The productive performance of Maghreibian dromedary camel as influenced by extensive, semi-intensive and intensive breeding system

By

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Abstract

An increase in both human population and economic growth has been accompanied by rising per capita demand for animal products. The livestock industry is under pressure to meet this demand. The present study was conducted to analyze the management practices and economic importance of the camels. At North Coast in north of Egypt in a private farm, 6-month study was undertaken on 30 Maghrabian dromedary camel at three (3) groups. the first group contain of 10 adult camel housed at under intensive management system (**IBS**) Maghrebian Camel Under Intensive System, while the second group contain of 10 dromedary camel were housed in semi-intensive system (**SIBS**) Maghrebian Camel Under Semi-Intensive System, while last group consist of 10 dromedary camel under Extensive management system (**EBS**) Maghrebian Camel Under Extensive Breeding System (**EBS**), the pedometer was installed in camel feet and JPS, camel walk to find out the plants that are carried out by these animals with the provision of water points in different places during the spiritualism of the spiritual. The results indicated that a significant increase in frequency, duration and grazing duration under semi-intensive system, significant increase in grazing frequency in semi-intensive system. A significant increase in diarrhea frequency and incidence of mastitis under extensive breeding system **(EBS**). The body weight and the daily growth rates of the camel under semi-intensive breeding system were significantly increasing, SIBS system were higher than the camel in the traditional system. It concluded that, the semi intensive breeding system showed some advantages for better growing camels compared with the Extensive breeding system (**EBS)**. So, supplementing camel by good management under semi-intensive system lead to high productivity and reduction of animal losses. The results of the current study revealed that EBS recorded

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higher percentage in abortion more than in intensive system (P≤0.05) and the biggest problem causing embryonic losses. cholesterol, triglycerides, were P<0.05 while urea, creatinine and albumin were non-significant (P>0.05). The reproductive efficiency of camel under natural pastoral conditions is low, due to extensive breeding system .

Keywords: Productive performance, *Camelus dromedaries*, management system.

Introduction

In rural areas of developing countries, the contribution of camels is highly valued and has an important role in feeding the populations, an item that is often not adequately recognized when comparing camel with cattle. In fact, camels are extremely intelligent animals, very agile, and independent, with a high level of resistance to diseases, much better than other ruminant species. **(Swelum A.A.,2018)**

Camel has been a very important animal in the desert regions because of its ability to provide milk, meat, and transport in harsh, dry conditions (**Ahmed Idris *et al,* 2015).** the camel's herds are managed by conventional husbandry system which is deeply rooted in the society and based on superstition and practices that were founded down by father to son over age **(Yagil *et al,* 1994)**. The camel's herds which are managed under semi-intensive system are dictated by the prevailing ecological habitat.

The dromedary Camel (Camelus dromedarius) like any other herbivore's animals grazing in arid range lands are seasonally challenged with shortage of feed and scarcity of water. However, they are known for their ability to survive and produce milk during dry and drought periods **(Moaeenuddin et al., 2004; Wernery, 2006).** The area characterized by stables kept all

camels and availability of pasture. **(Osman, A.M.,2015)** Improvement of the reproductive and productive performance and reduction of animal losses by management measures that are applicable to a mobile system appear to offer possibilities of increasing camel productivity of the herd in terms of milk production and growth of calves (**Chimsa et al., 2013)**. The information on camel management system and its impact on productive and reproductive performance are inadequate. The management system of camel depends on factors including environment conditions, size and composition of the herd and the degree to which the owners are dependent on their herds, (**Gihad 1995).** In traditional systems, the camel herders are in a continuous move in response to availability of grazing and water supplies. (**Gebreyohanes M.G., Assen A.M.2017)** Camels may be raised alone or mixed with sheep and goats and sometimes cattle **(Sweet, 1965).** Rearing of Camel calves under traditional systems is faced with several challenges that result in high death rates of the calves due to milk allowance to the calf is very critical, especially in the first three months of growth before the calf starts grazing. The major cause of calf mortality in camels is Supposed to be malnutrition resulting from competition between calf and farmer for milk (**Chimsa et al., 2013)**. Most camels' owners now living towns and increasing productivity by useable system like semi intensive which the animals are depending on the natural pastures and when coming at evening they take supplementation diets like sorghum, cakes …etc, also it improves the nutritional status of she camels in terms of improving body weight and growth rate of the calves lead to improve production and reproduction performance of the animals. In addition, poor management practices in the regions where most camels are raised, adversely affect its reproduction and productive performance. The most important factors affecting reproductive Parameters in the young female are

