices in Egyptian Pound (**LE**) of CFM and marketed lambs weaned were considered.

Statistical analysis: Data were statistically analyzed using the General Linear Model (GLM) procedures described by SAS (2004), to compare the biological estimates among the three treatment groups. The following model was applied:

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

Where,

Y_{ij} = the observations,

μ = the overall mean,

d_i = the effect of i^{th} treatment, i = 1,2 ,3,

e_{ij} = random error associated with the ij^{th} observation assumed to be random and normally distributed. Differences among treatments were tested according to Duncan's new multiple ranges test (Duncan, 1955).

RESULTS AND DISCUSSION

Biotic Indicators: Biotic Indicators reflecting live body weight changes, reproductive performance and productive performance of the experimental ewes are given below.

Live body weight changes: Table (2) and Figures (2) illustrate similar trend in respect of body weight changes for all the studied groups. The estimates of initial (pre-breeding) live body weights of G1, G2 and G3 groups of experimental ewes were 25.0 ± 1.45 kg, 25.4 ± 1.23 kg and 26.0 ± 0.44 kg, respectively. G3 group achieved the highest average body weight among the

groups, while the average body weight in G1 group was the lowest. The differences among the groups were statistically non-significant (P<0.05).The estimates of live body weights at the end of pregnancy period were 30.0 ± 1.43 kg, 31.9 ± 0.97 kg and 34.9 ± 0.70 kg of the corresponding groups, respectively. These changes in weight are considered acceptable, because it is expected that pregnant ewes lose at parturition a weight that is equivalent to the birth weight of lambs plus 60% of that weight as fluid and placenta. The present study showed that, most of the weight loses occurred after the parturition, but thereafter, live body weight of ewes remained almost constant in all the treatment groups. Slightly differences were found among ewes at the end of lactation period.

Table-2: Least squares means and standard errors (X ± SE) of live body weight changes (kg) of Abou-Delik ewes during the experimental period.

Experimental Period	G1 (X±SE)	G2 (X±SE)	G3 (X±SE)
Initial body weight	25.0 ± 1.45	25.4 ± 1.23	26.0 ± 0.44
Body wt. at mid pregnancy (MP)	27.0 ± 0.32	27.5 ±0.40	28.0 ±0.49
Body wt. at the end of pregnancy. (EP)	30.0 ± 1.43	31.9 ± 0.97	34.9 ± 0.70
Weight Losses after parturition (AP)	5.0	6.5	8.9
Body wt. at the end of lactation (EL)	23.5 ± 0.87	24.0 ± 1.11	25.9 ± 0.85

Note: Differences among the groups were statistically non-significant (P<0.05).

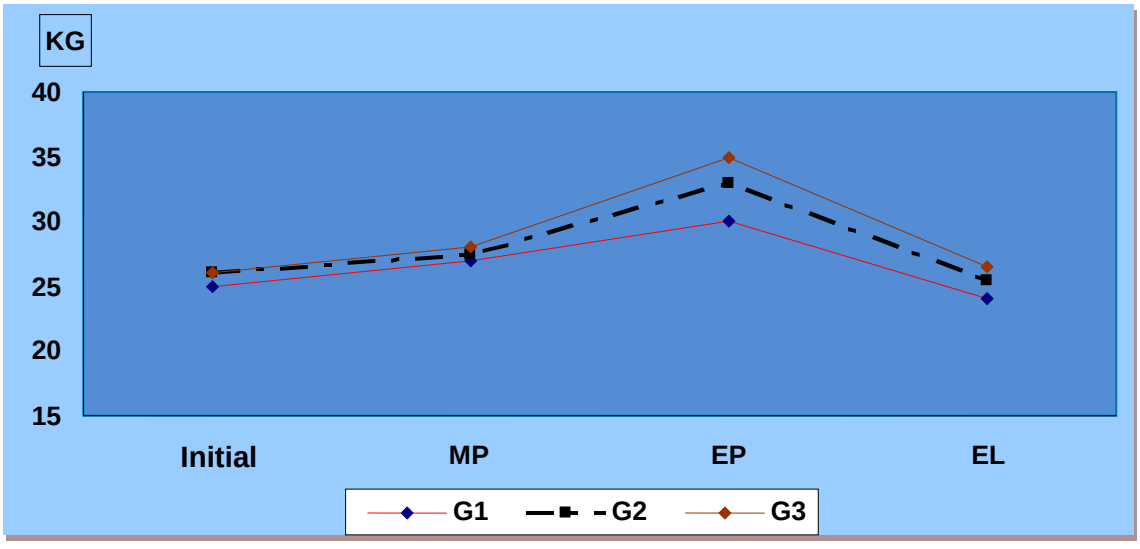

Figure-2: Live body weight changes of ewes during the experimental period.

Reproductive performance: Results of reproductive performance of the current study are presented in Table (3). The results revealed that conception rate was the highest (100%) in G3 group followed by G2 (90.9%) and G1 (81.9%) groups. The current results showed that, lambing rate (expressed as the number of ewes lambed per ewe joined) were 72.7 %, 81.8 % and 100 %, in G1, G2 and G3, respectively. Likewise the weaning (%) was the highest in G3 ewes (109 ± 0.13) compared to G2 (81.8 ± 0.12) and G1 (63.6 ± 0.5) ewes. These might be due to estrus synchronization along with flushing, which boosted the reproductive performance (conception rate). These results are in agreement with Abdalla et al. (2014), Mekuriaw et al (2015), and Gdey (2017), but disagree with Chaturvedi et al. (2006) who reported that fecundity in flushed ewes were lower than non-flushed ewes, which could be due to large number of deaths among the flushed pregnant ewes in their experiment. Kg of lambs weaned/ ewe joined in G3 ewes (18.8 ± 0.78) was significantly (P<0.05) higher than G2 (13.9 ± 2.2) and G1 (10.4 ± 2.52) ewes.

