Egypt. J. Anim. Prod., Vol. 27, No. 1, pp. 1 - 18 (1990)

Non Genetic Factors Influencing Milk Production Traits in Egyptian Buffaloes

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THIS investigation was carried out to study the non-genetic factors that influence initial (first 70-day), 6-month and 305-day milk yield as well as length of lactation period in Egyptian buffaloes. Data comprising 4608 normal lactation records, collected on the buffalo herd raised at Mehallet Mousa Station, Ministry of Agriculture were used to study the effect of parity as well as year and season of calving on initial, 6-month and 305-day milk yield in addition to length of lactation period. These data covered the period from 1962 to 1980.

Least squares overall means of initial, 6-month and 305-day milk yield were 521.37 $\pm$ 39, 1119.08 $\pm$ 7.47 and 1591.15 $\pm$ 13.10 kg, respectively, length of lactation period averaged 313.98 $\pm$ 2.83 days. Year of calving and lactation order (parity) had highly significant ($P < 0.01$) effects on initial 6-month and 305-day milk yield as well as on length of lactation period. Season of calving contributed significantly ($P < 0.01$) to the total variance of all traits except 6-month milk yield.

Key words : Buffaloes, Milk, Non genetic factors.

Milk production traits in Egyptian buffaloes are greatly influenced by many non-genetic factors. Many investigators studied the effects of these factors on milk yield produced by Egyptian buffaloes per lactation (Afifi, 1961 ; Khishin *et al.*, 1963 & 1968 ; El-Kimary, 1966, Alim, 1967 & 1978 ; Ragab *et al.*, 1970 & 1973 ; Soliman 1976, Mourad, 1978, Abdel-Aziz and Hamed, 1979 ; Ashmawy, 1981 and Salem, 1983). However, few reports are available on partial milk yield.

This work was carried out with the aim to investigate the effects of parity, season and year of calving, deemed to be the most important factors, on initial (70-day), 6-month and 305-day milk yield as well as on length of lactation period in a herd of Egyptian buffaloes.

Material and Methods

Data used in this work were collected on 70-day, 6-month and 305-day milk yield and length of lactation period recorded for the buffalo herd located at Mehallet Mousa, belonging to the Animal Production Research Institute, Ministry of Agriculture. These data covered the period from 1962 to 1980 and comprised 4608 normal lactation records taken on 1444 buffalo cows. Lactation records that lasted for less than 24 weeks (168 days) were considered as abnormals and excluded.

Systems of feeding and managerial procedures followed in that herd were reported by Kawthar Mourad *et al.*, 1986.

The least squares procedure, described by Harvey (1960), was followed for the statistical analysis because of the presence of disproportionate unequal number for the data subclasses. A linear model including the fixed effects due to parity ($1 \geqslant 10$), season of calving (winter, spring, summer and autumn) and year of calving (1962 - 1980) was adopted. Duncan's multiple range test (1955) was used to test differences between means of the effects with each factor involved in the model of the analysis.

Results and Discussion

A. *Milk Yield Traits*

The overall least squares means of initial (70-day), 6-month and 305-day milk yield of buffaloes studied were 521.8, 1119.1 and 1561.2 kg, respectively (Table 1).

The mean initial milk yield of this work (521.8 kg) is in the neighbourhood of 540.8 kg estimated on the same basis for Egyptian buffaloes by Mourad (1978) but less than the corresponding estimate (608.9 kg) reported by the same author (1984).

Soliman (1976) and Ashmawy (1981) calculated the average initial milk yield on the basis of the first 60 days of lactation as 485.6 and 471.8 kg, respectively. On the basis of the first 90 days of lactation, initial milk yield of Egyptian buffaloes was estimated as 630 kg by Bedeir (1965), 653.5 kg by Salem (1983) and 650 kg by Mohamed (1986). El-Chafie (1981) calculated the average milk yield of first 100 days of lactation as 640.4 kg for buffaloes located at Alexandria and 462.1 kg for buffaloes located at Mehallet Mousa.

