FACTORS AFFECTING SOME REPRODUCTIVE TRAITS OF EGYPTIAN BUFFALOES

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ABSTRACT

Data obtained from 3568 records relevant to 731 dairy buffaloes raised at Mehallet Mousa Experimental Station, Kafer El-Sheikh Governorate, Egypt *between 1970-1993 were utilized in this investigation to study the effects of sire, age at first calving, season and year of calving and parity on some reproductive traits of a buffalo dairy herd. The least squares analyses with unequal subclass numbers indicated that the overall least square means of age at first calving, gestation period, days open, calving interval, and breeding efficiency were 36.1 months, 317.8 days, 203.5 days, 521.3 days and 73.2 %, respectively.*

Sire had highly significant effect on all studied traits except gestation period which was not significantly affected. Age at first calving had significant influence on gestation period and had highly significant influence on all other traits. Season of calving had highly significant effect on days open, calving interval and breeding efficiency, but had no significant effect on age at first calving and gestation period. Year of calving had significant influence on days open and calving interval and had highly significant influence on age at first calving and breeding efficiency, but had nonsignificant effect on gestation period. Parity had highly significant effect on all studied traits except gestation period which was not affected significantly. The results of this investigation in general show that sire, managerial systems and appropriate environmental conditions have positive effects on reproductive traits of this herd of Egyptian buffaloes.

Key wards: age at first calving, gestation period, days open, calving interval, breeding efficiency, buffaloes

INTRODUCTION

In Egypt, Buffalo population is continuously increasing and is estimated to be about 3.92 million heads (FAO, 2006). This buffalo population produces about 2.30 million metric tons of milk and about 0.27 million metric tons of meat, representing about 49% of the total milk production (4.71 million metric tons) and 39% of the total meat production (0.65 million metric tons), respectively (FAO, 2006). In spite of the expansion of number of animals, there are no plans for any kind of improvement.

The reproductive efficiency is one of the primary factors which affect productivity in female buffaloes. It is greatly hampered by late attainment of puberty, prolonged age at first calving, long days open and prolonged calving intervals (Afifi *et al.* 1992 and Barile, 2005). Moreover, the incidence of silent heat in buffaloes may be considered a major factor influencing days open and consequently prolonged calving intervals (Afifi *et al.* 1992). Therefore, the optimal reproductive traits depend upon the interactions of genetic, nutritional, physiological and environmental factors.

The objective of this study was to investigate the effect of sire, age at first calving, season and year of calving and parity on age at first calving, gestation period, days open, calving interval, and breeding efficiency of an Egyptian buffalo herd.

MATERIALS AND METHODS

Source of data:

Data used in this study were from 3568 records relevant to 731 dairy buffaloes raised in Mehallet Mousa Expermintal station, Kafer El-Sheikh Governorate, Animal Production Research Institute, Ministry of Agriculture, Egypt. These buffaloes were free from diseases and disorders. The records covered the period from 1970 to 1993. The relevant details of the herd management were described by El-Shafie (1994) and El-Arian *et al.* (2001).These buffaloes were daughters of 65 sires and each sire had at least three daughters. The reproductive traits under investigation were age at first calving in months (AFC), gestation period in days (GP), days open in days (DO), calving interval in days (CI), and breeding efficiency in percent (BE). Breeding efficiency was calculated using the formula described by Wilcox *et al.* (1957).

Statistical procedures:

The data were analyzed using least squares analysis with unequal subclass numbers using Generalized Linear Model procedures (SAS, 1999) to estimate the effects of sire, age at first calving, season and year of calving and parity on the traits under investigation.

The statistical model used was as follows:

$Y_{ijklmn} = u + s_i + p_j + a_k + b_l + c_m + e_{ijklmn}$

Where,

Y_{ijklmn} : An observation of each trait.
u : The overall mean.
s_i : The random effect of the i^{th} sire.
p_j : The fixed effect of the j^{th} parity.
a_k : The fixed effect of the k^{th} age at first calving.
b_l : The fixed effect of the l^{th} season of calving.
c_m : The fixed effect of the m^{th} year of calving.
e_{ijklmn} : The random effect assumed to be distributed with mean zero and variance s^2_e.

The same model was used for age at first calving after excluding a_k.

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RESULTS AND DISCUSSION

Least square means and standard errors of the factors affecting the reproductive traits under investigation are presented in Tables (1) and (2). The overall means of AFC, GP, DO, CI, and BE were 36.1 months, 317.8 days, 203.5 days, 521.3 days and 73.2 %, respectively.