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nutrition and adequate growth. In pastoral system calving interval is usually 36 months or even more. In view of this fact, camel mortality possesses an added effect that limits camel productivity, high calf mortality appears to be one of the major Constraints to higher productivity in camels (**Sweet, 1965**). Also, the fertilization rate of camels is considered very low Fifty percent fertility, or even less, has been recorded **(Moaeenuddin et al., 2004; Wernery,2006)**

The objective of this study was to minimize mortality and improving management system on calves' camel rearing in Egypt, also the present study was planned to compare the efficiency of body weight gains in camel calves raised under traditional system and semi intensive management in Egypt.

Materials and Methods

Study area

The study was carried out in semi-intensive system in private farm in North coast and intensive system by pastoralist in closed farm Khamis farm village, in Matrouh Province, Egypt. The study was conducted between May and November 2019. The climate of this area is arid to semi-arid subtropical continental and mean monthly highest temperature goes up to 39 ºC, while in winter it goes from 20 to 16 ºC. Mean annual rainfall in the region ranges from 150-350 mm, increasing from South to North.

Seasonal shallow surface water wells are present as well as few very deep bores wells. However, the amount of water and the persistence of reserves during the summer dry season depend on the quantity of rainfall the wet season. As always in the semiarid regions, rainfall is the most important climatic factor in Egypt because people and their livestock depend on this factor which supports the growth of the vegetation for their animals. The annual mean temperature ranges from 32 C° during the day to 16

C° at night in January (winter) and from 46 C° during the day to 27 C° at night in May- June (summer). Two vegetation zones are existing in the area, namely semidesert *Acacia* shrub and short grasslands of the North Coast

Experimental animals

Thirty camel dromedaries (*Camelus dromedaries*) maghrebian camel divided into three equal groups: group1, group2 and group3, each was composed of ten camel with their dams. Group (I) was managed in Extensive system **(EBS**), the second group2 semi-intensive system **(SIBS)** and the third group3 intensive system (**IBS**), in which the animals were kept in closed pen during the midday. Group (2) was under traditional system managed traditionally ad libitum watering, health care and parasites control practiced. In addition, the camel was brought to grazing areas where they select food by themselves from the available plants, no-supplementation was offered, watering regime every (6-7) days was applied

Behavioral observation:

camel behavior was recorded in the time between 7 a.m. till 3 p.m. along experimental period by using focal sample technique (**Altmann,1974**), for each group with intervals (12 minutes) by 2 hours daily, visually by using (a note book for recording behavior, a stop watch, multipurpose counter and a video camera). The following behaviors were recorded:

Browse or graze 6-8 hours and chew cud another 6-8 hours each day. Constant work required to maintain health on low-nutrient desert plant life. Previously, migrated seasonally to green pastures. Movements now curtailed by human settlements.

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Table (1): Some of behaviors of dromedary camels

Behavior	***Definition***
Posture	
Standing	Standing in inactive upright posture on all four feet with no movement.
Lying	Body contact with the ground or camel sits in sternal recumbency
Walking	Camel does more than 2 complete steps.
Maintenance behavior	
Drinking	Drink water from water draft.
Rumination	A bolus of regurgitating food goes back into his mouth and the camel re-chewed and re-swallowing it again while standing or lying down.
Aggressive behavior.	
Attack behaviour	Including bite, cross-neck biting, ear-biting or pinching, front-wrestling, knee bite
Threatening behaviour	chasing, blowing inflatable from mouth, salivation and making sound by teeth grinding
Defensive behaviour	fleeing or running away, neck-away defensive and sideways defensive
Social interaction behavior	
Displacements number	One camel caused the receiving one to stop eating, remove its head from the manger and back out was summed daily for the entire 20 day observation period to get the average.
A displacement index (DI)	Proportion of successful displacements from the feed bunk relative to all displacements in which the animal was involved. (Galindo and Broom, 2000

Dromedaries camel may blow out (spit) cud when excited. Little aggressive behavior except among males during breeding season. Adults may push with lowered head and neck. Canine teeth used as weapons extreme fights can result in death of both combatants.

productive performance

Live body weight

The restraining of the camels proved to be highly efficient without causing any stress on the animals while affording maximum security for the workers. The live body weight of camel was obtained through direct balances and table balances for advance age (**Chimsa et al., 2013).** Weight of camel was measured using digital scale.

