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Department of Animal Production
Faculty of Agriculture, Assiut University, Egypt

SOME FACTORS AFFECTING BIRTH WEIGHT AND CALF MORTALITY IN FRIESIAN CATTLE UNDER UPPER EGYPT CONDITIONS

(With 4 Tables)

By

S.F. ABBAS; M.N. ABD EL-ATI and F.F. EL-HOMMOSI

بعض العوامل المؤثرة على الوزن عند الميلاد ونسبة نفوق العجول في أبقار الفريزيان تحت ظروف مصر العليا

سيف اليزل فتحي عباس ؛ محمد نصرت عبدالعاطى ؛ فيصل فرحات الحمصى

الوزن عند الميلاد ونسبة النفوق استخلص من ٤٠٨ من العجول الفريزيان الفردية في الفترة مـــا بيـــن ١٩٩٢ إلي ١٩٩٧ .أوضحت النتائج آن الجنس وسنة الولادة وترتيب موسم ولادة الأم لها تأثير معنوي على الوزن عند الميلاد ولكن موسم الولادة ليس له تأثير. نسبة النفوق قبل الفطام في العجلات أعلا من العجول (١٠,٩٥%في مقابل ٨,٥٦%) . وعالية في فصل الصـــيف عن الشتاء (١١,٤٠% في مقابل ٧,٦٨%) . وكذلك نسبة النفوق قبل الميلاد في العجلات التي تلد لأول مره عالية (١٧,٥٨%) عن الأبقار ذات الولادات المتعددة(٦,٢٥إلى ٩,٠٩%). ونسبة النفوق من الولادة حتى عمر سنتين كانت ٢٤,١٧ ، ١١,٤٦ ، ١٤,٢٨ ، ١٥,٢٩% للأبقار ذات الموسم الأول والثاني والثالث والرابع والخامس وأكثر على التوالي. والعجول ذات الأوزان المتوسطة منخفضة في نسبة النفوق (١٤,١٠%) بينما العجول ذات الأوزان الخفيفة عالية في نسبة النفوق (٦٩,١٤%) بينما كانت في العجول الثقيلة في الوزن (٢٧و٢٧%) .والوزن عند الميلاد وترتيب موسم الولادة من أكثر العوامل أهميه فى التأثير على نسبة النفوق . ومن النتائج يقترح العناية بالعجلات أثناء الولادة لتقليل نسبة النفوق.

SUMMARY

Birth weight and calf mortality rate were summarized from 408 live single birth of Friesian calves from 1992 to 1997. Birth weight was significantly affected by sex of calf , calving years and parity of dam , but not by season of birth. Pre-weaning mortality rate was relatively higher in female calves than in male ones mortality (10.95% vs. 8.56%). It was higher in summer season (11.40%) than in winter season (7.78%) Pre-weaning calf mortality rate was higher (17.58%) in heifers (first

parity) than in multiparous cows (6.25 to 9.09%). Mortality rate from birth to two years of age for calves born to cows in their 1st, 2nd, 3rd, 4th and 5th or later parity were 24.17, 11.46, 14.28, 16.95 and 15.29%, respectively. The intermediate weights had the lowest percentage of calf mortality (14.10%). Highest percentage of calf mortality (69.23%) was found for the light weights, followed by the heavy ones (27.27%). Calf birth weight and parity of dam are most important factors affecting mortality rate. Results suggest that heifers needs much care during parturition to decrease calves losses.

Keywords: *Friesian calves, birth weight, mortality*

INTRODUCTION

Death of young calves account for considerable economic losses to dairy farmers. Many factors seem to show some relationship to calf mortality rates such as age, parity of dam, sex of calf, birth weight and calving years.

Early calf mortality (normally restricted to 24 or 48 h) my be roughly divided into mortality associated with dystocia (Moore, 1969; Massip, 1980) and mortality occurring in deliveries considered normal. Feto-pelvic is the most factor for early calf mortality in heifers, and it has a less effect in older cows (Philipsson., 1976). The most important factor affecting calf mortality was calving difficulty (dystocia). Patterson et al. (1987) found that 45.9% of all pre-weaning deaths resulted from dystocia.

The objectives of this study were to investigate the effect of some non-genetic factors away from any possibility of an infectious disease such as sex, calving season, calving year and parity of dam on birth weight, calf mortality from birth until two years of age. Also, association between calf mortality and birth weight in Friesian cattle under Upper Egypt conditions.

MATERIAL and METHODS

Source of data:

Records of birth weight of 408 live single birth of Friesian calves from 150 dam. in Farm of Animal Production Department, Faculty of

Agriculture, Assiut University, Assiut, Egypt throughout 1992 to 1997 were collected for this study. Calves were weighted within 24 h of birth.

