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### A Case Study on Camel's Production System in Marsa-Matrouh Governorate, Egypt

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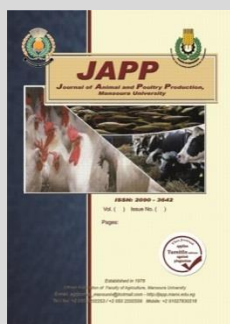
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#### ABSTRACT

The objective of this study is to characterize the prevailing production system of raising camels in Marsa-Matrouh governorate in Egypt. A semi-structured questionnaire was designed to collect the required data randomly from 58 respondents in four regions, during the year 2020/2021. The questionnaire contains socioeconomic characteristics, herd size, management practices, milk production, reproduction performance, birth and weaning weights, and the main constraints. The obtained results showed that more than 95% of the camel's breeders were illiterate or barely read and write. Their main job is farming. Most of the breeders were landowners. The majority of the breeders are raising sheep, goats, and poultry besides camels. All camel breeders are applying natural mating. The average age of the camel at first calving was 5.5 years, and days open were 56.4 days. Calving interval ranged from 20.8 to 22.1 months. Daily milk yield was ranged from 5-10kg/head, and lactation period was around 9 months. The average birth weight for both female and male calves was 30kg and 35kg, respectively. Camel calves are weaned at about 145kg and 7 months age. The main constraints facing camel breeders were increasing feeding costs, water shortage, poor pasture, and poor veterinary care. The study concluded that camels play an important role for the people living in the harsh climate. Camel breeders are facing many problems which affect camel productivity and reflect on their economic livelihood. Proper and prompt moving is badly needed to optimize performance and achieve efficient camel production and economic return.

**Keywords:** camel production system, camel breeders, socio-economics, Egypt.



#### INTRODUCTION

Camels are very important in semiarid and arid zones. They are more adapted to arid areas than other livestock species. Due to this adaptability, camel's milk and meat products represent a significant contribution of total intake in pastoral systems (Ahmad *et al.*, 2010). Camels have unique physiological characteristics, which allow them to produce under extreme environmental conditions, whereas the productivity and performance of other livestock species are adversely affected (Faraz *et al.*, 2013). So, camels are an important component of the desert ecosystem and play an important role in the socio-economic pastoral and agriculture system in the North West coastal zone of Egypt (Bhakat, 2000).

According to FAO statistics, the population of camels in Africa is more than 32 million head. The total number of camels in Egypt reached 119885 head (FAO, 2019). Despite camels being very important in pastoral areas, very little information is known about their production systems and productivity.

The overall goal to conduct a field study on the camel's production system in Marsa-Matrouh governorate is to investigate the main characteristics of the pastoral production systems. The study objectives were to determine the social characteristics of camel breeders in Marsa-Matrouh governorate, characterize the prevailing production system of raising camels, assess camel's productive and reproductive performance, and investigate

the main constraints and problems facing the camel breeders.

#### MATERIALS AND METHODS

This study was conducted in four regions in Marsa-Matrouh governorate from July 2020 till May 2021. These regions are Matrouh, Sidi Barani, El-Negila, and Ras El-Hekma. Marsa-Matrouh governorate is located on the North-West coast of Egypt at 27.237° longitudes and 31.353° latitudes. Using a semi-structured questionnaire, a total of 58 camel breeders were randomly selected and interviewed. The questionnaire's information included: some socioeconomic characteristics, herd size, management practices, milk production, reproduction performance, birth and weaning weights, and the main constraints facing the camel's breeders.

The collected data were divided into three groups according to the herd size: group 1 (G1; <40), group 2 (G2; 40-60), and group 3 (G3; >60); as shown in table (1). Data were processed and analyzed by one-way ANOVA test using SAS statistical package (SAS, 2010). The least-squares technique using the General Linear Model procedure (GLM) of SAS program. The significant differences among means were set at  $P < 0.05$  using the multiple range test of Duncan. Chi-square test was applied to express means in terms of frequency and percentages (Snedecor and Cochran, 1993). The preliminary analysis revealed that there is no effect of the location on the observed traits. So, it was omitted from the model. The

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following statistical model was applied to analyze the observed traits:

$$Y_{ij} = U + G_i + e_{ij}$$

Where:  $Y_{ij}$ : is an individual observed traits Y, U: is the overall mean,  $G_i$ : is the number of camel heads,  $i = 1, 2, \text{ and } 3$ ;  $1 = <40$  head of camels (G1),  $2 = 40-60$  head (G2), and  $3 = >60$  head (G3), and  $e_{ij}$ : is an error attached to the  $ij$  observation.

