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Age and Weight at Weaning of Holstein/ Friesian Calves in Northern Gezira Dairy Project, Sudan

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Abstract

The data used in this study included 1653 records of weight and age at weaning of which 1030 records for male calves and 623 records for females covering the period from 1989 to 2002. The effects of the factors of sex of calf, year and season of birth and parity on age and weight at weaning were also investigated. The overall mean weight and age at weaning of Holstein/ Friesian calves in this farm during the study period were 67.43 ± 0.41 kg and 75.43 ± 1.03 days for female and males respectively. The mean weight at weaning was 66.62 + 0.66 kg for male calves and 67.96 ± 0.52 kg for females. Sex of calf did not exert any significant effect on these traits ($P \geq 0.05$). Weight at birth affected both traits significantly ($P \leq 0.001$). Weight at weaning was significantly affected by age at weaning ($P \leq 0.00$), year of Birth ($P \leq 0.001$) and parity of dam ($P \leq 0.001$) while it was not affected by season of birth ($P \geq 0.05$). Sex of calf, year and season of birth and parity of dam did not exert any significant effect on age at wearing ($P \geq 0.05$). The interactions of these factors had variable effects on both traits. It is concluded that this study has revealed important information about age and weight at weaning of Holstein-Friesian cattle under the prevailing management and environmental factors in the farm under study in Sudan.

Key words: age at weaning, weight at weaning, sex of calf, parity of dam, year, season, interactions.

I. Introduction:

Weaning weights were measured to evaluate differences in mothering ability of cows and differences in growth potential of calves, Campbell and Marshall (1975).Weight at weaning of calves is a composite of weight at birth i.e. prenatal growth and postnatal growth whilst the animal is still under direct genetic influence. This pre-weaning growth is influenced by genetic effects (individual genotype), maternal genetic effects (dam genotype) and associated environmental effects, Vaccaro (1975) and Barlow (1978). Williamsons and Payne (1978) reported that in temperate-zone countries they practice early weaning at 24-31 days of age. When thus weaned, calves suffered severe growth checks, but in due course they recovered satisfactorily without permanent damage. The choice of the system of weaning must depend on local circumstances i.e. the availability of good starter, good quality roughage and the prices of milk. It is necessary to compromise between the needs of the calf and the cost of rearing .Friesian calves weaned at an age of at least 56±3 days with weights of at least 82kg for males and 70kg for females had improved fattening capacity for males and resistance of females as dairy cows, Sviben et al (1990) .However Bittante et al(1992) stated that early weaning technique had to be adjusted to the requirements of each breed, but was technically and economically effective. In the tropics, Chamberlain (1993) reported that weaning was possible at three months of age provided that the calf has had no setbacks like scouring. When management was poor and dry feeds were expensive, longer milk feeding was the better alternative. Calves must be weaned onto high-quality feeds to take the place of milk.

The weight and age at weaning are dependent on management decision according to the prevailing environmental and economic conditions in the farm. These traits are important to consider because they may affect the future performance of the animal. Though important, they are not given enough attention by many farmers in Sudan. Hence, the objective of this work is to study these traits in the farm of Northern Gezira Dairy Project. It worth mentioning that in this farm different systems of weaning were practiced during the period 1984-2002.These included weaning at 45,90 and 180 days with variation in weights according to local circumstances in the farm. Age and weight at weaning were studied under the factors of weight at birth, sex of calf, year and season of birth, parity of dam and age at weaning and their interactions.

II. Materials and Methods:

1. The Data and source of data:

The source of data in this study was the farm of the Arab company of Agricultural Production and Processing at Albagair in Northern Gezira.The data used in this study included 1653 records of weight and age at weaning of which 1030 records for females and 623 records for male calves. The data covered the period from 1989 to 2002. The effect of sex of calf ,year and season of birth, parity of dam and their interactions on weight and age at weaning were examined .The effect of weight at birth on both traits was examined .The effect of age at weaning on weight at weaning was also investigated .