Statistical Methods:

Two fixed statistical models were performed according to SAS (1989). The first model included the effects of sex, calving season, calving years and parity of dam as main factors on birth weight.

Fixed effect model:

$Y = \mu + SEX_i + S_j + Y_k + P_l + SIRE_m + E_{Ijklm}$

μ = Overall means

SEX_i = Effect of the i^{th} sex of calf.

S_j = Effect of the j^{th} calving season. Two seasons were defined: winter season (October to March) and summer season (April to September).

Y_k = Effect of the k^{th} year

P_l = Effect of the l^{th} parity of dam: Five parities were defined: 1, 2, 3, 4 and ≥ 5

E_{Ijklm} = Experimental error.

The second model included the effect s of sex, calving season, calving years and parity of dam as main factors on mortality by chi-square.

RESULTS and DISCUSSION

Factors affecting birth weight:

1- Sex of calf:

Differences between sexes of birth weight were significant (Table 1). At birth, males were heavier by 1.47 kg than females. The direct effect of sex on birth weight may be due to genetic differences between males and females. This results is in agreement with that Bollews et al. (1996), Morris et al. (1986) and Abassa et al. (1993). Fisher and William (1978) reported that Holstein males calves were weighted 2.9 kg more than female ones.

2- Calving season:

Table (1) shows that calving season had no significant effect on birth weight of calves (29.70 kg in winter Vs 29.81 kg in summer). Gianola and Tyler (1974) reported that birth weight was not significantly affected by calving season in Holstein Friesian.

3- Calving year:

calving year had significant effect ($p < 0.05$) on birth weight of calves (Table 1). Calves born within the last three years (1995 - 1997) were heaviest at birth, whereas, calves born in 1992 and 1993 were the lightest ones. These results may be attributed to genetical and managerial improvement. Tawonezvi (1989) showed that year of birth had a highly significant effect on live weight at birth in Mashona calves.

4- Parity of dam:

The least square means of parity of dams and their analysis of variance are presented in Table 1. Differences among parity groups in birth weight of calves were significant ($p < 0.05$). The values were 26.57, 29.87, 30.50, 31.02, and 30.85 kg for 1st, 2nd, 3rd, 4th and 5th or later parity, respectively. Birth weight increased with increasing the parity of dams but the rate of increase decreased as parity of dams increase. The big difference in birth weight was found between first and second parity (3.3 kg), while the difference between second and third calves (mature cows) was 0.63 and those between third and fourth calves was 0.53. Similar findings obtained by Fisher and William (1978), who reported that the difference in birth weight between first and second parity was 2.8 kg while between second calves and calves from mature cows was 0.0.80. These results may be attributed to the improvement in body size of dam, with the advancement in age.

It is clear that birth weight was significantly affected by sex of calf, calving years and parity of dam , but not by season of birth.

Factors affecting Pre-weaning calf mortality:

1- Sex:

Table (2) shows that calf mortality rate was greater for male calves (5.05%) than for females (4.29%) within 24 h after birth. This result may be due to that size of male calves are relatively heavier at birth than females. Dematawewa and Berger (1997) reached the same result in Holstein cows. Morris et al. (1986) reported that male calves were more likely to die at birth than females in New Zealand beef cattle. However, female calves had higher total pre-weaning mortality rate than male mortality (10.95% vs. 8.56%, Table 2). Similarly reported that pre-weaning mortality rate was higher in female than in male Friesian calves Omar (1998) and in beef cattle (Nix et al., 1998).

2- Calving season

Total calf Mortality rate to weaning (3 months of age) was higher in summer season (11.40%) than in winter season (7.78% % ,Table 2) .

Also, it was higher in summer season than in winter one within 24 h from birth (5.70% vs. 3.33%). These results may be attributed to the effect of hot environment in summer season (36.22 - 40.37 °C and relative humidity percentage 49.2 - 74.6 at Assiut). Weather effects on calf mortality have been reported by Withers (1952) in dairy and beef calves. The mortality rate attributed to severe weather was 3.6%. Our study shows that the mortality attributed to heat stress was 2.37%. While, Bollews et al. (1987) reported that 6.9% of the mortality in 620 normal calves attributed to cold exposure (chilling).

3- Calving year:

Table (2) shows that pre-weaning calf mortality rate was affected by year of calving. The highest mortality rate (12.12%) was found in 1994, but the lowest one (4.76) was that of 1995. As well as within 24 h after birth, calf mortality rate was the highest (7.58%) in 1994 and the lowest (1.41%) in 1992. The variability in pre- weaning calf mortality within the studying period may be due to variations in temperature, humidity, nutrition and other environmental factors.