The average 6-month milk yield of the present work (1119.1 kg) is near 1062.5 kg reached by El-Irian (1981) when considering the lactations from the second up to the eighth and 1115.4 kg estimated for the same trait by Mourad (1984). At the same time it is higher than 741.6 kg calculated by El-Irian (1981) when considering the first 6 months of the first lactation only.

The average 305-day milk yield obtained heroin (1561.2 kg) is higher than 1004.3 kg, 1503.5 kg and 1461.4 kg reported by El-Tawil *et al.* (1976), El-Irian (1981) and Mourad (1984) on Egyptian buffaloes ; 1368 kg and 1436.2 kg estimated by Agarwala (1962) and Dutt *et al.* (1965) for water buffaloes and 1250 kg by Singh and Desai (1962) for Murrah buffaloes. Also, the present estimate is less than the averages of 305-day milk yield calculated by Ashmawy (1981), Salem (1983) and Mohamed (1986) for Egyptian buffaloes (2097.0 kg, 2154.6 and 1618 kg, respectively), by Dassat *et al.* (1966) and Roy Chaudhury (1970 a, b) for Italian buffaloes (1699 kg and 1695 kg) respectively, and by Singh and Shing (1967) for Murrah buffaloes (1707.7, 1951.7 and 1760.8 kg for summer, rainy and winter seasons, respectively).

Differences in the means of the studied traits estimated by different investigators for the different herds of buffaloes in the same or in different countries or at different periods of time for the same herd may be due to differences origin, genetic make-up, genetic change, lactation, climatic conditions, season and year of calving, types and amounts of feedstuffs provided and/or management Differences in size of samples used, in number and distribution of records across lactation order and/or factors involved in the model of analysis and their levels could be added in this respect.

Parity

Initial milk yield increased with advance of parity up to the seventh, decreased in the eighth and increased up to ≥ the tenth (Table 1). Typical observations on initial milk yield were reported by Mourad (1984). Findings of the present work with respect to 6-month and 305-day milk yield were showed a general trend indicating the increase of the amount of milk yield with advance of parity till reaching its peak at the eighth lactation and decreased thereafter in the subsequent lactation (Table 1). This means that parity effects on 6-month and 305-day milk yield exhibited a curvilinear pattern. This pattern was also observed for milk yield of different periods of lactation in Egyptian buffaloes (Ragab *et al.*, 1953 ; Hilmy, 1954 ; Afifi, 1961 ; Bedeir, 1965 ; Soliman, 1976 ; Mourad, 1978 and Ashmawy, 1981), in Indian buffaloes (Singh and Desai, 1962 and Sekhon and Gehlon, 1966) and in Italian buffaloes (Maymone, 1942 ; Dassat *et al.*, 1966 and Roy Choudhury and Deshmukh, 1975), but the peak of milk yield was reached at varying lactations. Reaching the peak of milk yield of any period of lactation at varying lactations in the different herds in the same country or in different countries may possibly be due to differences among different herds in the genetic properties, age at first calving, length of lactation and dry periods and/or in managerial procedures. Differences among the sizes of data and models analysis used could be added in this respect. Differences in the time of reaching the peak of milk yield in the same herd at different periods of time for the same herd may be attributed to genetic change which usually occurs with passing time.

The increase of milk yield with advance of parity (sequence of lactation) till reaching the peak of production was indicated to be a result of advance in age which is accompanied by growth and full development of the animal's body weight and size as well as the increase in size, capacity and physiological functions of the mammary glands (under), digestive, circulatory and other body systems (Hilmy, 1954 ; Soliman, 1976 and Ashmawy, 1981). The decrease in milk production with advance of parity after reaching its peak was reported to be mainly due to simply (Hilmy, 1954) as well as to the decrease in the physiological activity of all body systems and the partial degeneration in the secretory tissue of the udder which usually starts after the female reaches its mature body weight and size (Ashmawy, 1981).