Table-3: Least squares means and standard errors (X ± SE) of reproductive performance of Abou-Delik ewes during the experimental period.

Trait	G1 (X±SE)	G2 (X±SE)	G3 (X±SE)
Conception rate (%)	81.9 ± 0.14	90.9 ± 0.12	100 ± 0.00
Lambing rate (%)	72.7 ± 0.14	81.8 ± 0.12	100 ± 0.00
Average litter size/ 100 ewes lambed	100	100	109
Lambs weaned/ ewe joined (%)	63.6^{a}±0.5	81.8^{ab} ±0.12	109^{b}±0.13
Kg of Lambs weaned/ ewe joined, kg	10.4^{a} ± 2.52	13.9^{a} ±2.2	18.8^{b} ±0.78

^{ab} Means within the same row with different superscripts are significantly different (P<0.05).

Productive performance: Least squares means and standard errors of birth weight, weaning weight and average daily gain in body weight between birth and weaning in different treatment groups are presented in Table-4. The overall means of birth weight (kg), weaning weight (kg) and average daily gain (kg/ day) of Abou-Delik lambs were 2.91 ± 0.065, 16.89 ± 0.50, and 0.116 ± 0.004 respectively. The least squares means of birth weight (kg), weaning weight (kg) and average daily gain (kg/ day) were 3.02 ± 0.08, 17.19 ± 0.87 and 0.118 ± 0.006 respectively in G3 group, followed by 2.93 ± 0.13, 16.98 ± 0.93 and 0. 117 ± 0.007 respectively, in G2 group, and 2.7 ± 0.11, 16.27 ± 0.79 and 0.113 ± 0.006 respectively in G1 group. The differences among the groups were statistically non-significant (P<0.05). The current results are comparable with the local Barki sheep raised in NWCZ (Mohammady, 2005).

Table-4: Least squares means and Standard errors (X ± SE) of birth weight, weaning weight and average daily gain (kg) of Abou-Delik ewes during the experimental period.

Parameters	Birth Weight (X±SE)	Weaning Weight (X±SE)	Average Daily Gain (X±SE)
Overall mean	2.91 ± 0.065	16.89 ± 0.50	0.116 ± 0.004
Experimental groups			
G1	2.7 ± 0.11	16.27 ± 0.79	0.113 ± 0.0068
G2	2.93 ± 0.13	16.98 ± 0.93	0.117 ± 0.0075
G3	3.02 ± 0.085	17.19 ± 0.87	0.118 ± 0.0068

Note: Differences among the groups were statistically non-significant (P<0.05).

Economic Indicators: The estimates of the economic indicators revealed obvious positive economical consequences due to the treatment and management practices (synchronization and flushing) in the current study. Results in Table (5) showed that, G3 consumed the highest amount of DMI per head (99 kg) but it also delivered the highest kg of weaned lambs per ewe (18.8 ± 0.78 kg) , scored lowest cost to produce one kg of weaned lambs (**LE** 37.95) and lowest FCR (5.3) than the other groups (G1 and G2). The attained results showed that, total feed costs in G3 and G2 groups were **LE** 7829.25 and **LE** 7092, respectively. Consequently, relative feeding costs in G2 and G3 groups exceeded G1 by +3.5% and +14% respectively. However, the benefit/cost ratio in G1, G2 and G3 were 1.08, 1.4 and 1.71 respectively, which means that G3 (pp + flushing) was more profitable than G1 (control) and G2 (pp).

Table-5: Economic indicators of Abou-Delik ewes of different treatment groups.

Item	G1	G2	G3
Total Dry Matter Intake/ head/ period, kg	95.4	94	99
Concentrate feed mixture intake, Ton	1.053	1.091	1.204
Total feed costs (LE)	6848	7092	7829.25
Relative feeding cost (%)	….	+3.5	+14
Total Revenues/ group (LE)	7416.5	9945	13423.8
Benefit/ Cost ratio (B/C)	1.08	1.40	1.71
Cost of feed to produce one kg of lambs (LE)	60.1	46.4	37.95
Feed conversion ratio (FCR)	9.2	6.77	5.3

CONCLUSION

It could be concluded that there is a considerable scope for improving the economical returns through refinement of management practices (pp+flushing) even under extensive management system. The present study showed that Abou-Deliek ewes induced with PGF 2 α and flushed with concentrate feed supplementation for two weeks under traditional range management showed considerable improvement in reproductive performance with increase in conception rate, lambing rate and increase in kg of weaned lambs leading to increase economic returns. Moreover, from the biological point of view, improvement through management tool is quicker than improvement through genetic tool in livestock due to involvement of longer generation interval.

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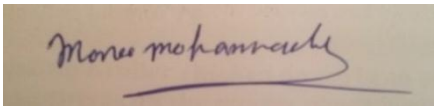
UNDERTAKING

It is certified that the research paper named **"BIOTIC AND ECONOMIC INDICATORS OF ABOU-DELIK SHEEP RAISED IN HALAIEB–SHALATEEN–ABOURAMAD TRIANGLE OF EGYPT"** is an original work carried out jointly by the authors of the Division of Animal Production and Poultry and Department of Animal Physiology, Desert Research Center, Mataria, Cairo, Egypt. It has neither been published nor contemplated for publication elsewhere.



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