The value of AFC was lower than an estimate of 39.9 months reported by Hammoud (1991) on another buffaloes herd in Egypt. Lower AFC heifers should be offered higher levels of feeding and better management during their early stages of rearing and ought to be bred at the proper time of the estrous cycle to ensure conception. A reduction in the AFC will minimize the raising costs and shorten the generation interval and subsequently maximize the number of lactations per head. The present estimate of GP was approximately similar to an estimate of 315.1 days depicted by Mostageer *et al.* (1981) on another buffalo herd in Egypt. The overall mean of DO was higher than an estimate of 135.5 days found by Mostageer *et al.* (1981). Days open could be shortened significantly through hormonal manipulation or increasing the frequency of observing buffaloes for heat signs. Also, the current estimate of CI was higher than the estimate of 452.2 days reported by Mostageer *et al.* (1981). Buffaloes would manifest regular calving intervals of 12-13 months if subjected to effective estrus detection regimes (Barkawi *et al.* 1998). About 90 % of buffalo females resumed their ovulatory and estrous activities within 60 days post-partum (Barkawi *et al.* 1998). Long CI may affect the overall economic revenues of the dairy herd and might be the main cause of genetic losses in the form of heifers for replacements and / or bulls for insemination. The overall mean of BE in this study was similar to an estimate of 73.9% reported by Singh and Yadav (1989) on Nili buffaloes in India. Optimum rates of breeding efficiency in dairy buffaloes are attained through regular delivery of one viable calf per buffalo in the herd in 12-13 months. Low breeding efficiency rates could be attributed to long calving intervals of the lactating buffalo which is mainly due either to low conception rate and / or high early embryonic mortality.

1- Effect of Sire:

Sire had highly significant effect on AFC, DO, CI and BE. This indicates sire selection usefulness for the genetic improvement of these traits. However, sire had nonsignificant effect on GP. Highly significant effect of sire on AFC was reported by El-Shafie (1994) and El-Arian *et al.* (2001). Badran *et al.* (1991) and Mahdy *et al.* (1999) found that sire had highly significant influence on DO and CI, but Afifi *et al.* (1992) indicated that sire had nonsignificant effect on the same traits. Highly significant effect of sire on BE was obtained by El-Barbary and Badran (1987).

2- Effect of age at first calving:

Age at first calving had significant influence on GP and highly significant influence on DO, CI and BE. DO and CI were increased with increasing age at first calving and consequently BE decreased. Consequently buffalo heifers can calve at an early age without any deleterious effect on the reproductive traits. Nutrition and management of buffalo heifers provide the opportunity to reduce generation intervals and accelerate rates of genetic progress (Campanile *et al.* 2001). Afifi *et al.* (1992), Hamed (1994) and Hassan *et al.* (2005) indicated that DO was affected highly significantly by AFC. Nonsignificant effect of age at first calving on DO was noted by El-Shafie (1994). Also, highly significant effect of age at first calving on CI was depicted by Afifi *et al.* (1992); however, Hamed (1994) and Hassan *et al.* (2005) reported that CI was not affected significantly by age at first calving. Nonsignificant effect of age at first calving on BE was found by El-Barbary and Badran (1987).

3- Effect of season of calving:

The effect of season of calving on AFC was not significant. Similar results were noted by Ashmawy (1981), Hammoud (1991), El-shafie (1994) and Singh and Yadav (1987). On the other hand, El-Arian *et al.* (2001) found that the effect of month of calving on AFC was highly significant. Also, the effect of season of calving on GP was not significant. However, Mostageer *et al.* (1981) indicated that season of insemination had significant effect on GP. Buffaloes calved in spring had longer DO and CI than those calved in summer, autumn and winter. The effect of season of calving on DO and CI was highly significant. Cady *et al.* (1983), Afifi *et al.* (1992), Hamed (1994), Ibrahim (1998), Mahdy *et al.* (1999) and Hassan *et al.* (2005) indicated that season of calving had highly significant influence on DO and CI. On the other hand, Mostageer *et al.* (1981) and Badran *et al.* (1991) reported that DO and CI were not affected significantly by season of calving. The effect of season of calving on BE was highly significant. Buffaloes calved in summer and autumn had higher BE than those calved in winter and spring. Singh and Yadav (1989) found similar influence for season of calving on BE. However, nonsignificant effect of season of calving on BE was documented by El-Barbary and Badran (1987). The highly significant influence of season of calving on DO, CI and BE could be attributed to the changes in climatic conditions and feeding regimes during different seasons.

4- Effect of year of calving:

The highest AFC was recorded on buffaloes calved during the years 1982-1985, 1986-1989 and 1990-1993. Year of calving had highly significant effect on AFC. Similar effect was reported by

Ashmawy (1981), Hammoud (1991) and El-Arian *et al.* (2001). However, Singh and Yadav (1987) and El-Shafie (1994) indicated that AFC was not influenced significantly by year of calving. On the other hand, year of calving had nonsignificant influence on GP.