**Table 1. Number of households, average, minimum, and maximum camel's herd size.**

Group*	Household s No.	Herd size (head)		
		Average	Minimum	Maximum
G1	19	26	3	35
G2	17	47.5	40	57
G3	22	102	60	300

\*G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

## RESULTS AND DISCUSSION

### Social characteristics

The analyses of collected data as shown in Table (1) revealed that about one-third of camel's breeders had less than 40 heads of camels, 38% had equal or more than 60 heads, and only 29% of them had from 40 to less than 60 heads. The questionnaire data shows that 100% of the camel's breeders were male in all groups. This may be due to the nature of the pastoral system and customs and traditions of the society in Marsa-Matrouh governorate. From table (2), more than 95% of the breeders were illiterate or barely can read and write. This result is close to those found by Mansour (2016), who mentioned that 33% of camel's herders were illiterate and about 57% learning at Quran schools "Kouttab". Also, Marghazani *et al.* (2019) noted that most of the camel breeders in Pakistan are illiterate. About fifty-three percent of the breeders in G2 have increased their camel's herd size, while the rest maintained it fixed. The percentage reached 45.45 and 47.36% in both G3 and G1, respectively. Farming is the main job for most camel breeders (more than 88%) in the three groups (table 2).

**Table 2. Social characteristics of camel breeders.**

Classification	Group*					
	G1		G2		G3	
	No.**	%	No.	%	No.	%
Education level:						
Intermediate education	1	5.26	0	0	1	4.54
Read and write (Literacy)	12	63.15	5	29.41	7	31.81
Illiterate	6	31.57	12	70.58	14	63.63
Herd size:						
Increased	9	47.36	9	52.94	10	45.45
Fixed	10	52.63	8	47.05	12	54.54
The main job:						
Farmer	17	89.47	15	88.23	20	90.90
Governmental employee	0	0	0	0	1	4.55
Others***	2	10.52	2	11.76	1	4.55

\*G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

\*\*No: number of households.

\*\*\*Others: include other jobs like a driver, trader, and worker....etc.

Differences between groups for education level are not significant ( $\chi^2 = 7.0317, P = 0.1342$ ).

Differences between groups for herd size are not significant ( $\chi^2 = 0.2246, P = 0.8938$ ).

Differences between groups for the main job are not significant ( $\chi^2 = 0.2.3429, P = 0.6730$ ).

According to table (3), years of experience of camel's breeders ranged from 32.5 up to 40.4 years in the

three groups, with no significant differences among groups. Family size was ranged from 6.6-7.9 people in the three groups. The differences among groups were not significant. This result is less than what was found by Hussain *et al.* (2013) who estimated that the mean family size in Pakistan was 13.4 people. The difference in average family size between Egypt and Pakistan can be explained by applying the family-planning programs in Egypt, which resulted in decreasing family size.

**Table 3. Least-squares means and standard errors (LSM±SE) of family size, breeder's age, and years of experience of camel's breeders.**

Group*	Family size (person/family)	Breeder's age (year)	Years of experience
G1	7.89±0.433 <sup>a</sup>	54.74±2.444 <sup>b</sup>	32.58±3.296 <sup>a</sup>
G2	7.94±0.457 <sup>a</sup>	62.53±2.584 <sup>a</sup>	40.47±3.484 <sup>a</sup>
G3	6.68±0.402 <sup>a</sup>	53.73±2.271 <sup>b</sup>	33.23±3.063 <sup>a</sup>

\*G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

Means with different letters within the same column are significantly different ( $p < 0.05$ ).

The data presented in table (4) shows that more than 85% of the breeders were landholders. About Fourteen percent of the breeders in the third group were found to need to rent extra land. The data in table (5) revealed a variation in the average owned and rented land between groups. This may be explained by the structure variance of the herd size in the third group as mentioned in table (1). It has been realized in this current study that the land tenure issue was found to be more than what reported by Kaurajo *et al.* (2020), who cited that each camel herder owned from 1-5 acres of land. This can be explained due to the nature of the pastoral system in Marsa-Matrouh governorate, where "put the hand" is applied on many land areas.

