Environmental Factors Affecting Some Productive and reproductive Traits in Egyptian Buffaloes

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A B S T R A C T

This study was conducted to evaluate the effect of some environmental factors on milk production in Egyptian buffaloes and the effect of parity and season of calving on calving interval and days open. There was a significant effect of parity ($P \leq 0.05$) on 305day milk yield, while season of calving had a highly significant effect ($P \leq 0.01$) on 305day milk yield. Animals with age at first service less than 21 months and age at first calving less than 35 months had higher milk yield than other animals (2489.5 and 2526.7 kg, respectively). With increasing days open, milk production increased so animals had more than 160 days open produced 2757.8 kg milk. Milk yield in winter (2600.5 kg) was higher than in summer season (2441.5 kg). Animals which conceived four or more services produce more milk yield (2529.8 kg). Season of calving had a significant effect ($P \leq 0.05$) but parity had a highly significant effect ($P \leq 0.01$) on calving interval and days open. There was direct relationship between milk yield with each of calving interval and days open. Animals that gave more than 3000 kg showed the maximum calving interval and days open (14 months and 111.8 days, respectively).

Keywords: calving interval, 305day milk yield, Egyptian buffaloes, Paritym Season of calving, Services.

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1. INTRODUCTION

Water buffaloes include river buffaloes and swamp buffaloes; the Egyptian buffaloes are the river type. It is a species of great economic value in Egypt due to it is a main source of milk and meat. Egyptian buffaloes can be classified according to their geographical locations into Beheiri, Balady and Menoufi which are found in North Egypt and Saiedy found in South Egypt (DAS-IS, 2004). There were nearly 195 million buffalo in the world, 97% in Asia, 0.2% in Europe mainly in Italy and 2% in Africa mainly in Egypt (FAO, 2013). Bovine species characterized by their high milk and meat production also their tolerance to hot environmental condition, draught ability and a reasonable growth rate on roughage feed so these animals mostly used in developing countries (Mondal et al., 2007). Reproductive efficiency of dairy animals has an effective role on the profitability of the dairy farm. Fertility traits as number of services per conception and days open play an effective role on productive life of animal. The short day's open and minimum number of services per conception increases productive life of the animal and the number of calf crops (Ali et al., 2011).

The objective of this study was: Determination of the effects of some environmental factors on milk production in Egyptian buffaloes such as age at first service, age at first calving, calving interval, days open or service period, number of services per conception, dry period and season of calving. A. Determination of the effects of some environmental factors on calving interval and days open such as parity and season of calving. B. To determine the relationship between the level of production and fertility traits.

2. Material and methods

The data used in the present study were collected from the productive and reproductive records of Egyptian buffaloes maintained at Mahalet-Mousa experimental farms of Animal Production Research Institute (APRI), Agricultural Research Centre, Ministry of Agriculture. Animals were fed on a balanced ration covering all

requirements of them either the maintenance or milk production requirements according to the recommendation of (APRI, 1997). Heifers were naturally served for the first time when they reach 24 month of age and or 300 to 350 kg of body weight.

2.1. Studied traits:

2.1.1. Non–genetic factors affecting milk production traits:

1. Parity. **2.** Age at first service. **3.** Age at first calving. **4.** Calving interval. **5.** Days open. **6.** Number of services /conception. **7.** Dry period. **8.** Season of calving.

2.1.2. Factors affecting calving interval and days open:

1. Season of calving. **2.** Parity.

2.1.3. Level of production in relation to fertility traits:

1. Number of services /conception. **2.** Age at first service. **3.** Age at first calving. **4.** Calving interval. **5.** Days open.

2.2. 2.2. Statistical Data Analysis:

2.2.1. Least squares analysis of covariance:

All data were analyzed using GLM model of SAS (SAS, 2001) for non-genetic factors**.**

2.2.1.1. First model:

To analyze the factors affecting on 305day milk yield in the present investigation, the following model was assumed. $Y_{ijklmnop} = \mu + P_i + AFS_j + AFC_k + CI_l + DO_m + S/C_n + DP_o + S_p + b_1 (Age) + b_2 (Age)^2 + e_{ijklmnop.}$