2. Statistical analysis :

The data were analyzed by the Method of least Mean Squares (Steel ,Torrie and Dickey,1997) .They were subjected to analysis of variance using SPSS Version 12.5 programme. The following fixed model was applied:

$$Y_{ijklm}=\mu+R_i+S_i+P_K+H_I+Cm+(R\times S)+(R\times H)+(R\times P)+(S\times H)(S\times P)+(H\times P)+ E_{ijKLM}$$

Where:

Y_{ijklm}=the trait studied

μ =overall mean

R_i=effect of year of birth

S_i=effect of season of birth

P_K=effect of parity of dam

HL = effect of sex of calf

C_m =interactions

$E_{ijKLM=}$ Standard error

III. Results:

1. The overall mean weight and age at weaning:

The statistical analysis of the data revealed that the overall mean weight and age at weaning of Holstein –Friesian calves in this farm during the study period were 67.43 kg and 75.43 days respectively (Tables 1 and 2) .

Table(1): Overall Mean of Weight at Weaning of Calves (kg)

Dependent Variable: Weight at Weaning.

Mean (kg)	Std. Error
67.43	0.41

Table(2): Overall Mean of Age at Weaning of Calves (days).

Dependent Variable: Age at Weaning.

Mean (days)	Std. Error
75.43	1.03

2. The Effect of Weight at Birth on Weight and Age at Weaning:

The results in this study showed that weight at birth of calves had a highly significant (P≤ 0.001) effect on both weight and age at weaning. This is clearly evident in tables (3) and (4).

Table (3): Analysis of Variance for the Effect of Age at Weaning, Weight at Birth, Sex, Year and Season of Birth, Parity and Their Interactions on Weight at Weaning of Calves.

Dependent Variable: Weight at Weaning.

Source	df	Mean Square	F	Sig.
Age_at_Weaning	1	11274.579	119.839	.000
Weight at Birth	1	13081.497	139.045	.000
Sex	1	113.130	1.202	.273
Year of Birth	6	3112.882	33.087	.000
Season of Birth	2	148.874	1.582	.206
Parity of Dam	7	426.273	4.531	.000
Sex * Year of Birth	4	503.619	5.353	.000
Sex * Season of Birth	2	300.673	3.196	.041
Year of Birth* Season of Birth	12	371.480	3.949	.000
Sex * Year of Birth* Season of Birth	8	581.674	6.183	.000
Year of Birth * Parity	37	143.647	1.527	.023
Season of Birth * Parity	14	120.645	1.282	.211
Error	1456	94.081		

Table (4): Analysis of Variance for the Effect of Weight at Birth, Sex, Year and Season of Birth, Parity of Dam and their Interactions on Age at Weaning of Calves.

Dependent Variable: Age at Weaning

Source	df	Mean Square	F	Sig.
Weight at Birth	1	17013.672	28.723	.000
SEX	1	1285.371	2.170	.141
Year of birth	6	695.672	1.174	.317
Season of birth	2	820.063	1.384	.251
PARITY	7	375.699	.634	.728
SEX * year of birth	4	1241.472	2.096	.079
SEX * Season of birth	2	1127.628	1.904	.149
year of birth * season of birth	12	1863.852	3.147	.000
year of birth * PARITY	37	335.930	.567	.983
SEX * year of birth * PARITY	17	270.403	.457	.971
Season of birth * PARITY	14	278.490	.470	.949
Error	1457	592.338		

3. The Effect of Sex of Calf on Weight and Age at Weaning:

In this study the sex of calf did not have any significant effect (P≥0.05) on either weight at weaning (Table 3) or age at weaning (Table 4).The mean weight at weaning was 66.62kg for males and 67.96 kg for females (Table 5) .The mean age at weaning was 71.92 days for males and 77.76 days for females (Table 6) .

Table (5): Means and Standard Errors of Weight at Weaning (kg) in Male and Female Calves.

Dependent Variable: Weight at Weaning.

SEX	Mean (kg)	Std. Error
Female	67.96	0.52
Male	66.62	0.66

Table (6): Means and Standard Errors of Age at Weaning (days) in Male and Female Calves.

Dependent Variable: Age at Weaning

SEX	Mean (Days)	Std. Error
Females	77.76	1.31
Males	71.92	1.65

4. The Effect of Weight at Birth on Weight and Age at Weaning:

The analysis of data revealed that weight at birth had exerted a highly significant (P≤0.001) effect on both weight and age at weaning (Tables 3 and 4).

5. The Effect of Age at Weaning on Weight at Weaning:

It was shown in Table (3) that age at weaning had a highly significant (P≤0.001) effect on weight at weaning.