The highest DO and CI were recorded on buffaloes calved during the years 1970-1973, 1974-1977 and 1978-1981. Year of calving had significant effect on DO and CI. Similar effect was reported by Cady *et al.* (1983), Afifi *et al.* (1992), Hamed (1994), Ibrahim (1998) and Hassan *et al.* (2005) for DO, and by Cady *et al.* (1983), Ibrahim (1998) and Hassan *et al.* (2005) for CI. On the other hand, Afifi *et al.* (1992) and Hamed (1994) reported that CI was not affected significantly by year of calving. Year of calving had highly significant effect on BE. The highest BE was recorded on buffaloes calved during the years 1970-1973, 1974-1977 and 1978-1981. The significant effect of year of calving on AFC, DO, CI and BE is mainly due to the changes in managerial systems and environmental conditions which occurred during different periods.

5- Effect of parity:

The lowest AFC was recorded on buffaloes attained the highest number of parities. This indicates that the lowest AFC was highly significantly associated with the highest longevity. The effect of parity on GP was not significant. However, Mostageer *et al.* (1981) reported significant effect of parity on GP. The parity affected DO and CI highly significantly. DO and CI were decreased with increasing the parity. Mostageer *et al.* (1981), Cady *et al.* (1983), Afifi *et al.* (1992), Ibrahim (1998), Mahdy *et al.* (1999) and Hassan *et al.* (2005) reported highly significant effect of parity on DO and CI. However, Badran *et al.* (1991) reported that DO and CI were not affected significantly by parity. Breeding efficiency was affected significantly with parity and was increased with increasing the parity. The highly significant effect of parity on AFC, DO, CI and BE is logical due to the increase in age accompanied with the increase in body weight and sexual maturity.

In conclusion, highly significant effect of sire on AFC, DO, CI and BE indicates that sire selection is useful for the genetic improvement of these traits. The adjustments for year and season of calving, age at first calving and parity seem to be necessary if bulls are to be evaluated for the fertility of their daughters. Consequently, the results of this investigation show that sire, managerial systems and appropriate environmental conditions have positive effects on reproductive traits of this herd of Egyptian buffaloes.

Table (1): Least-square means (LSM) and standard errors (SE) of factors affecting age at first calving (AFC) and gestation period (GP).

Factor	AFC(month)		GP (day)	
	No	LSM±SE	No	LSM±SE
Overall mean	3568	36.1±0.1	2854	317.8±0.1
Sire (1 - 65)		**		NS
Minimum		30.1±0.7 (53)		315.0±1.2 (20)
Maximum		45.6±0.9 (28)		319.4±1.2 (17)
Age at first calving				*
<31		-------	422	318.1±0.3
31 - 36		-------	1015	318.1±0.3
37 - 42		-------	920	318.0±0.3
43 - 48		-------	381	317.1±0.4
>48		-------	116	317.6±0.5
Season of calving		NS		NS
Winter	1063	36.0±0.2	872	317.7±0.3
Spring	884	35.9±0.2	719	317.9±0.3
Summer	540	36.0±0.3	399	317.5±0.3
Autumn	1081	36.3±0.2	864	318.0±0.3
Year of calving		**		NS
1970 - 73	126	32.1±0.6	125	317.7±0.7
1974 - 77	560	33.3±0.4	540	317.7±0.5
1978 - 81	1027	34.8±0.3	926	317.4±0.4
1982 - 85	1114	36.8±0.2	795	317.5±0.3
1986 - 89	386	38.7±0.3	260	317.9±0.3
1990 - 93	355	40.7±0.3	208	318.3±0.4
Parity		**		NS
1st	731	39.5±0.2	723	317.6±0.2
2nd	718	38.9±0.2	562	317.5±0.2
3rd	556	37.9±0.2	442	317.6±0.3
4th	435	37.3±0.3	352	317.6±0.3
5th	350	36.4±0.3	275	318.3±0.3
6th	275	35.6±0.4	200	318.3±0.4
7th	201	34.8±0.4	134	317.8±0.5
8th	135	34.7±0.5	83	317.8±0.6
9th	84	33.7±0.6	49	318.0±0.5
10th and over	83	31.8±0.7	34	317.5±1.0

NS : Not significant (P>0.05), * : Significant (P< 0.05), ** : Highly significant (P< 0.01).
Figures in parentheses indicate the number of observations.

Table (2): Least-square means (LSM) and standard errors (SE) of factors affecting days open (DO), calving interval (CI) and breeding efficiency (BE).