Where:- $Y_{ijklmnop}$: The observed value; (i.e. total milk yield and 305 milk yield), μ: The overall mean, P_i: The effect of the i^{th} parity; (i= 1, 2, 3 and 4, whereas 1=first parity, 2=second parity, 3=third parity and 4= fourth parity or more), AFS_j: The effect of the j^{th} age at first service; (j=1, 2 and 3, whereas 1=less than 21 months, 2=21 - 25 months, and 3=more than 25 months), AFC_k: The effect of the k^{th} age at first calving; (k=1, 2 and 3, whereas 1=less than 35 months, 2= 35-40 months, and 3=more than 40 months), CI_l: The effect of the l^{th} calving interval; (l=1, 2 and 3, whereas 1=11 to 12 months, 2=13 - 15 months, and 3=more than 15 months), DO_m: The effect of the m^{th} days open; (m=1, 2, 3 and 4, whereas 1=less than 60 days, 2=60 to 109 days, 3=110 - 160 days, and 4=more than 160 days), S/C_n : The effect of the n^{th} number of services/conception; (n=1, 2, 3 and 4, whereas 1=one service, 2= two services, 3=three services, 4=four and more services), DP_o: The effect of the o^{th} dry period; (o=1, 2 and 3, whereas 1=less than 170 days, 2=170 - 230 days, and 3=more than 230), S_p: The effect of the p^{th} season of calving; (p=1, 2, 3 and 4, whereas 1= summer season, 2=winter season, 3=autumn season and 4=spring season), b_1 and b_2: partial linear and quadratic regression coefficients of $Y_{ijklmnop}$ on age at calving and $e_{ijklmnop}$: random error.

2.2.1.2. Second model:

This model used to analyze the factors affecting on calving interval and days open in the present investigation, the following model was assumed. $Y_{ij} = \mu + S_i + P_j + e_{ij..}$ Where: - Y_{ij}: The observed value; (i.e. calving interval and days open), μ: The overall mean, S_i: The effect of the i^{th} season of calving; (i=1, 2, 3 and 4, whereas 1= summer season, 2=winter season, 3=autumn season and 4=spring season), P_j: The effect of the j^{th} parity; (j= 1, 2 and 3, whereas 1=second parity, 2=third parity and 3= fourth parity or more), e_{ij}: random error.

2.2.1.3. Third model:

This model used to analyze the effect of level of production on fertility traits in the present investigation, and the following model was assumed.

Table (1): Analysis of Variance of Factors Affecting 305-Day Milk Yield

S.O.V	D.F	M.S	F-Value
Parity.	3	680102.27	2.82*
Age at First service.	2	21735.59	0.09
Age at First calving.	2	485449.57	2.01
Calving Interval.	2	602970.59	2.49
Days Open (days).	3	427965.41	1.77
Number of Services Per Conception (S/C).	3	364393.94	1.51
Dry Period.	2	489455.90	2.03
Season of Calving.	3	1960535.80	8.12**
Age at Calving.	1	307415.15	1.27
Age at Calving 2.	1	320601.80	1.33
Experimental error	937	241323.3	

*Significant at level ($p \leq 0.05$). ** Highly significant at level ($p \leq 0.01$).

$Y_i = \mu + L_i + e_i$. Where: - Y_i: The observed value; (i.e. service per conception, age at first service, age at first calving, calving interval and days open), μ: The overall mean, L_i: The effect of the i^{th} level of production (305DMY); (i=1, 2 and 3, whereas 1= less than 2000 kg, 2=2000-3000 kg and 3=more than 3000 kg) and e_i: random error.

Table (2): Least Squares Means, Standard Errors of Various Factors Affecting 305-Day Milk Yield

Classification	N	L.S.M ± S.E
Parity.		
The 1st lactation	144	2294.25[b] ±93.22
The 2nd lactation	165	2506.63[a] ±54.64
The 3rd lactation	151	2526.05[a] ±43.82
The 4th lactation and more.	495	2600.96[a] ±55.14
Age at First Service (months).		
Less than 21.	264	2489.54[a] ±39.69
21-25.	487	2487.74[a] ±34.54
More than 25.	204	2468.63[a] ± 45.46
Age at First Calving (months).		
Less than 35.	402	2526.78[a] ±42.91
35-40.	343	2448.42[a] ±37.74
More than 40.	210	2470.72[a] ±39.68
Calving Interval (months).		
11-12.	331	2548.77[a] ±66.23
13-15.	330	2664.75[a] ±47.88
More than 15.	150	2477.72[a] ±96.97
Days Open (days).		
Less than 60.	250	2496.10[ab]±63.94
60-109.	264	2521.75[ab] ±58.09
110-160.	148	2479.26[b]±65.19
More than 160.	149	2757.89[a] ±98.78
Number of Services/Conception		
One Service.	516	2429.52[a] ±37.62
Two Services.	252	2443.99[a]±39.13
Three Services.	86	2524.54[a] ±56.71
Four Services and more.	101	2529.84[a] ±51.77
Dry Period (days).		
Less than 170.	297	2624.10[a] ±48.59
170-230.	254	2580.05[a] ±43.76
More than 230.	260	2487.10[a] ±40.36
Season of Calving.		
Summer.	239	2441.52[bc]±40.45
Winter.	191	2600.54[a] ±44.19
Autumn.	374	2385.48[c]±36.67
Spring.	151	2500.36[ab] ±46.07