Duncan's test in Table (1) indicated that the observed increase in initial, 6-month and 305-day milk yield with advance of parity till reaching its peak was significant up to the fourth lactation and non-significant thereafter.

The least squares analysis of variance revealed that parity effects on initial, 6-month and 305-day milk yield were highly significantly ($P < 0.01$). Similar findings were reported on Egyptian buffaloes for initial milk yield (Soliman, 1976 ; Mourad, 1978 ; Ashmawy, 1981 ; Salem, 1983 ; and Mourad, 1984), for 6-month milk yield (El-Irian, 1981 and Mourad, 1984) and for 305-day or total milk yield per lactation (Soliman, 1976 ; Mourad, 1978 ; Ashmawy, 1981, El-Irian, 1981 and Salem, 1983). In agreement with the present findings, Bhatnagar *et al.* (1961), Singh and Sing (1967), Raizada *et al.* (1971) Basu and Ghai (1978) and Kumar and Bhat (1978) found that milk yield in Indian buffaloes was significantly affected by lactation sequence.

The relative sizes of f-values of all factors included in the model of analysis (Table 1), showed that the effects of parity constituted the most important factor influencing initial, 6-month and 305-day milk yield. Results of Soliman (1976), Ashmawy (1981), El-Irian (1981) and Mourad (1984) on initial milk yield, those of El-Irian (1981) on 6-month milk yield and those of Ashmawy (1981) on 305-day milk yield gave the same picture. In this respect, Soliman (1976) and Ashmawy (1981) found that most variance in milk yield caused by factors studied was contributed by parity effects.

Season of calving

Means fitted for the effects of season of calving showed that the best performance was shown by buffaloes calving during winter season for initial (70-day) milk yield, during summer for 6-month milk yield and during spring for 305-day milk yield (Table 1). Investigators on Egyptian buffaloes showed different findings in this concern (El-Tawil *et al.*, 1976, Soliman, 1976 ; Mourad, 1978, Ashmawy, 1981, El-Irian, 1981 ; Salem, 1983, Mourad, 1984 and Mohamed, 1986). These different findings is expected to be due to some or all of the causes mentioned for the differences between means estimated for the same traits by different authors working on different herds of the same or different countries.

TABLE. 1 : Least squares means, standard errors, F-values and tests of significance for factors influencing milk yield in kilograms.