Table (2) Chemical composition of camel feedstuffs which offerd to IBS and SIBS groups (% dry matter basis)

Item	Alfalfa	Concentrated mixture	Rice straw
DM	89.96	89	89.25
OM	90.00	87.64	86.33
CP	13.76	13.48	4.92
CF	36.20	9.00	37.87
EE	1.28	2.81	1.03
NFE	38.76	62.36	42.51
ASH	10.00	12.35	13.67

*ab: Means in the same column bearing different superscripts are significant. SE standard error of mean; ** $p<0.05$

IBS: intensive breeding system **SIBS**: semi-intensive breeding system

Blood samples and analysis

Blood samples were drawn from the jugular vein of each camel. Ten ml of blood were collected into tubes. Serum was prepared by centrifugation at 1400 r for 15 min. **(Osman, A.M *et***

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***al* ,2015).** Then separated from the other container tube and was immediately frozen at -20°C for future analyses until assayed. The serum samples were analyzed for concentrations of steroid hormones including estradiol-17 (E2), progesterone (P4), Try-Iodothyronine (T3) and thyroxin (T4) determined by ELISA Reader (CLINDIAG, MR-96 -2015.Belgium) using the standard kits (USA) methods.

Biochemical tests:

BIOMERIEUX diagnostic kits (France) were used to determine the concentrations of the following parameters in serum samples: total Protein, Albumin, Globulin, total Bilirubin, Cholesterol and Glucose to know the liver Functions also determine the Creatinine, Urea, uric acid as well as the activities of the Kidney. All parameters were determined photometrically using Spectrophotometer – JENWAY (Genova. UK). All blood parameters were determined in the animal health Research institute- Cairo–Egypt.

Hormonal assay:

The concentrations of estradiol, progesterone and Thyroid hormones (Triiodothyronine, Thyroxin) in serum were measured using ELISA micro wells procedures.

Estradiol (E17-β) assay:Serum estradiol levels were assayed using enzyme immunoassay test kit (Cat. No.: BC-111, from BioCheck, Inc, Foster City) according to (**Tietz, 2006)** ***Principle:*** - The assay based on the principle of competitive binding between estradiol in the sample and estradiol-horseradish peroxidase (enzyme-labeled estradiol) for a constant amount of rabbit anti-estradiol. The absorbance is measured by ELISA reader at 450 nm and the colour intensity was inverselyrelated to the estradiol concentration of the sample.

Triiodothyronine (T3) assay:

Serum T3 levels were assayed using kits purchased from immune spec.

Statistical Analysis

For Statistical analysis using the Statistical Package for Social Sciences program (SPSS software, version 11). The Questionnaire data were analyzed mainly in the form of Descriptive Statistics for means, and one-way ANOVA test was used to significant difference between means within group.

Result and discussion

place for camels:

The study revealed that there is no specific place in EBS system (100%) also, in SIBS there were managed in spring area in morning time tell beginning night at 4 pm camel housed, the majority (76.5%) haven't, but some (23.5%) have with significance difference (P≤ 0.05) . In IBS intensive system all camel housed during day. **(Ismail, N. D. and Al-Mutairi, E. 1991).**

Table (3): specific place of management systems (mean values ±SE)

Management system	Specific place (%)	
EBS	--------	100[a]
SIBS	70.4	29.6
IBS	100[a]	

*ab: Means in the same column bearing different superscripts are significant. SE standard error of mean; ***p*<0.05

2- Sources of Nutrition

In Table (2) that illustrates EBS system the majority camels depend grazing on natural pasture (range grazing) &fodders from Rain fed agriculture (**Payne, W. J. A. 1990)**. and few of camel depend completely on grazing from natural pasture. In SIBS camel fed 33.3% fodders and concentrate, **(Osman et al., 2015; Ahmed et al.,2015)**. while that in IBS intensive system some