Within the same classification, the appearances of least square means with the different letters are significantly different ($p \leq 0.05$). Otherwise, they do not.

3. RESULTS

Table (1) showed a significant effect of parity ($P \leq 0.05$) on 305-day milk yield, while season of calving had a highly significant effect ($P \leq 0.01$) on 305day milk yield. Table (2) mentioned that animals with age at first service less than 21 months, age at first calving less than 35 months and animals with days in milk less than 180 days had the highest milk yield. Also, animals with days open more than 160 days and with dry period less than 170 days showed the highest milk production. Table (3) noted that season of calving had a significant effect ($P \leq 0.05$) on calving interval and days open. Moreover, parity had a highly significant effect ($P \leq 0.01$) on calving interval and days open. Table (4) showed that summer season had the highest calving interval and days open than winter. With increasing lactation season, calving interval and days open decreased. Table (5) showed that a significant effect ($P \leq 0.05$) between AFC and level of production. While, there was a non-significant effect between each of AFS, CI, DO and number of services per conception with the level of production. Table (6) showed that animals that produced more than 3000 kg of milk per season showed the lowest age at first service and calving, while showed the highest number of services per conception, calving interval and days open.

Table (3): Analysis of Variance of Season of Calving and Parity Affecting Calving Interval and Days Open.

S.O.V	Calving Interval			Days Open		
	D.F	M.S	F-Value	D.F	M.S	F-Value
Season of Calving	3	25.40	2.91*	3	19136.05	2.52*
Parity	2	600.81	68.87**	2	500075.30	65.87**
Experimental error	1067	8.72425		1065	7592.169	

*Significant at level ($p \leq 0.05$). ** Highly significant at level ($p \leq 0.01$).

Table (4): Least Squares Means, Standard Errors of Season of Calving and Parity Affecting Calving Interval and Days Open.

S.O.V	Calving Interval		Days Open
	N	L.S.M ± S.E	
Season of Calving.			
Summer.	247	14.79^{a} ±0.19	135.88^{a} ±5.7
Winter.	224	14.55^{ab} ±0.20	124.26^{ab} ±6.0
Autumn.	451	14.31^{b} ±0.14	118.92^{b} ±4.4
Spring.	151	15.05^{a} ±0.24	134.21^{ab} ±7.3
Parity.			
The 2nd lactation	232	16.29^{a} ±0.19	175.13^{a} ±5.9
The 3rd lactation	185	14.08^{b} ±0.22	111.06^{bc} ±6.5
The 4th lactation and more.	656	13.65^{bc} ±0.12	98.76^{c} ±3.5

Within the same classification, the appearances of least square means with the different letters are significantly different ($p \leq 0.05$).

Table (5): Analysis of Variance of Level of Production in Relation to Fertility Traits.

S.O.V	Service Per Conception	Age at First service	Age at First calving	Calving Interval	Days Open
D.F	2	2	2	2	2
M.S	0.439219	11.84224	98.99364	4.598312	6170.048
F-Value	0.30	0.88	3.60*	0.53	0.85
S.O.V	Experimental error				
D.F	952	952	952	808	808
M.S	1.454812	13.52532	27.52751	8.654362	7298.682

*Significant at level ($p \leq 0.05$). ** Highly significant at level ($p \leq 0.01$).

Table (6): Least Squares Means, Standard Errors of Level of Production in Relation to Fertility Traits.