Classification	Initial (70-day) milk yield			6-month milk yield			305-day milk yield		
	No.	Mean ± S.E. (kg)	F-value	No.	Means ± S.E. (kg)	F-value	No.	Mean ± S.E. (kg)	F-value
Overall mean :	4608	521.37±3.82		4608	1119.10±7.4^{de}		4608	1561.15±13.10	
Parity		**	204.42		**	192.72		**	89.76
1st	1254	338.20±3.72^{a}		1254	772.63±7.27^{a}		1254	1147.70±12.76^{a}	
2nd	1093	452.95±4.14^{b}		1093	1001.95±8.11^{b}		1093	1449.78±14.22^{b}	
3rd	843	513.45±4.69^{c}		843	1106.62±9.17^{c}		843	1540.28±16.09^{ce}	
4th	540	550.29±5.72^{d}		540	1180.80±11.18^{D}		540	1631.77±19.61^{D}	
5th	340	555.75±7.07^{d}		340	1186.36±13.84^{d}		340	1633.56±24.27^{d}	
6th	213	556.30±8.81^{d}		213	1172.60±17.23^{d}		213	1645.79±30.23^{d}	
7th	136	557.17±10.90^{d}		136	1197.30±21.33^{d}		136	1672.74±37.41^{d}	
8th	88	539.76±13.47^{cd}		88	1207.02±26.34^{d}		88	1698.99±46.21^{d}	
9th	53	542.11±17.26^{cd}		53	1182.43±33.76^{de}		53	1587.21±59.23$^{de.}$	
10th	48	607.73±18.13^{e}		48	1183.15±35.47^{de}		48	1603.70±62.22^{de}	
Season of calving :		**	13.78		N.S.	0.85		**	13.58
Winter	1479	539.04±4.66^{a}		1479	1116.75±9.12^{a}		1479	1550.02±16.00^{a}	
Spring	1123	514.19±5.00^{b}		1123	1114.28±9.77^{a}		1123	1617.24±17.15^{b}	
Summer	663	520.72±5.91^{b}		663	1137.37±11.57^{a}		663	1570.11±20.29^{d}	
Autumn	1343	511.55±4.73^{b}		1343	1113.94±9.25^{a}		1343	1507.24±16.22^{c}	
of claving :		**	20.47		**	27.41		**	18.49
1962	20	450.82±28.17		20	949.77±55.09		20	1298.04±96.64	
1963	109	493.55±18.71		109	1074.70±24.87		109	1505.01±43.62	
1964	157	454.81±10.76		157	948.01±21.05		157	1308.28±36.92	
1965	175	427.53±10.21		175	933.82±19.97		175	1318.84±35.03	
1966	259	472.82±8.60		259	1012.14±16.81		259	1395.00±29.49	
1967	308	504.22±7.95		303	1060.43±15.55		308	1480.31±27.28	
1968	312	518.57±7.85		312	1100.76±15.35		312	1495.33±26.93	
1969	305	511.10±7.87		305	1109.70±15.39		305	1523.59±26.99	
1970	310	530.57±7.78		310	1147.03±15.21		310	1606.13±26.68	

TABLE 1 : (Cont.)

Classification	Initial (70-day) milk yield			6-month milk yield			305-day milk yield		
	No.	Mean ± S.E. (kg)	F-value	No.	Means ± S.E. (kg)	F-value	No.	Mean ± S.E. (kg)	F-value
1971	254	561.15±8.40		254	1210.40±16.42		254	1719.34±28.81	
1972	323	543.45±7.54		323	1164.96±14.74		323	1635.71±25.86	
1973	257	549.58±8.20		257	1192.70±16.04		257	1685.82±28.13	
1974	244	557.82±8.43		244	1194.67±16.49		244	1652.57±28.93	
1975	262	575.68±8.06		262	1227.95±15.77		262	1693.76±27.67	
1976	341	535.18±7.24		341	1127.68±14.16		341	1637.43±24.84	
1977	292	513.31±7.64		292	1120.44±14.94		292	1560.72±26.21	
1978	251	540.97±8.19		251	1141.08±16.03		253	1622.48±28.12	
1979	280	570.79±7.82		280	1251.59±15.29		280	1725.25±26.82	
1980	149	594.16±10.39		149	1294.79±20.32		149	1798.26±35.65	

Data presented in Table (1) indicate that season of calving effects were highly significant ($P < 0.01$) on initial and 305-day milk yield, but non-significant on 6-month milk yield. In agreement with these findings, Soliman (1976), Mourad (1978), Ashmawy (1981), El-Irian (1981), Salem (1983) and Mohamed (1986) found that effects of season of calving on initial milk yield of Egyptian buffaloes were highly significant ($P < 0.01$, Abdel-Aziz and Hamed (1979), Mourad (1984) and Mohamed (1986) reported similar findings on 305-day milk yield ($P < 0.01$). Also, El-Irian (1981) found that season of calving was a highly significant source of variation in 10 month (305-day) milk yield when studying lactations from the second to the tenth. Similar to the presonl finding on 6-month milk yield, Mourad (1984) found that effects of season of calving on 6-month milk yield were not-significant.

The significant effects of season of calving were also reported on total milk yield of Egyptian buffaloes (Ragab *et al.*, 1970 ; Soliman, 1976, Mourad, 1978 and Ashmawy 1981) on Pakistani buffaloes (Ashfaq and Mason, 1954), Murrah buffaloes (Goswami and Nair, 1965) and Italian buffaloes (Roy Choudhury, 1970 a, b and Roy Choudhury and Deshmukh, 1975).