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camels depend in their feeding on pasture+ fodders + concentrate and others depend completely on fodders+ concentrate without grazing. And few of them depend on pasture + fodders

Table (4): Sources of Nutrition (mean values ±SE)

Management system	Source of Nutrition %			
	Grazing	Grazing &Fodders	Grazing,fodders& concentrate	Fodder & Concentrate
EBS	95.6[a]	4.4	0	0
SIBS	33.3	33.3	33.3	60.6[a]
IBS	0	5.3	91.5[a]	8.5

*ab: Means in the same column bearing different superscripts are significant. SE standard error of mean; **p<0.05

Table (5): Proximate analysis (%) of crop residue and different grazing species which found in IBS in desert

Feed/Forage Species	DM	CP	EE	CF	NDF	ADF	Crude ash
Acacia modesta	53.4	13.23	2.21	35.40	46.6	28.78	6.94
Haloxylonsalincornicum	15.85	3.09	32.33	51.34	51.34	37.5	11.93
Cicerarientinum	93.53	9.72	2.60	44.4	68.7	47.6	7.83
Ziziphusmauritiana	40.2	15.52	5.77	28.02	48.3	26.9	8.48
Haloxylonsalincornicum	34.2	15.85	3.09	23.42	51.34	37.5	11.9

*ab: Means in the same column bearing different superscripts are significant. SE standard error of mean; **p<0.05

3- Feeding behavior during 6 months

Drinking: Drink water from water draft.Rumination: A bolus of regurgitating food goes back into his mouth and the camel re-chewed and re swallowing it again while standing or lying down. (**Ramadan D. El Shoukary,2020)**

Regarding the influence, the management system during 6 months on feeding behavior of camel results in Table (3) showed that a significant increase drinking frequency, duration and grazing duration under semi-intensive system SIBS, while there was a significant decrease in grazing frequency in semi-intensive breeding system. there was significant difference in body weight gains between the two management systems; this may be depending on the type of management and these findings were agreement with the results of (**Turki et al. 2007).**

Table (6): Behavioral observations (mean values ±SE) in camel feeding behavior during 6 months under intensive system, semi-intensive and extensive system Duration (in seconds)

Management breeding system	Drinking	Rumination	grazing
	duration	duration	duration
EBS	2.19±.09b	3.62±.21b	2.31±.10b
SIBS	6.12±.12a	9.82±.17a	7.34±.19a
IBS	1.11±.09	5.23±.10b	2.11±.10b

*ab: Means in the same column bearing different superscripts are significant. SE standard error of mean; ***p*<0.05

The effect of management system on aggression compared to EBS, SIBS and IBS groups, IBS groups had significant increases in aggressive and standing behaviors (P < 0.05), however, **(Khanna, N. D *et al.*, 2004)**.it had significant decreases in the daily duration and frequency locomotion activity

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(walking), and rumination and the body condition score (P < 0.05). In addition, there were no significant differences in the duration of drinking behavior (P > 0.05).

4- Handling camels in management systems

There were a significant difference between three groups of systems of handling with camels (**Sallam *et al.*, 2012)** in EBS camel did not have any care except installing of pedometer on their feets and let them in the spring area (10.3%) but in SIBS were (25.7%) . but all care was a significant difference (P < 0.05) in IBS **(Field, C. R. 1979).**

Table (7): Handling camels in management systems (mean values ±SE)

Management systems	Handling camels		
	Good nutrition %	Only observation %	Doesn't have any care %
EBS	5.2	54.9	0
SIBS	45.5	23.3	25.7
IBS	60.6	8.9	5.3

*ab: Means in the same column bearing different superscripts are significant. SE standard error of mean; ***p*<0.05

Table (8): The average body weight of the experimental animals through 6 months

Item	EBS	SIBS	IBS
Initial body weight in the first period of trail (Kg)	293.4	292.0	291.6
Final body weight in the final period of trail (Kg)	297.6	308.8	300.3
Average body weight(g)	420	1680	870