6. The Effect of Year of Birth on Weight and Age at Weaning:

The year of birth of calf had a highly significant (P ≤0.001) effect on weight at weaning (Table 3), but it did not affect age at weaning (Table 4). The lighter weaning weights (56.74 kg,61.28kg) were seen in the year-periods 1991-92 and 1995-96 respectively while the heaviest weaning weights (88.30kg, 77.80kg) were observed in the year-periods 1999-200 and 2001-2002 respectively (Table7). The youngest weaning ages (67.69 and 72.03 days) were seen in the year periods 1990-1992 and 1995-1996 respectively while the eldest weaning ages (79.15, 97.92 days)were observed in the year-periods 1993-94 and 2001-2002 respectively (Table 8).

Table (7): Means and Standard Errors of Weight at Weaning (Kg) of Calves in Different Years of Birth.

Dependent Variable: Weight at Weaning.

Years of Birth	Mean (kg)	Std. Error
1.989-1990	66.06	2.27
1991-1992	56.74	0.94
1993-1994	70.82	0.98
1995-1996	61.28	0.70
1997-1998	62.97	0.97
1999-2000	77.80	0.91
2001-2002	88.30	2.49

Table (8): Means and Standard Errors of Age at Weaning (Days) of Calves in Different Years of Birth.

Dependent Variable: Age at Weaning.

Years of Birth	Mean	Std. Error
1989-1990	69.88	5.69
1991-1992	67.69	2.35
1993-1994	79.15	2.47
1995-1996	72.03	1.75
1997-1998	77.71	2.43
1999-2000	74.90	2.30
2001-2002	97.92	6.22

7. The Effect of Season of Birth on Weight and Age at Weaning:

The season in which the calf was born did not significantly ($P \geq 0.05$) affect either weight nor age at weaning (Tables 3 and 4) . Mean weaning weights in winter, dry summer and wet summer were 68.61, 66.75 and 66.86 kg respectively (Table 9). Mean weaning ages in winter, dry summer and wet summer were 78.45, 74.71 and 73.12 days respectively (Table 10).

Table (9): Means and Standard Errors of Weight at Weaning (kg) of Calves in Different Seasons of Birth

Dependent Variable: Weight at Weaning.

SEASON	Mean (kg)	Std. Error
Winter (Nov. - Feb.)	68.61	0.71
Dry Summer (March - June)	66.75	0.77
Wet Summer (July - Oct)	66.86	0.65

Table (10): Means and Standard Errors of Age at Weaning (Days) of Calves in Different Seasons of Birth.

Dependent Variable: Age at Weaning.

Season of Birth	Mean	Std. Error
Winter (Nov.-Feb)	78.45	1.78
Dry summer (March-June)	74.71	1.93
Wet summer (July-Oct)	73.12	1.64

8. The Effect of Parity of Dam on Weight and Age at Weaning:

Weight at weaning of calves born to dams at different parities showed highly significant($P \leq 0.001$) variations reveling the strong effect of parity of dam on this trait (Table 3 and 11) .The first parity had the lightest weaning weights (63.58kg) while parity seven showed the heaviest(72.24kg) as seen in table (11). Age at weaning was not significantly ($P \geq 0.05$) affected by parity of dam (Table 4) .The 1^{st} ,and 7^{th} parities showed the youngest and eldest ages at weaning respectively (Table 12).

Table (11): Means and Standard Errors of Weight at Weaning (kg) of Calves in Different Parities of Dams.

Dependent Variable: Weight at Weaning.

PARITY	Mean (kg)	Std. Error
2	69.53	0.66
3	66.51	0.80
4	69.84	0.96
5	65.89	1.14
6	64.01	1.77
7	72.24	2.22
8	69.98	3.11

Table (12): Means and Standard Errors of Age at Weaning (Days) of Calves in Different Parities of Dams.

Dependent Variable: Age at Weaning.