**Table 4. Number of households and percentage of landholding in the three groups.**

Landholding	Group*					
	G1		G2		G3	
	No.**	%	No.	%	No.	%
Owner	18	94.73	17	100	19	86.36
Owner and land renter	1	5.26	0	0	3	13.63

\*G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

\*\*No: household number.

**Table 5. Average, minimum, and maximum of owned and rented land in the three groups.**

Group*	Owned land (acres)			Rented land (acres)		
	Average	Minimum	Maximum	Average	Minimum	Maximum
G1	57	4	300	0.5	0	10
G2	73	10	300	0	0	0
G3	136	1	600	14	0	200

\*G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

Table (6) shows that the main three sources of income for breeders were breeding livestock, cultivating land, and off-farm employment. The income from breeding camels was found to represent 22.5, 23.9, and 21.5% of total income in G1, G2, and G3 respectively. While, representing 45.4, 50.4, and 48.9% of income from breeding livestock in

G1, G2, and G3 respectively. No significant differences were found among groups in all income sources.

**Table 6. Least-squares means and standard errors (LSM±SE) of income sources for breeders in the studied areas.**

Source of Income	LSM ±SE
Income from breeding livestock* (L.E/month):	
G1**	3023.68±226.107
G2	2970.59±239.037
G3	3068.18±210.126
Income from cultivating land (L.E/month):	
G1	2776.32±326.428
G2	3000.00±345.096
G3	3477.27±303.357
Income from off-farm employment (L.E/month):	
G1	289.47±278.985
G2	294.12±294.940
G3	431.82±259.266
Income from breeding camels (L.E/month):	
G1	1373.68±126.545
G2	1497.06±133.782
G3	1500.00±117.601
Total income (L.E/month):	
G1	6089.47±606.058
G2	6264.71±640.718
G3	6977.27 ±563.222

\* Livestock: includes camels.

\*\* G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

Differences among groups are not significant at 5% level (P<0.05).

The breeders purchased their camels either from neighbors or the market. It has been found that 86% of breeders in the third group prefer to purchase camels from neighbors, while the other two groups recorded about 60% (table 7). The main reason behind that the source of purchasing the animals is a highly matter for the breeders, where the average herd size in G3 was 102 heads (see table 1), so they want to be reassured what they purchase. In the meantime, they want to reduce the purchase costs by skipping the commission of the middlemen.

**Table 7. Place of purchase camels in the three groups**

Purchase Place (%)	Group*		
	G1	G2	G3
Neighbors	62.5	58	86
Market	37.5	42	14

\* G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

**Production system characteristics**

The prevailing camel breed in the target area of the study was Maghrebi. The majority of breeders raised sheep, goats, and poultry besides camels (73.6% in G1, 58.7% in G2, and 45.5% in G3). About six percent of breeders in G2 and 13.6% in G3 breed camels only (Table 8). These findings were found to be near to those reported by Mansour (2016), who found that 10% of respondents raised camels only. In general, there were no buffaloes. This may be due to the water shortage in Marsa-Matrouh governorate, which made it a constraint to breed buffaloes.

The camel's breeders are cultivating figs, grapes, and olive trees. While 13.5% are cultivating watermelon to

generate further income in the summer season. They sell 75% of the yield for cash and 25% for home consumption. The main cultivated crops in the winter season are wheat and barley. All breeders are using whole wheat yields for home consumption while only 70% of barley yield is used for home consumption and the rest for animal feeding.

The herders depend on grazing on the natural pastures, but, pasture quality is poor. Animals grazed on crop residues, desert herbs, bushes, and trees like "Ajram and Akoul". So, complementary feeding is practiced. The herders fed their camels about 5kg/head on a mixture of corn, bean, barley, or wheat daily in the evening. The herders depend on either wells or stored rainwater in drinking camels and kept camels in a barn close to the tent in the pasture.

**Table 8. Number of households and livestock percentages in the three groups.**

Livestock	G1*		G2		G3	
	No.*	%	No.	%	No.	%
Camels, cows, sheep, goats and poultry	1	5.3	1	5.9	5	22.6
Camels, sheep, goats and poultry	14	73.6	10	58.7	10	45.5
Camels, sheep and goats	2	10.5	1	5.9	3	13.6
Camels, sheep and poultry	0	0	1	5.9	0	0
Camels and sheep	1	5.3	3	17.7	1	4.6
Camels and goats	1	5.3	0	0	0	0
Camels only	0	0	1	5.9	3	13.6

\*G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

\*\*No: number of households.

