

The Effect of Age and Weight at First Calving on the Productive and Reproductive Performance of Primiparous Buffaloes

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A TOTAL of 109 pregnant buffalo heifers was derived from Mahelet Mousa Farm of Ministry of Agriculture and was used to determine the effect of age and weight of dam at first calving on calf birth weight (WCB), service period length (SPL), milk production in the first 120 days of lactation (IMY) and total milk production (TMP). All these characters belong to the first calving interval. Data were analyzed by the least squares method and with respect to weight of dam at parturition, buffaloes were divided into four groups. Group 1, included buffaloes weighing 400 kg or less after first calving, while groups 2, 3, and 4, included buffaloes having a post-partum body weight of 401-450 kg, 451—500 kg and 501 kg or more, respectively.

The overall means of WCB, SPL, IMY and TMP were 33.98 ± 0.52 kg, 151.74 ± 6.52 days, 512.90 ± 12.3 kg and 988.97 ± 26.02 kg, respectively. On the basis of the investigated characters buffaloes of weight group 3 were shown to have the best performance while those of group 1 were the poorest. Buffaloes of group 2 were of intermediate performance between group 1 and 3. Buffaloes of group 4, however were the heaviest, but values of their investigated characters excluding WCB approximated those of group 1.

Increasing age of dam at parturition was shown to affect WCB ($b = -0.2266$), SPL ($b = +3.7381$), IMY ($b = -9.7505$) and TMP ($b = -14.2598$) unfavourably. All partial regression coefficients were significant ($P < 0.01$). The present data indicate that buffalo heifers should be brought to conceive at the earliest possible age, at that time their live body weight should average 370.9 ± 4.2 kg. This particular weight at conception corresponds to an average weight at parturition of 475.1 ± 3.6 kg (range = 451—500 kg).

It is established that primiparous buffaloes were shown to have a markedly long service period length (Ragab *et al.*, 1956, El-Sheikh and Mohamed, 1965, and El-Fouly *et al.*, 1977) and a considerably low milk production (Ragab *et al.*, 1954 and 1956). Moreover, it is claimed that a considerable number of them either does not lactate or have an abnormally short lactation period length. Trials to evaluate the importance of age and weight at first calving on the subsequent productive and reproductive performance of the first-calf buffalo are lacking. Such information, if available, it will help in the determination of the optimal age and weight at first breeding, which are usually estimated on arbitrary basis.

Experiments reported here describe trials aimed to determine the contribution of age and weight at parturition, in Egyptian buffaloes, on some economical characters of the first lactation. These characters include weight of calf at birth, service period length, milk production in the first 120 days and total milk production.

Material and Methods

The study included 109 pregnant heifers that were made available from Mahellet Mousa Farm, in the Nile Delta, Egypt. Animals were born in September through December, 1971 and were reared under the same conditions of management. All terminated pregnancy normally without calving difficulties. Dams and calves were weighed within 24 hr after parturition. Suckling was allowed for one week, thereafter, calves were raised artificially and dams were hand milked twice daily at 8.00 a.m. and 4.00 p.m. Daily production records were available for each animal. Buffaloes were dried up two months before the expected time of delivery, if still lactating.

During summer and autumn buffaloes were tied under semiopen sheds and were fed concentrate mixture along with wheat or rice straw. Maintenance and productive requirements were calculated according to the standards of Tommi (1963). During winter and spring animals were left free to graze Egyptian clover (*Trifolium Alexandvium*). Heat was checked three times daily at 7.30 a.m., 12.00 noon and 3.90 p.m. Animals detected in heat were hand mated to bulls known to be fertile mating, however, was postponed for estrus buffaloes still in their post-partum refreshment period (6 weeks after calving). Mated buffaloes did not show heat symptoms for two months, were checked for pregnancy. The interval from parturition to the fertile service was referred to as service period length.

Data were analyzed by the least squares method described by Harvey (1960) using a multiple classification model with regressions and unequal subclass number. The model included the fixed variable weight and age at parturition and lactation period length. With respect to weight after calving, buffaloes were divided into four different groups as follows :

Group 1 : 400 kg or less.