Contrary to the present results, Mourad (1984) observed that differences in initial milk yield due to affect of season of calving were non-significant. The same observation was also reported on 305-day or total milk yield of Egyptian buffaloes (Alim, 1967 ; Khishin *et al.*, 1968 ; El-Tawil, *et al.*, 1976 ; Abdel-Aziz and Abdel-Ghany, 1978, Alim, 1978 and Salem, 1983) of Indian buffaloes (Venkayya and Anantakrishnan, 1957, Singh and Singh, 1967 ; Gopalan *et al.*, 1971 ; Raizada *et al.*, 1971 ; Kanaujia and Balaine, 1975 ; Basu and Ghai, 1978 and Kumar and Bhat, 1978).

Seasonal differences in milk yield of Egyptian buffaloes were attributed to differences in the availability of green fodder (Egyptian clover) and its dry matter content, weather conditions especially those of atmospheric temperature, humidity and managerial systems (Ragab, *et al.*, 1954 ; Kamal, 1956, Afifi, 1961, Mokhtar, 1971 ; El-Tawil *et al.*, 1976 and Ashmawy 1981).

Year of calving

The least squares means of initial (70-day), 6-month and 305-day milk yield of the buffaloes studied varied significantly ($P < 0.01$) from one year of another (Table 1). Similar, Egyptian findings were reported on initial milk yield based on different periods (Soliman, 1976 ; Mourad, 1978 ; Ashmawy, 1981, El-Irian, 1981 ; Mourad, 1984 and Mohamed, 1986), on 6-month milk yield (Mourad, 1984) and on 305-day milk yield (Abdel-Aziz and Abdel-Ghany, 1978 ; Abdel-Aziz and Hamed, 1979 ; Ashmawy, 1981 ; Mourad, 1984 and Mohamed, 1986). They found that year of calving effects in this concern were significant ($P < 0.05$ or $P < 0.001$) year of calving effects were also reported on milk yield of Indian buffaloes (Singh and Dhelon, 1975 ; Kanaujia and Balaine, 1975 ; Basu and Ghai, 1978 ; Bhat and Patro, 1978 and Kumar and Bhat, 1978) and of Pakistani buffaloes (Ashfaq and Mason, 1954).

The relative sizes of F-values for the effect of year of calving when compared to those of the other factors included in the model of analysis when coupled with its significance, gave an evidence that year of calving effects contributed considerably to all milk yield traits studied. The same results were shown for initial milk yield (Mourad, 1978 ; Ashmawy, 1981 ; El-Irain, 1981, Mourad 1984 and Mohamed, 1986) and for 305-day milk yield (Ashmawy, 1981, Mourad, 1984 and Mohamed, 1986).

B. *Lactation period*

The overall least squares mean of length of lactation period in buffaloes of the study was 313.98 ± 2.83 (Table 2). This mean is close to 315.0, 312.3, 315.0 and 311.1 days estimated for Egyptian or Indian buffaloes by Hilmy (1954) Bhatnagar *et al.* (1961), Lall (1975) and Alim (1978) respectively. It is longer than those reported on either Egyptian or Indian buffaloes by Ragab (1945), Kohli and Malik (1960), Afifi (1961), Singh and Desai (1962), Venkataratnon and Venkayya (1964), Bedeir (1965), Goswami and Nair (1965), Rai (1966), Khishin *et al.* (1968), Shalash *et al.* (1969), Kanaujia (1974), Sharma and Singh (1974), Kanaujia and Balain (1975), Jawarkar and Johar (1975), Gurnani *et al.* (1976 a & b), Basu and Ghai (1978 a & b), Kumar and Bhat