Difference between groups for livestock are not significant ( $\chi^2 = 14.8116, P=0.2519$ )

**Reproductive performance**

Reproduction data showed that 100% of the camel's breeders used the natural mating by a bull from the herd. Also, they didn't use palpation to ensure the incidence of pregnancy. About three-quarters of them noted that the breeding season was from November to March. They usually mate she-camels four times to get pregnant. However, Abd El-Salaam and Arafa (2018) noted that the number of services per conception in the Maghrebian she-camels in Egypt ranged from 2.86 to 4.43 times according to parity order. On the other hand, Simenew *et al.* (2013) said that the number of services per conception was 1.63±0.85 in Afar camels in Ethiopia. Gherissi *et al.* (2020) reported that the number of services per conception in Algerian camels was 2.09±1.03, and Faraz *et al.* (2021) found that the pastoralists in Pakistan mate she-camels 2-3 times in order to get pregnant.

The average age at first calving was 5.5 years. It was close to Simenew *et al.* (2013) who found that the mean age at first calving was 5.36±0.74 years. Also, Bhakat (2000) reported that age at first mating was 4 years. While it was found to be more than 4.4 years for camels in Western Sudan as estimated by Musa *et al.* (2006). Also, Gherissi *et al.* (2020) in Algeria noted that the average age at first calving was 4.25 years. Calving interval ranged from 20.8 to 22.1 months. This result was found to be in line with Bhakat (2000), Musa *et al.* (2006), and Gherissi *et al.* (2020) who noted that calving interval was 22.3±3.0, 20.96, and 22.32±5.63 months, respectively. But it was found to be less than 31.2 months as estimated by Simenew *et al.* (2013). No

significant differences were found among groups in all reproduction parameters, as shown in table (9).

**Table 9. Least-squares means and standard errors (LSM±SE) of reproduction parameters for she-camels in the studied areas.**

Classification	LSM±SE
Age at first calving (Year):	
G1*	5.26±0.131
G2	5.59±0.143
G3	5.62±0.124
Calving interval (month):	
G1	22.11±0.903
G2	20.82± 0.954
G3	21.55± 0.839
Days open (day):	
G1	55.79±1.889
G2	56.47±1.997
G3	56.82±1.755
No. of insemination/conception:	
G1	4.47±0.269
G2	4.29±0.284
G3	4.41±0.250

\* G1: camel herd size is <40 head, G2: camel herd size is 40-60 head, and G3: camel herd size is >60 head.

Differences among groups are not significant at 5% level (P<0.05).

### Productive performance

Camel herders milked the dams twice daily. The daily milk yield was ranged from 5-10kg/head in the three groups. This result was in a match with what was found by Musa *et al.* (2006) and Eisa and Mustafa (2011) who found that the milk yield of Sudan camels ranged from 5-10kg/day. This yield was found to be in line with Hussain *et al.* (2013), Kaurajo *et al.* (2020), and Faraz *et al.* (2021) who estimated that the average daily milk yield was ranged from 4-9 liters in different camel's breeds in Pakistan. While it was more than what was found by Bhakat (2000) and Marghazani *et al.* (2019) who noted that the average daily milk yield was 3kg, and ranged from 2-5 liters in both Egypt and Pakistan, respectively. The differences in the daily milk yield can be explained by the breed differences and environmental and management conditions (Aljumaah *et al.*, 2011 and Kamoun and Jemmali, 2012).

The extra milk, after calves suckling, was used for home consumption and as a gift for relatives and neighbors. The lactation period was around 9 months with no significant differences among the groups. The result was almost the same as what was found by Bhakat (2000) and Musa *et al.* (2006), who said that the average lactation length was 9.4 and 9.9 months, respectively. But, it was different from that of Faraz *et al.* (2021), who mentioned it ranged from 6-18 months.

Calves' average birth weight was 30kg and 35kg for both females and males. These findings were less than what was found by Faraz *et al.* (2021), who estimated that calves' birth weight ranged from 32-39 and 34-50 for females and males, respectively. Also, Abdel Fattah and Roushdy (2016) reported that calves' birth weight was 37.45 and 37.6kg under semi-intensive and traditional systems in Egypt, respectively.