Group 2 : 401-450 kg.

Group 3 : 451-500 kg.

Group 4 : 501 kg or more.

The investigated characters were weight of calf at birth (WCB), service period length (SPL), milk production in the first 120 days (IMY) and total-milk production. The analyses of variances were done together with the tests of significance for individual means. These tests were Duncan multiple range tests (Duncan, 1955).

Results and Discussion

Least square means of weight of calf at birth (WCB), service period length (SPL), milk production in the first 120 days of lactation (IMY) and total milk production (TMP) of primiparous buffaloes are given in Table 1, and analysis of variances for all investigated characters are presented in Table 2.

TABLE 1. Least squares means (\pm S.E.) of weight of calf at birth (WCB), service period length (SPL), milk production in 120 days (IMY) and total milk production (TMP) in primiparous buffaloes.

Classification	N	WCB (kg)	SPL (day)	IMY (kg)	TMP (kg)
Overall mean	109	33.98 \pm 0.52	151.74 \pm 6.52	512.90 \pm 12.30	988.97 \pm 26.02
Weight group	1	29.48 \pm 1.00	168.97 \pm 12.60	486.77 \pm 23.70	932.34 \pm 50.29
	2	34.02 \pm 0.88	145.49 \pm 11.10	502.33 \pm 20.95	976.72 \pm 44.31
	3	36.95 \pm 1.04	140.26 \pm 13.15	605.00 \pm 24.85	1097.61 \pm 52.50
	4	35.46 \pm 1.21	152.22 \pm 15.30	457.48 \pm 28.72	949.21 \pm 60.98

Means within a column having the same letter differ non-significantly from each other, otherwise, they differ significantly at $P < 0.01$.

¹Holding the other two variables (age of dam at calving and lactation period) constant.

The overall means

The overall means of WCB, SPL, IMY and TMP were 33.98 \pm 0.52 kg, 151.74 \pm 6.52 days, 512.9 \pm 12.30 kg and 988.97 \pm 26.02 kg, respectively.

TABLE 2. Analyses of variances of weight of calf at birth (WCB), service period length (SPL), milk production in 120 days (IMY) and total milk production (TMP) in primiparous Egyptian buffaloes.

Source of variance	D.F.	Mean squares	D.F.	Mean squares		
		W.C.B.		SPL	IMY	TMP
Weight of dam, postpartum	3	272.76**	3	4321.35 NS	98228.87**	140441.34 NS
Regression on age of dam	1	245.25**	1	41463.29**	283857.27**	603390.29**
Regression on lactation period	—	—	1	52726.60**	6456137.49**	37889925.39**
Residual	104	4861.29	103	4386.58	15651.98	70039.08

NS : Not significant

** Significant at the 1% level.

The effect of weight

The weight of primiparous buffaloes at parturition was shown to be significantly ($P < 0.01$) related to WCB of their first calf. Dams weighing 400 kg or less at parturition gave birth to the lightest calves (29.48 ± 1.00 kg), meanwhile, the most heavier calves (36.95 ± 1.04 kg) were those of group 3. Duncan's multiple range tests revealed that differences in WCB mean of group 1 and the other three groups were significant ($P < 0.01$), while differences between means of these three groups lacked significance. Using the same statistical technique Singh *et al.* (1970) came to a similar conclusion in cattle as they found that the influence of dam's weight at parturition on WCB was highly significant. It is understood that heavier buffaloes should have a bigger size and hence their calves were provided, during their prenatal life, with a more favourable maternal environment to express their genetically determined growth potentialities.

The weight of the first-calf buffalo at parturition affected SPL non-significantly. The length of the character decreased gradually from group 1 till it became of minimal value for buffaloes of group 3, thereafter, it underwent an increase in group 4. In multiparous buffaloes, weight of dam at calving was shown to be associated with SPL (El-Fouly *et al.*, 1977). In their work heavier buffaloes have a significantly ($P < 0.01$) short SPL than that for their lighter counterparts. It is interesting to mention that the present data demonstrate that retarded conception in first-calf buffaloes was, to a greater extent, due to a delay in the restoration of the post-partum ovarian functions. The interval from calving to the first service in buffaloes of group 1 and group 3 accounted for 83.2% and 86.3% of their corresponding SPL. This finding is in accordance with El-Fouly, (1977). Apparently, weight of dam after parturition is involved somehow, in the establishment of post-partum ovarian activity.