4- parity of dam:

Heifers had higher (17.58%) Pre-weaning calf mortality than old cows (6.25 to 9.09%). Moreover, death of calf within 24 h after birth was higher in heifer (8.79%) than in multiparous cows (1.67 to 6.78%). Nix et al. (1998) reported that dystocia was greater in heifer than in multiparous dams (17% Vs 4%) in beef cattle. The high calf mortality rate at weaning partially due to higher calving difficulty. Calving difficulty in heifers is due to two reasons; the first reason heifer have not reach their mature size potential and therefore the size of birth canal is smaller than in mature cows. The second reason is that their calves represent a higher percentage of their body weight as compared to mature cows (Lasley, 1981). Similarly, Azzam et al. (1993) and Dematawewa and Berger (1997) found that in beef and dairy cows, more calf losses for heifers than for multiparous cows due to increase in dystocia.. Present results suggest that heifers needs much care during parturtion to decrease calves losses.

Total calf mortality from birth to 3 months of age was 9.08% similar results were reported by Vaccaro et al. (1999) who found that calf mortality from birth to 4 months of age was 10.1% and 9.0% in Holstein -Zebu and Brown Swiss-Zebu, respectively. Agerholm et al. (1993) found that calf mortality in Danish cattle from 1 to 6 months of age was 11%.

However, the data presented in Table (2) shows that about 47.55% of total death from birth to weaning were resulted from calving difficulty. Results reported by Patterson et al. (1987) and Azzam et al. (1993) indicated that 43.6% to 45.9% of all pre-weaning deaths resulted from dystocia. in beef calves.

Factors affecting calf mortality from weaning to two years of age:

Sex of calf, season of calving, calving year and parity of dam:

Frequency distribution of calf livability and mortality by sex, calving season, year of birth and parity of dam. for post-weaning calves are presented in Table (3). Overall mortality rate from weaning (3 months old) to one year , from one to two years, from weaning to two years and from birth to 2 years of age was 5.15, 1.48, 6.63 and 16.42%, respectively. Mortality rate was greater for male calves (8.56%) than female ones (4.76%) from weaning to two years of age. Calf Mortality rate from weaning to two years of age was higher in winter (7.78%) than in summer (5.71%).

The data in Table (3) revealed that calf mortality rate from three months to two years of age was the highest (10.15%) in 1997 and in 1996 (9.88%), but the lowest (1.72%) in 1993 As well as from birth to two years of age calf mortality was the highest (21.74) in 1997 and in 1996 (20.99%) and the lowest (12.06) in 1992 and in 1993 (12.68%). This variability may be due to variation in temperature, humidity, nutrition and other environmental factors.

Death from birth to two years of age for calves born to cows in their 1st, 2nd, 3rd, 4th and 5th or later parity, were 24.17, 11.46, 14.28, 16.95 and 15.29%, respectively. However mortality rate from 3 months to one year of age was higher in 1st parity (6.59%) than for multiparous cows (range from 2.60 to 5.88%).

Association between calf mortality and birth weight groups:

The association between calf mortality and birth weight was presented in Table (4). Calf mortality rate was significantly high for light weights (69.23%) and heavy weights (27.27%). The lowest value was that of the intermediate weights (14.10%). Similarly, Azzam et al. (1993) reported that calf mortality was higher for small born calves to cows with dystocia. Berger et al. (1992) found that mortality was lowest at 26 kg to 35 kg and highest at weights above 35 kg in Angus cows and heifer. Morris et al. (1986) reported that high death rates from calves of light weight for both sexes in New Zealand beef. The possibility of endocrine factors responsible for prolonged labor (weak labor) when calves are small, should be given attention in addition to the anatomical

factor usually associated with dystocia (Azzam et al., 1993). Ogata et al. (1999) showed that the weak calves had anemia characterized by a significant decreased of blood cell valves and bone marrow hypofunction. The anemia due to bone marrow hypofunction presumably caused intrauterine growth retardation of the foetus, and also, dames delivering the weak calves showed significantly lower serum concentrations of estrone sulphate during late pregnancy than those normal calves. Moreover, the high calf mortality for heavy weights may be attributed to pelvic area, which partially responsible for increased calving difficulties.

In conclusion, males were weighted 1.47 kg more than females at birth. Birth weight increased with parity of dam. Intermediate birth weights of 21 to 35 kg was optimal for decreased calf mortality rate. Mature cows were lower calf mortality than heifers and produced weighed calves at birth.. Results suggest that heifers needs much care during parturition to decrease calves losses. Calf birth weight and parity of dam are most important factors affecting in mortality rate.

Table 1: Effect of sex of calf, calving season, calving years and parity of dam on birth weight (Kg).