Classification	N	Service per conception L.S.M ± S.E	AFS L.S.M ± S.E	AFC L.S.M ± S.E	N	CI L.S.M ± S.E	DO L.S.M ± S.E
Level of Production (kg) (305DMY).							
- less than 2000	155	1.76^{a}±0.09	23.26^{a}±0.29	37.32^{a}±0.42	106	13.71^{a}±0.28	98.58^{a}±8.33
-2000-3000	673	1.84^{a}±0.04	23.11^{a}±0.14	36.31^{b}±0.20	582	14.02^{a}±0.12	109.48^{a}±3.56
- More than 3000.	127	1.86^{a}±1.07	22.70^{a}±0.33	35.70^{b}±0.46	123	14.06^{a} ±0.27	111.82^{a}±7.70

Within the same classification, the appearances of least square means with the different letters are significantly different ($p \leq 0.05$). Otherwise, they do not.

4. DISCUSSION

Parity had a significant effect ($P \leq 0.05$) on 305day milk yield. Fourth lactation season or more showed the maximum yield (2600.9 kg). The previous results are in agreement with those recorded by ((Mahdy et al., 2001), (Badran et al., 2002), (Thiruvenkadan and Panneerselvam, 2010), (Sohail, 2010) and (Eskandari and Karimpour, 2012)) who showed that there was an effect of parity on 305day milk yield. Age at first services had a non-significant effect on 305day milk yield. The maximum yield (2489.5 kg) was obtained at age 21-25-months and minimum yield was 2468.6 kg obtained at age less than 21 months. These results agreed with (Sohail, 2010**)** who found that age at puberty had a non-significant effect on 305day milk yield. Age at first calving had a non-significant effect on 305day milk yield. The maximum value of 305day milk yield was 2526.7 kg obtained in animals calved for the first time at age less than 35 months. The previous results are in agreement with those recorded by (Thiruvenkadan et al., 2010) and (Sohail, 2010) showed that age at first calving had no significant effect on 305day milk yield. Calving interval had a non-significant effect on 305day milk yield. The maximum milk yield was 2664.7 kg when calving interval was ranged from 13-15 months. These results agreed with (Sohail, 2010) found that a non-significant effect of calving interval on 305day milk yield. Days open had a non-significant effect on 305day milk yield. The maximum milk yield was 2757.8 kg when days open was more than 160 days. The opposite results obtained by (Penchev et al., 2009) found that a significant effect of days open on the 305day milk yield. Number of services per conception and dry period had a non-significant effect on 305day milk yield. The highest yield was recorded for animals had four or more services and dry period less than 170 days (2529.8 kg and 2624.1 kg, respectively). Season of calving had a highly significant effect ($P \leq 0.01$) on 305day milk yield. Winter season showed higher milk production than summer season 2600.5 kg and 2441.5 kg, respectively). These results agreed with (Elmaghraby, 2010), (Thiruvenkadan et al., 2010) and (Pawar et al., 2012) who showed that that there was significant effect of the season on 305day milk yield. On the contrary, (Badran et al., 2002), (Sarkar et al., 2006) and (Sohail, 2010) noted that there was a non-significant effect of season of calving on 305day milk yield. Season of calving had a significant effect ($P \leq 0.05$) on calving interval days open. calving interval and days open in summer (14.7 months and 134.2 days, respectively) was more than in winter season (14.5 months and 124.2 days, respectively).The obtained results were in the same line of those obtained by (Cady et al., 1983), (Shah et al., 1989), (Aziz et al., 2001) and (Marai et al., 2009) who reported that there was a significant effect of season of calving on calving interval and days open. On the contrary, (Marai et al., 2001) showed that season of calving had a non-significant effect on calving interval. Parity had a highly significant effect ($P \leq 0.01$) on calving interval days open. With increasing parity number, calving interval and days open decreased. This results agreed with (Mahdy et al., 2001) and (Thiruvenkadan and Panneerselvam, 2010) who noted that parity had highly significant effects on calving interval and days open**.** On the contrary, parity had a non-significant effect on calving interval of buffalo (Marai et al., 2001) and (Mberato et al., 2016). Also, parity had a non-significant effect on days open (Hussain et al., 2006). Animals that produced less than 2000 kg of milk per season showed minimum number of services per conception (1.76), also showed maximum age at first service and age at first calving (23.2 and 37.3 months, respectively). There was direct relationship between milk yield

with each of calving interval and days open. Animals that gave more than 3000 kg showed the maximum calving interval and days open (14 months and 111.8 days, respectively). Animals with high calving interval and days open may be due to low expression of estrous cycle or any breeding problem. These results agreed with (Zedian, 1990), (Ayesh, 1992), (Ali et al., 2000), (Atashi et al., 2013) and (Němečková et al., 2015) who showed that calving interval, days open and number of services per conception was higher in low producing cows than higher producing animals.

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