The lowest IMY was that for buffaloes of group 1 (486.77 ± 23.70 kg) and group 4 (457.48 ± 28.72 kg), while the highest value (605.00 ± 24.85 kg) was recorded for group 3. IMY of group 2 was of intermediate value (502.33 ± 20.95 kg) between groups 1 and 3. The ANOVA revealed highly significant differences among weight groups in IMY and Duncan's test indicated that differences between the mean of group 3 and those of the other three groups are significant ($P < 0.01$), otherwise, differences between other means are non-significant. The gradual increase in IMY by increasing dam's weight at first parturition, noticed in the three first groups is not surprising, but what is puzzling is the situation of group 4. It did include the heaviest first calf buffaloes, nevertheless, gave the lowest IMY.

Total milk production of the four investigated groups is given in Table 1. It appears evident that the character showed almost the same trend reported for IMY. The ANOVA, however, revealed that differences among groups lacked significance. It should be mentioned that buffalo cow weight changes during the first lactation period ($\bar{x} = 6.9$ months and the range was between 0.0 and 14.1 months) have not been considered here. Weight changes may vary from one group to the other, moreover, it may vary between individuals of the one group. If this is the case, this certainly impairs the influence of dam's weight at first parturition on TMP of the first lactation period.

The effect of age

The effect of age at first calving on WCB, SPL, IMY and TMP was expressed in terms of partial regression coefficients (Table 3). The b values for these respective characters are -0.2866 ± 0.0966 , $+3.7381 \pm 1.2722$, -9.7505 ± 2.2896 and -14.2598 ± 4.8583 , all are statistically highly significant. Thus, when holding weight of dam at first parturition and lactation period length constant, age increase of the first-calf buffalo was shown to exert unfavourable effects on all investigated characters. One month increase in age at

TABLE 3. Partial regression coefficients (\pm S.E.) of weight of calf at birth (WCB), service period length (SPL), milk production in 120 days (IMY) and total milk production (TMP) on age of dam at first calving and the first lactation period length⁽¹⁾.

Character	Age of dam (month)	First lactation period (day)
WCB (kg)	$-0.2866^{**} \pm 0.0966$	—
SPL (day)	$+3.7381^{**} \pm 1.2722$	$+0.1719^{**} \pm 0.0496$
IMY (kg)	$-9.7505^{**} \pm 2.2896$	$+5.4240^{**} \pm 0.2671$
TMP (kg)	$-14.2598^{**} \pm 4.8583$	$+4.6063 \pm 0.1982$

⁽¹⁾Holding post-partum weight of dams constant.

first calving was associated with a decrease in WCB (0.29 kg), IMY (9.75) and TMP (14.26 kg) and an increase in SPL (3.74 days). The determination of age at first calving free of, or with a less unfavourable effects has not been worked out.

The data clearly show that for the best productive and reproductive performances, during the first lactation, buffaloes heifers should be bred to calve at the earliest possible age. At calving their body weight should range between 451 and 500 kg ($\bar{X} = 476.1 \pm 3.6$ kg).

The effect of lactation period

Partial regression coefficients of SPL, IMY and TMP are shown in Table 3. The obtained values for the respective characters are $+0.1719 \pm 0.0496$, $+5.4240 \pm 0.2671$ and $+4.6063 \pm 0.1982$. The first two regression coefficients are highly statistically significant while the third is not significant. The significant b value of SPL indicates that milking exerted some effects in delaying post-partum conception. El-Fouly *et al.* (1977) concluded that buffaloes with a short lactation period length of 120 days or less have a significantly ($P < 0.01$)

TABLE 4. Data on growth and reproductive performance of buffaloes of groups 1 and 3 during their nulliparous life.