(1978), Mourad (1978), Bhat (1979), Nagarcenkar (1979) El-Irian (1981) and Mourad (1984) which ranged between 245 and 304-days. It is also longer than 285.7, 258.0, 258.4 and 275.0 days calculated for Italian buffaloes by Defranciscis *et al.* (1969) ; Roy Choudhury (1970), Deskmukh and Roy Choudhury (1971) and Franciscis (1979), respectively. At the time the present mean length of lactation period is shorter than those given by Khishin (1951), Ragab *et al.* (1953), Alim and Ahmed (1954), Sankunny (1964), El-Kimary (1946), Alim (1967), El-Itriby (1974) Soliman (1976), Raut and Singh (1978), Ashmawy (1981) and Salem (1983) which ranged from 323.76 to 365.9 days.

TABLE 2: Least squares means ± S.E. of length of lactation period.

Classification	No.	Estimate ± S.E. (day)	F-value	Classification	No.	Estimate ±S.E (day)	F-value
Overall mean	4608	313.98±2.83		Year of calving		**	8.87
Parity		**	5.06	1962	20	308.04±20.87	
1st	1254	330.55±2.75^{acd}		1963	109	314.80±9.42	
2nd	1093	326.95±3.07^{acd}		1964	157	332.73±7.97	
3rd	843	308.53±3.47^{b}		1965	175	340.93±7.57	
4th	540	308.69±4.23^{b}		1966	259	325.95±6.37	
5th	340	312.71±5.24^{bd}		1967	308	318.57±5.89	
6th	213	315.73±6.53^{ba}		1968	312	298.01±5.82	
7th	136	320.74±8.08^{ba}		1969	305	295.16±5.83	
8th	88	313.30±9.98^{ba}		1970	310	308.83±5.76	
9th	53	297.74±12.79^{b}		1971	254	308.17±6.22	
10th	48	304.86±13.43^{bc}		1972	323	318.47±5.58	
				1973	257	323.50±6.08	
				1974	244	319.44±6.25	
Season of Calving		**	31.33	1975	262	319.21±5.97	
				1976	341	345.87±5.36	
Winter	1479	324.23±3.45^{a}		1977	292	323.09±5.66	
Spring	1123	330.81±3.70^{a}		1978	251	309.34±6.07	
Summer	663	300.14±4.38^{b}		1979	280	281.11±5.79	
Autumn	1343	300.74±3.50^{b}		1980	149	274.36±7.70	

Parity

Length of lactation period fluctuated with advance of parity but showed a decreasing effect (Table 2), the first lactation was the longest and the last lactation was the shortest. In agreement with this findings, Singh Desai (1962) reported that the lactation length tended to decreased with increasing lactation number. Different trends for the influence of parity on lactation length

were obtained on the Egyptian buffaloes (Ragab *et al.*, 1953 ; Bedeir, 1965 ; Soliman, 1976 ; Mourad, 1978 ; Ashmawy, 1981 ; Salem, 1983 and Mourad, 1984) and on Murrah buffaloes, (Bhatnagar *et al.*, 1961, Jawarkar and Johar, 1975 and Basu and Ghai, 1978).

Parity effects contributed significantly ($P < 0.01$) to the total variance in length of lactation period (Table 2). Similar findings were reported on Egyptian buffaloes (Bedeir 1965 ; Soliman, 1976, Mourad, 1978 and El-Irian 1981) and on Murrah buffaloes (Bahatnagar *et al.*, 1961 ; Jawarkar and Johar, 1975, Kumar and Bhat, 1978 and Basu and Ghai, 1978). On the contrary, few reports (Ashmawy, 1981 and Mourad, 1984 on Egyptian buffaloes and Gurnani *et al.*, 1976 on Murrah buffaloes), showed that parity effects on length of lactation period were non-significant.