PARITY	Mean	Std. Error
1	73.65	2.07
2	78.07	1.65
3	76.84	2.00
4	76.76	2.41
5	74.00	2.85
6	67.61	4.43
7	79.28	5.56
8	74.29	7.81

IV. Discussion:

The mean weight at weaning of Holstein- Friesian calves in this study was 67.43 kg at an age of 75.43 days. Dutch-Friesian calves in Egypt scored a range of 79-88.6 kg at an age of 105 days, (Vaccaro1975). Williamson and Payne (1978) reported an age of 3-6 months for weaning calves in the tropics. Kabuga and Agyemang (1986) reported an average weaning weight of 104.6kg at an age of 138 days for Canadian Holstein- Friesians in Ghana. Holstein- Friesian calves in Turkey were weaned at an early age of 35days and a weight of 52kg. Chamberlain (1993) reported that the ideal weaning weights were 70 kg for large breeds and 45 kg for smaller breeds. The findings of this study (67.43 kg) were not far from this ideal goal. However, it is obvious from the literature that there were wide variations in policies as to the age and weight at weaning depending upon prevailing environmental and management factors. This was clearly demonstrated by Bittante et al (1992) who reported that Holstein- Friesian calves were weaned when intake of starter mixture was 1.4kg daily for three consecutive days at an age of 57 days

provided that mean daily gain was 618 grams. In U.S.A, according to the Study of Dairy Calf Management Practices in the National Animal Health Monitoring System (1992), as cited by Quigley (1998), most dairy producers use age of the calf as the primary criterion for weaning. The most common age at weaning was 8 weeks although some producers wean at 10 weeks of age or later and few others wean at ≤3 weeks of age .Some producers weaned calves when their starter intake reached a predetermined level (usually 700-1000g/day) or when they reach a preselected body weight .According to Quigley (1998) the preparation for weaning was a function of dry feed intake, not age. However it is important to note that in the farm under study weaning of calves was a function of age and weight. It was influenced by the prevailing environmental and management factors in the farm.

In this study weight at birth had exerted a highly significant effect on weight at weaning. This went on line with the findings of Barlow (1978) who reported that weight at birth was a component of weaning weight .Silva (1986) also stated that birth weight was genetically correlated with body weight at weaning and hence agreed with the findings of Boyd et al (1987).The results were also augmented by the reports of Baily and Mears (1990) who reported similar findings.

The results of this study showed that sex of calf had no significant effect on either weight or age at weaning, hence going in line with the findings of Vaccaro (1975)in Friesians in Holland in which male and female calves at 12 weeks of age had weighed 85.2 and 85.3kg respectively. This contradicted with the findings of Silva (1986) in Nellore cattle in Brazil, Reimer et al (1986) and Najera et al (1992). Almeida et al (1993) also reported that body weight at 90 days of Holstein calves in Brazil averaged 88.1kg for males and 83.0kg for females showing the important effect of sex on this trait.

The effect of year of birth on weight at weaning was highly significant in this study, but season of birth had no significant effect. This was because year of birth had an effect on weight at birth and consequently the latter affected weight at weaning. The effect of year of birth on weight at birth and hence on weight at weaning might be attributed to the availability of feed and its effect on the body condition of the dam. Milagres et al (1986), Rodriguez et al (1986) and Polinkovskii (1992) agreed with the findings of this study on the significant effect of year, but disagreed with it on the effect of season which they reported to have had a significant effect on

weight at weaning .Azevedo et al (1986) and Najera et al (1992) reported a significant effect of year of birth on weight at weaning which went on line with the results of this study. Oishi et al (1986) and Singh et al (1992) disagreed with the results of this study on the effect of year which they reported to have had no effect on weight at weaning or daily gain to weaning respectively. Khedkar et al (1986) reported that season of birth had no effect on body weight at 13 and 26 weeks ,hence going in line with the results of this study on the effect of season of birth on weight at weaning.

The significant effect of parity of dam on weight at weaning found in this study agreed with the findings of Oishi (1986) who reported a significant effect of parity on weight at weaning at 180 days. Cordeiro (1986) also agreed with the results of this study by reporting that parity of dam had affected weaning weights at 90,180 and 270 days .This went in line with the findings of Lee et al (1986) who reported that parity of dam had significantly affected weights at 90 and 180 days especially the 3^{rd} -6^{th} parities after which the effect decreased .Azevedo et al (1986) reported that age of dam significantly affected weight at 205days of age of the nucleus herd of Tabapuá cattle in Brazil . Milagres et al (1986) also reported similar significant results in Nellore cattle in that country. This also agreed with the findings of Almeida et al (1993) which showed that calves born from dams aged 7-9 years had the highest weights at the age of 90 days. This might be attributed to the effect of parity on weight at birth which consequently affected weight at weaning.

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