Factors	No.	LSM±SE
Sex		
Male	198	30.50±0.25[a]
Female	210	29.03±0.25[b]
Calving season		
Winter	180	29.70 ±0.23
Summer	228	29.81±0.26
Calving years		
1992	71	27.26±0.43[d]
1993	58	27.16±0.47d
1994	66	28.96±0.44[c]
1995	63	32.37±0.44[a]
1996	81	32.28±0.40[a]
1997	69	30.53±0.43[b]
Parity of dam		
1	91	26.57±0.37[c]
2	96	29.87±0.36[b]
3	77	30.50±0.41[a]
4	59	31.02±0.46[a]
≥5	85	30.85±0.39[a]

a, b, c Means with different superscripts are significantly different ($p < 0.01$).

Table 2: Frequency distribution of calf livability and mortality by sex, calving season, calving year and parity of dam for pre-weaning calves.

	No.	Calf livability from birth to weaning NO. %	Within 24 h No. %	1st month NO. %	2nd month NO. %	3rd month NO. %	Total at weaning NO. %
Overall mean	408	368 90.20	19 4.66	13 3.19	3 0.74	5 2.38	40 9.80
Sex							
Male	198	181 91.41	10 5.05	6 3.03	1 0.25	- -	17 8.56
Female	210	187 89.05	9 4.29	7 3.33	2 0.49	5 2.38	23 10.95
Calving eason							
Winter	180	166 92.22	6 03.33	7 2.78	1 0.56	- -	14 07.78
Summer	228	202 88.60	13 05.70	6 2.63	2 0.88	5 2.19	26 11.40
Calving year							
1992	71	65 91.55	1 1.41	4 5.63	- -	1 1.41	6 8.45
1993	58	52 89.66	2 3.45	4 5.90	- -	- -	6 10.34
1994	66	58 87.88	5 7.58	2 3.03	- -	1 1.52	8 12.12
1995	63	60 95.24	3 4,76	- -	- -	- -	3 4.76
1996	81	62 88.89	4 4.94	1 1.23	2 2.47	2 2.47	9 11.11
1997	69	61 88.41	4 5.80	2 2.90	1 1.45	1 1.45	8 11.59
Parity of dam							
1	91	75 82.42	8 8.79	7 7.69	1 1.25	- -	16 17.58
2	96	90 93.75	3 3.21	2 2.08	- -	1 1.04	6 6.25
3	77	70 90.91	3 3.90	2 2.60	- -	2 2.60	7 9.09
4	59	54 91.53	4 6.78	- -	- -	1 1.69	5 8.47
≥5	85	79 92.94	1 1.76	2 2.35	2 2.35	1 1.76	6 7.06

Table 3: Frequency distribution of calf livability and mortality by sex, calving season, birth year and parity of dam. for post-weaning calves .

	No.	Calf livability from birth to 2 years old NO. %	Calf dead from weaning to 1 year old NO. %	Calf dead from 1-2 years old NO. %	Calf dead from weaning to 2 years old NO. %	Calf dead from birth to 2 years old NO. %
Overall mean	408	341 83.58	21 5.15	6 1.48	27 6.63	67 16.42
Sex						
Male	198	164 84.29	14 5.07	3 1.52	17 8.56	34 17.12
Female	210	177 82.83	7 3.33	3 1.43	10 4.76	33 15.71
Calving season						
Winter	180	152 84.44	12 6.67	2 1.11	14 7.22	28 15.00
Summer	228	189 82.89	9 3.95	4 1.75	13 5.71	39 17.11
Calving year						
1992	71	62 87.32	3 04.23	- -	3 4.23	09 12.68
1993	58	51 87.93	1 01.72	- -	1 1.72	07 12.06
1994	66	55 83.33	2 03.03	1 1.52	3 4.55	11 16.67
1995	63	55 87.30	3 04.76	2 3.17	5 7.94	08 12.70
1996	81	64 79.01	6 07.41	2 2.47	8 9.88	17 20.99
1997	69	54 78.26	6 10.15	1 1.45	7 10.15	15 21.74
Parity of dam						
1	91	69 75.82	6 6.59	- -	6 6.59	22 24.17
2	96	85 88.54	5 5.21	- -	5 7.25	11 11.46
3	77	66 85.71	2 2.60	2 2.60	4 5.19	11 14.28
4	59	49 83.05	4 6.78	1 1.69	5 8.47	10 16.95
≥5	85	72 84.71	5 5.88	2 2.35	7 8.23	13 15.29

Table 4: Percent of calf mortality as affected by birth weight

Birth weight (kg) category	No. of calves at birth	No	%
15 - 20	13	9	69.23
21 - 25	88	13	14.77
26 - 30	155	20	12.90
31 - 35	130	19	14.62
36 - 40	22	6	27.27
Chi- Square value	246.23	Prob.	0.001

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