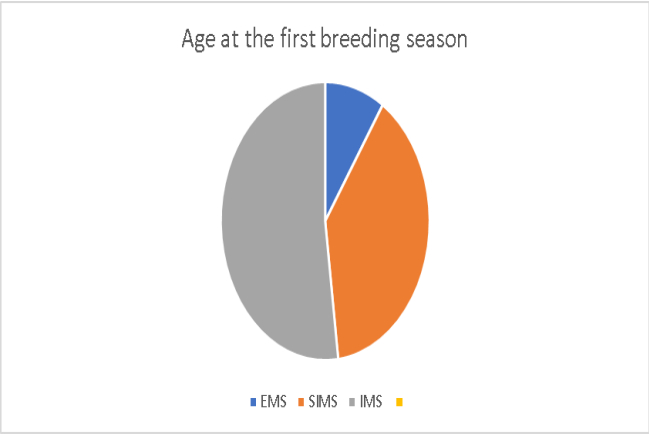
***ab: Means in the same column bearing different superscripts are significant. SE standard error of mean; ***p*<0.05

Weight of camels which found in group ISBS were ignificantly increase in their weight than those in other groups

5- Age of camel at the first breeding season:

The results of current study revealed that the majority (64.7%) in intensive system IBS and (56%) in EBS system of female camel are attending puberty age at first breeding at 3-4 years in both systems, (**Chimsa *et al.*, 2013)** furthermore in IMS intensive system some (23.5%) females are attending less than 3 years and little (11.8%) at 4-5 years this contrasted with EBS system as some (39.1%) females are attending at 4-5 years and little (4.3%) less than 3 years with significant affects($P \leq 0.05$)**,(Hammadi, *et al* .,2001)** On the other hand, age of male camel at the first breeding season showed that the differences among the two production systems. (**Tamhane, A. C. and Dunlop, D. D. 2000)** in IBS intensive system the majority (64.7%) of male camel, are attending age at first breeding at 4-5 years, contrasted with EBS system, the majority males are attending at age more than 5 years with significant deferent ($P \leq 0.05$), **(Schwartz, H. J. and Dioli, M. 1992).**

Figure (1): Age at first breeding season



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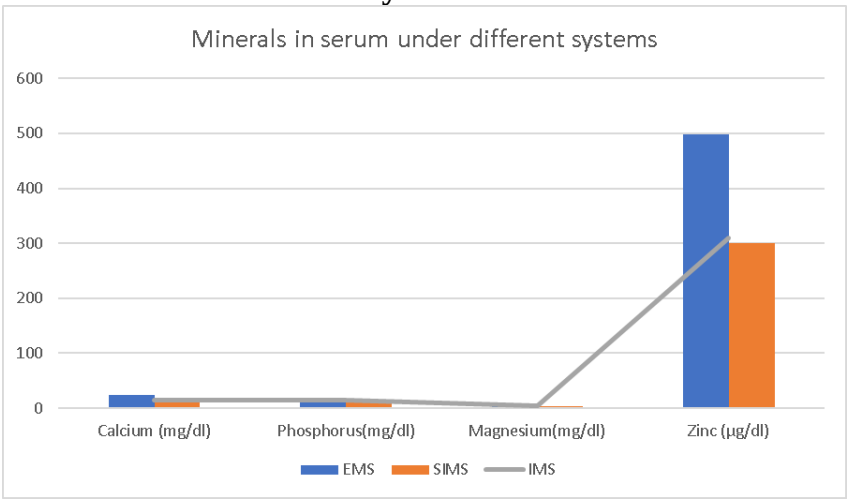
6- Minerals:

Blood minerals of Maghrebian camel were (**Gebreyohanes M.G., Assen A.M,2017).**studied at different management systems and measuring some of it such as Calcium, Phosphorus, Magnesium, and Zinc. The means of results are presented in figure below

Figure (2): Minerals in serum under different management systems



7- The effect of breeding system on blood bio chemicals and hormones levels

Levels of testosterone, T3, T4 and T3 / T4 ratio were decreased in the HSD group in comparison with the EBS and the SIBS groups; however, IBS had a significant increase in the cortisol level. (**Hashem N.M.,2016)**On the other hand, there were no significant differences in the measured biochemical blood parameters between all the tested groups.