Season of calving

Data presented in Table (2) showed that the average length lactation period differed significantly ($P < 0.01$) with season of calving and that spring calvers recorded the longest lactations while summer calvers gave the shortest lactations. These results, agree well with those of Soliman (1976), Mourad (1978), Ashmawy (1981) and Mourad (1984) who reported that the maximum length of lactation period was given by spring calvers. However, Sidky (1952) Ragab *et al.* (1954), Abdel-Aziz and Abdel-Ghany (1978), El-Irian (1981) and Salem (1983), also, with Egyptian buffaloes noted that the longest lactations were given by either autumn or winter calvers.

In agreement with the present results, Soliman (1976), Mourad (1978), Alim (1978), Ashmawy (1981), Salem (1983) and Mourad (1984) found that season of calving effects on length of lactation period were significant ($P < 0.05$ or $P < 0.01$). On the contrary, Afifi (1961), Venkataratnan and Venkayya (1964), Khishin *et al.* (1968), Sharma and Singh (1974), Kanaujia and Balaine (1975), Abdel-Aziz and Abdel-Ghany (1978) and Kumar and Bhat (1978) with Egyptian or Indian buffaloes, observed that season of calving did not show any significant effect on length of lactation period.

The comparison of the F-value of the factors included in the model of analysis, indicate that season of calving was the most important factor influencing length of lactation period (Table 2).

Year of calving

Length of lactation period varied significantly ($P < 0.01$) with year of calving (Table 2). Soliman (1976), Mourad (1978), Alim (1978), Ashmawy (1981) and Mourad (1984) with Egyptian buffaloes, reported similar results. Also, Kanaujia and Balaine (1975) with Italian buffaloes and by Jawarkar and Johar (1975) and Basu and Ghai (1978) with Murrah buffaloes, found that year of calving influenced length of lactation period significantly. However, Abdel-Aziz and Abdel-Ghany (1978) with Egyptian buffaloes and Kumar and Bhat (1978) with Murrah buffaloes, showed that year of calving did not show any significant effect in this respect.

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تأثير العوامل غير الوراثية على صفات انتاج اللبن المختلفة في الجاموس المصرى

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اجرى هذا البحث لدراسة تأثير العوامل غير الوراثية على انتاج اللبن المبدئى (الانتاج فى ٧٠ يوم) والانتاج فى ٦ شهور وانتاج اللبن فى ٣٠٥ يوم كما درس هذا التأثير ايضا على طول فترة الحليب فى الجاموس المصرى . اخذت بيانات ٤٦٠٥ سجل لبن طبيعى جمعت من الجاموس التابع لمحطة محله موسى التابعة لمعهد بحوث الانتاج الحيوانى بوزارة الزراعة واستخدمت لدراسة تأثير ترتيب الموسم والسنة وموسم الولادة على انتاج اللبن المبدئى والانتاج فى ٦ شهور وانتاج اللبن فى ٣٠٥ يوم حليب بالاضافة لطول فترة الحليب وتغطى البيانات الفترة ممن ١٩٦٢ حتى ١٩٨٠ .

قدرت المتوسطات بطريقة المربعات الصغرى وكانت المتوسطات لانتاج اللبن المبدئى والانتاج فى ٦ شهور والانتاج فى ٣٠٥ يوم ٥٢٢ر٣٦ + ٣ر٩ ، ١١١٩ر٠٨ + ٧ر٤٧ ، ١٥٩١ر١٥ + ١٣ر١٠ كجم على الترتيب وكان متوسط طول فترة الحليب ٢١٣ر٩٨ + ٢ر٨٣ يوم. كان تأثير سنة الولادة وكذلك ترتيب الموسم عالى المعنوية على كل من انتاج اللبن المبدئى وانتاج اللبن فى ٦ شهور وانتاج اللبن فى ٣٠٥ يوم وكذا طول فترة الحليب اما موسم الولادة فكان ذا تأثير عالى المعنوية بالنسبة لمجموع مربع الاختلافات فى كل الصفات المدروسة ماعدا انتاج اللبن فى ٦ شهور .