Character	Group 1 mean \pm S.E.	Group 3 mean \pm S.E.
Birth weight (kg)	31.8 \pm 1.2 a	33.8 \pm 1.6 a
Age at first service (month) . . .	23.2 \pm 0.9	23.5 \pm 0.06
Weight at first service (kg)	333.1 \pm 17.3 a	360.5 \pm 4.1 b
Age at fertile service (months) . .	24.1 \pm 1.2 a	24.1 \pm 0.06 a
Weight at fertile service (kg) . . .	341.7 \pm 8.0 c	370.9 \pm 4.2 d
Number of services/conception	1.6 \pm 0.2 a	1.5 \pm 0.2 a
Age at first calving (months) . .	34.1 \pm 1.1 a	34.3 \pm 0.6 a
Weight after calving (kg)	378.5 \pm 7.1 c	476.1 \pm 3.6 d

Means within a row having the same letter differ non-significantly from each other, otherwise they differ significantly at 5% level for means with letters a and b and at 1% level for means bearing c and d.

shorter SPL than their counterparts with a longer lactation periods. Moreover, in this species suckling was shown to be a more powerful stimulus, rather than milking in delaying post-partum conception (El-Fouly *et al.*, 1976).

Growth and reproductive performance of buffaloes of groups 1 and 3 before their first parturition

On the basis of the present findings, buffaloes of group 3 were the best with regard to their performance in the first lactation. On the contrary buffaloes of group 1 were the poorest. Of interest is to compare growth and reproductivity of animals of these two particular groups before their first parturition. Such data are given in Table 4. Buffaloes of group 1, however, were slightly lighter at birth (31.3 ± 1.2 kg) than their counterparts of group 3 (33.8 ± 1.6 kg), yet, difference in their birth weights is not significant. Apart from that, buffaloes of group 3 were significantly heavier at first breeding, conception and parturition. It should be noted that corresponding ages of the three parameters in the two groups were very close and statistically not different.

Results do suggest that, under managerial conditions similar to those of the current research, buffalo heifers should be bred for the first time whenever their body weight is about 360 kg and a corresponding age of about 23.5 months.

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تأثير العمر والوزن عند الوضع الأول للجاموس على بعض الصفات الانتاجية والتناسلية لفترات بين الولادتين

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استعمل فى البحث ١٠٩ عجله جاموسى حامل تابعة لمحطة التربية بمحلة موسى وذلك لدراسة تأثير العمر والوزن عند الوضع الأول على : وزن العجل الأول عند الميلاد ، طول فترة التلقيح الأولى ، انتاج اللبن فى ١٢٠ يومه الأولى من الوضع الأول ، الانتاج الكلى من اللبن فى موسم الحليب الأول .
وتتلخص نتائج تأثير الوزن عند الوضع الأول على هذه الصفات فى التالى :

١ - أحسن الصفات المتحصل عليها كانت للجاموس الذى وضع لأول مرة ووزنه وعندما كان وزن الجاموسة بعد الوضع الأول أعلى من ٥٠٠ كيلو جراما كانت بعد الوضع الأول ٤٠٠ كيلو جراما متدهورة للغاية .

٢ - مجموعة الجاموس التى كان وزنها بعد الوضع الأول يتراوح بين ٤٠١ - ٤٥٠ كيلو جراما كانت صفاتها وسط بين تلك لمجموعتى الوزن السابقتين ، وعندما كان وزن الجاموسة بعد الوضع الأول أعلى من ٥٠٠ كيلو جراما كانت جميع صفاتها - باستثناء وزن عجلها الأول عند الميلاد متشابهة للمجموعة التى كان وزنها بعد الوضع الأول ٤٠٠ كيلو جراما أو أقل .

وأثبتت النتائج أن زيادة العمر عند الوضع الأول له تأثيرات غير مرغوبة على جميع الصفات التى شملتها الدراسة . وخلاصة البحث تفيد بأنه يجب توليد العجلات الجاموس لأول مرة على أقل عمر ممكن بحيث يكون وزنها بعد الوضع الأول يتراوح بين ٤٥٠ - ٥٠٠ كيلو جراما .