Table (9): The effect of breeding system on blood bio chemicals and hormones levels

Blood parameters	Bredding systems (%) *		
	EBS	SIBS	EBS
Blood Chemicals			
Total protein *(g\100 ml)*	7.3 ± 0.3	7.5 ± 0.4	7.2 ± 0.3
Albumin *(g\100 ml)*	2.7 ± 0.2	2.8 ± 0.6	2.6 ± 0.2
Globulin *(g\100 ml)*	4.6 ± 0.4	4.7 ± 0.3	4.6 ± 0.4
A/G ratio	0.59 ± 0.01	0.60 ± 0.01	0.57 ± 0.01
Blood hormones			
Cortisol (n. mol/l)	83.8 ± 2.1 b	85.9 ± 1.5 b	92.8 ± 1.9 a
Testosterone (n. mol/l)	1.7 ± 0.3 a	1.8 ± 0.4 a	1.2 ± 0.1 b
T3 (n. mol/l)	1.9 ± 0.3 b	2.2 ± 0.6 a	1.6 ± 0.4 b
T4 (n. mol/l)	3.5 ± 0.8 ab	3.8 ± 0.7 a	3.3 ± 0.6 b
T4 / T3 ratio	1.84 ± 0.2 ab	1.72 ± 0.3 b	2.06 ± 0.5 a

*ab: Means in the same column bearing different superscripts are significant. SE standard error of mean; **$p<0.05$

In the present study, the increased serum cortisol level with IBS agreed with (**Degen, 1987**) who found that, IBS associated with elevation in the cortisol level. These results can be attributed to adrenal function alterations and elevated cortisol concentrations, which mobilize energy to manage stress, such as the fight/flight response (**Yesihak, Y. and Bekele, T. 2004)**

Testosterone is the most important sex hormone, which regulate most of the reproductive functions such as the activity of sex accessory glands, spermatogenesis and libido of male animals **(Al-Mutairi, S. E.*et al.*, 2000)** reduction in the

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testosterone levels in the IMS could be attributed to elevated cortisol level and stress (**Chimsa, M. *et al*,. 2013.)**

Thyroid hormones (T3 and T4) play a vital role in controlling thermoregulation and metabolism, they are influenced by stress. In the current study, the reduction in serum T3 and T4 levels with IBS agreed with that reported by (**Iqbal, A., Gill.,*et al*.,2000)**. The activity between the thyroid gland and hypothalamus are strongly linked, and the observed decrease in the levels of T3 could be attributed to the influence of IMS related stress on the hypothalamus. When enhanced by stress, the hypothalamus reduced the thyroid stimulating hormone-releasing hormone (TSH-RH), this inhibit the thyrotropes of the anterior pituitary from releasing the TSH (**Agab, H. 1993).** The concentrations of the TSH-RH will be measured in a future study to support this hypothesis.

There was no significant effect of stocking density on serum biochemical parameters. The lack of observable difference between groups may be due to the same amount of feed and the same feeding and watering space provided to all groups.

Conclusion

Camels may have the potential to breed all year around, but are constrained by the environmental signs. Whether daylight duration or food supply is the key factor inducing seasonality in camels remains to be clarified. the study suggest that food supply may be more important

Most camels in North Coast region in Egypt though are generally considered to be in good health and excellent condition, **(Altmann, J. 1974)** doubtless because of the ample availability of feed in the form of durra byproducts. Access to harvested durra fields, however, does not come cheaply indicated that; availability of feed for camels under EMS system increased and improved blood biochemical.The results of the present study

showed there were no variation in the concentrations of serum Creatinine and Glucose of dromedary camels under three management systems.

The current study demonstrated there were significant changes in the level of Total Proteins, Albumin, Globulin, Total Bilirubin, Urea Concentration and Uric Acid and all observed were higher in EBS system except Urea Concentration was higher in IBS Intensive system.

The present study confirmed that the performance of camels at semi-intensive system SIBS was better in comparison to the EBS management systems; therefore initiation of the semi-intensive system should be encouraged at the different region in Egypt .Breeding practices should be modernized and improved .We recommended that improvement of nutrition and health increase ,the efficiency of reproduction and production of camel

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Ethical consideration

This study was carried out in accordance to the ethical rules for handling the experimental
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Conflict of Interest

Authors have no conflicts of interest to disclose

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