The camel's herders leave calves with their dams for natural suckling. Weaning happens when calves reach

145kg weight at about 7 months of age. These results were less than Musa *et al.* (2006) and Faraz *et al.* (2021) who estimated weaning age at 9 and 12-16 months, respectively. After weaning, the camel breeders sell the male calves; which are out of their need at about one year old to get cash to pay for their basic needs. On the other hand, they keep the females for increasing herd size and replacement. The same result was found by Bhakat (2000). They also sell out old females who have reproductive and productive problems. The average mortality rates before and after weaning were 22% and 2%, respectively. It was near (20%) to those estimated by Faraz *et al.* (2021). Also, Bhakat (2000) found that mortality rates ranged from 16-20% and 0-1% for both calves and adult camels, respectively.

### The main constraints

The main constraints facing camel breeders in raising camels were, increasing feeding costs, water shortage, poor pasture, and camel's death due to road accidents and rodenticides used by oil companies. Also, the breeders were suffering from poor veterinary care and the high price of vaccination and medication which resulted in the spread of diseases like (scabies, clostridia, septicemia, blood parasites especially Trypanosoma, camel pox, and viral diseases). The breeders proposed some solutions for the problems like providing forages at subsidized prices or purchasing on credit through cooperative societies, establishing reservoirs and dams to collect rainwater, cultivation of forage crops on rain, and paying the attention to veterinary care from the veterinary medicine directorate.

### CONCLUSION

Camels consider a perfect source for food production mainly for pastoralists and people in arid and semi-arid areas. Camel's breeders are facing many constraints, which resulted in poor economic returns. Poor nutrition is the most important problem. Thus resulting in poor growth performance, decreased conception rate, increased calving interval, and low milk yield. Further studies are needed to analyze and evaluate the camel's production system in Marsa-Matrouh governorate. Also, to study and characterize different production systems in rearing camels in different regions in Egypt. Policy-makers should pay attention to this neglected animal, which could be the future hope for food security, especially under the existing problems of climatic changes.

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**دراسة حالة على نظام إنتاج الإبل في محافظة مرسى مطروح بمصر**  
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تهدف هذه الدراسة لتحديد خصائص نظام الإنتاج السائد لتربية الإبل في محافظة مرسى مطروح بمصر. تم تصميم استمارة استبيان لجمع البيانات عشوائياً من 58 مربى للإبل في أربعة مراكز خلال عام 2021/2020. تضمنت بيانات الاستبيان الخصائص الاجتماعية - الاقتصادية، حجم القطيع، إنتاج اللبن، الأداء التناسلي، أوزان الميلاد والفظم، وأهم المعوقات. وأظهرت النتائج أن أكثر من 95% من مربى الإبل أميون أو بالكاد يقرأون ويكتبون. كانت "الفلاحة" هي المهنة الرئيسية للمربين. و كان معظم المربين من ملاك الأراضي. غالبية المربين يربون الأغنام والماعز والدواجن إلى جانب الإبل. كان نظام التلقيح الطبيعي هو النظام المتبع لتلقيح الإبل. كان متوسط العمر عند أول ولادة 5.5 سنوات، وبلغ عدد الأيام المفتوحة 56.4 يوماً و تراوحت الفترة بين الولادتين بين 20.8-22.1 شهراً. كان إنتاج اللبن اليومي يتراوح بين 5-10 كجم/رأس، واستمر موسم الحليب حوالي تسعة أشهر. بلغ متوسط وزن الميلاد لكل من الإناث والذكور 30 و35 كجم على التوالي. تقطع العجول عندما يبلغ وزنها حوالي 145 كجم وعمرها سبعة أشهر. كانت أهم المعوقات التي واجهت المربين هي زيادة تكاليف التغذية ونقص المياه وضعف المراعي وسوء الرعاية البيطرية. خلصت الدراسة إلى أن الإبل تلعب دوراً هاماً للأشخاص الذين يعيشون في الظروف المناخية القاسية. ويواجه مربو الإبل العديد من المشاكل التي تؤثر على إنتاجيتهم و تنعكس على معيشتهم الاقتصادية. وهناك حاجة ماسة إلى التحرك على نحو صحيح وعاجل من أجل تحسين الأداء و تحقيق الكفاءة والعائد الاقتصادي من إنتاج الإبل.