Factor	No	DO (day) LSM±SE	CI (day) LSM±SE	BE (%) LSM±SE
Overall mean	2854	203.5±1.0	521.3±1.1	73.2±0.0
Sire (1 - 65)		**	**	**
Minimum		169.3±13.3 (32)	486.5±13.4 (97)	56.6±2.1 (31)
Maximum		301.5±22.6 (31)	619.5±22.8 (31)	81.9±2.7 (18)
Age at first calving		**	**	**
<31	422	189.3±8.3	507.5±8.3	74.0±0.8
31 - 36	1015	179.9±6.7	498.0±7.8	76.1±0.6
37 - 42	920	203.6±7.4	521.6±7.4	72.8±0.7
43 - 48	381	206.3±9.1	523.5±9.2	73.6±0.9
>48	116	238.4±13.7	556.1±13.8	69.5±1.3
Season of calving		**	**	**
Winter	872	209.0±7.6	526.7±7.6	72.2±0.7
Spring	719	226.8±7.9	544.8±7.9	72.0±0.7
Summer	399	194.0±8.6	511.5±8.7	74.3±0.8
Autumn	864	184.2±7.5	502.3±7.5	74.3±0.7
Year of calving		*	*	**
1970 - 73	125	234.8±18.4	552.6±18.5	76.6±1.7
1974 - 77	540	215.3±12.7	533.2±12.8	75.8±1.2
1978 - 81	926	202.8±9.2	520.2±9.3	74.7±0.9
1982 - 85	795	186.9±7.2	504.5±7.2	73.1±0.7
1986 - 89	260	189.0±9.1	506.4±9.2	69.8±0.8
1990 - 93	208	192.3±10.9	510.1±11.0	69.1±1.1
Parity		**	**	**
1st	723	259.8±6.7	585.9±5.8	65.0±0.5
2nd	562	223.4±7.1	553.5±6.3	66.1±0.6
3rd	442	189.7±7.9	524.8±7.0	68.8±0.7
4th	352	175.6±8.9	516.1±8.0	70.6±0.7
5th	275	160.0±9.9	506.2±9.2	72.3±0.9
6th	200	164.0±11.5	516.2±11.0	73.7±1.0
7th	134	140.0±13.4	492.6±13.0	75.3±1.2
8th	83	132.8±16.3	488.2±15.9	77.7±1.5
9th	49	144.3±20.1	498.6±20.0	79.4±1.8
10th and over	34	166.5 ±25.6	531.3±25.8	82.9±2.4

* : Significant (P< 0.05), ** : Highly significant (P< 0.01).
Figures in parentheses indicate the number of observations.

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الملخص العربي

العوامل المؤثرة علي بعض الصفات التناسلية للجاموس المصري

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أجري هذا البحث على البيانات الخاصة بقطيع الجاموس بمحطة بحوث محلة موسى – محافظة كفر الشيخ – معهد بحوث الإنتاج الحيواني– وزارة الزراعة– مصر. وقد شملت الدراسة عدد ٧٣١ جاموسة لها ٣٥٦٨ سجل خلال الفترة من ١٩٧٠ وحتى ١٩٩٣. واستهدف البحث دراسة تأثيركل من الأب، العمر عند أول ولادة، فصل الولادة، سنة الولادة وترتيب الولادة علي بعض الصفات التناسلية للجاموس في هذا القطيع الإنتاجي.

تم تحليل البيانات إحصائياً بطريقة الحد الأدنى للمربعات، وتتلخص أهم النتائج المتحصل عليها فيما يلي :

١– المتوسط العام : بلغ المتوسط العام للعمر عند أول ولادة ٣٦,١ شهر، لفترة التلقيح ٢٠٣,٥ يوم، مدة الحمل ٣١٧,٨ يوم، للفترة بين الولادتين ٥٢١,٣ يوم وللكفاءة التناسلية ٧٣,٢ %.

٢ – الأب: له تأثير معنوي جداً علي الصفات موضع البحث فيما عدا مدة الحمل حيث كان التأثيرغيرمعنوي.

٣ – العمر عند أول ولادة: له تأثير معنوي علي مدة الحمل وتأثير معنوي جداً علي الصفات الأخري موضع الدراسة.

٤ – فصل الولادة: ليس له تأثيرمعنوي علي العمر عند أول ولادة ومدة الحمل بينما له تأثير معنوي جداً علي باقي الصفات.

٥ – سنة الولادة: لها تأثير معنوي جداً علي العمر عند أول ولادة، والكفاءة التناسلية ولها تأثير معنوي علي فترة التلقيح والفترة بين الولادتين وليس لها تأثير معنوي علي مدة الحمل.

٦ – ترتيب الولادة: له تأثير معنوي جداً علي جميع الصفات فيما عدا طول مدة الحمل حيث كان التأثير غير معنوي.

توضح نتائج هذا البحث بصفة عامة أن للأب ونظم الرعاية المناسبة والظروف البيئية الملائمة أثر كبير علي الكفاءة التناسلية للجاموس المصري.