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Evaluation of Imported and Locally-born Friesian Cows Raised in Commercial Farms in Egypt

2 - Evaluation of Correction Factors and of Some Genetic Effects

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DATA on 1646 lactation records of two commercial Frisian herds were collected in the period from 1981 to 1988 on yield of milk recorded in 90 days (90DY), 305 days (305DY) and total lactation (TY), lactation length (LP), dry period (DP), age at calving (AC), days open (DO) and calving interval (CI). Two methods of gross comparison (GC) and polynomial regression analysis (PRA) were used to calculate different sets of multiplicative correction factors for age. DO and LP correction factors were constructed using PRA method based on modal class or maximal production. Lists of these factors were presented. Differences in age-correction factors were consistent across 90DY, 305DY and TY. Consistent trends for DO and LP correction factors were also observed where these factors tend to decrease with the increase of DO or LP. The PRA factors of age were generally overestimated relative to GC factors at younger ages while the reverse trend was observed at older ages. Correction factors of PRA seemed to be relatively the most successful method in removing the effect of age on milk yield. Factors of PRA based on either of modal class or maximal-production class for DO or LP were closely similar in removing the effect of DO or LP on milk production. However, all methods used here for estimating the correction factors were successful in removing the effect of age, DO and LP on milk production. All traits studied were significantly (P < 0.001) affected by cow within herd. Repeatability estimates for 90DY, 305DY, TY and LP were moderate in magnitude ranging from 0.23 to 0.37, while a low estimate for DP was observed (0.11). Repeatability estimates for CI and DO were 0.30 and 0.29, respectively.

Keywords: Friesian cattle, lactation traits, correction factors evaluation, repeatability.

In constructing a genetic index for use in cow and sire evaluations, there is a need to account for important non-genetic factors which influence the animal's performance. Milk production records in Friesian cattle in Egypt are most be affected by age at calving, days open, lactation length and other non -genetic factors. Therefore , investigation on the value and methods of estimating for these factors and correcting for, their effects was deemed to be important. Many studies (Miller *et al.*, 1970; Schaeffer and Henderson, 1972; Oltenacu *et al.*, 1980; Cooper and Hargrove, 1982; Hansen *et al.*, 1983; Soliman *et al.*, 1989) estimated different sets of correction factors and they have recommended to correct 305-day and/or total milk yield for age at calving and concurrent days open. In Egypt, some sets of age and days-open correction factors for lactation records were derived (Galal *et al.*, 1974; Khattab and Ashmawy, 1988), but no account was taken of lactation length.

The purpose of the present study was to derive sets of correction factors of milk yield for age at calving, days open and lactation length. Repeatabilities for all traits studied will also be estimated.

Material and Methods

This study was carried out using the productive and reproductive records of two commercial Friesian herds belonging to the General Cooperative of Developing the Animal Wealth and Products (GCDAWP), Egypt. The two private herds namely Mashal and Kombera are located in Gharbia and Giza Governorates, respectively. Productive traits studied were 90-day milk yield (90DY), 305-day milk yield (305DY), total milk yield (TY), length of lactation period (LP) and length of dry period (DP). Reproductive traits were days open (DO) and calving interval (CI). Details of management, feeding, breeding plan and models of analysis are presented by Afifi *et al* (1992). Table 1 includes the list of traits analysed and the factors that

TABLE 1 . Models and model components used in the analysis of data .

		Model components												
		Herd	Cow+ within herd	Source within herd	Year	Season	Parity	Age class++	Age within Parity	Days open	Lactation length	Herd x Year	Herd x Season	Year x Season
Trait	Model	i	ij	ik	l	m	n	o	no	p	r	il	im	lm
90DY, 305DY, TY	Model 1	x	x	x	x	x		x				x	x	x
90DY, 305DY, TY														
LP, DO, CI	Model 2	x	x	x	x	x	x		x			x	x	x
305DY, TY	Model 3	x	x	x	x	x	x		x	x		x	x	x
305DY, TY	Model 4	x	x	x	x	x	x		x		x	x	x	x

\+ Cows within herd are considered as random effects .
++ Age classes were 3 months intervals starting at 24 months and ending at ≥88 months .

were presumed to contribute to their variability.

Correction factors

Age - correction factors are usually calculated to convert the production of the cow at a certain age to mature equivalent base. Age corrections factors for milk yield were constructed using two procedures. Firstly, age correction factors for 90DY, 305DY and TY were calculated by fitting the second degree polynomial of age into milk production using gross comparison method (GC) described by Areve *et al* (1964) as :

$$Yi = \mu + b_L (X_i - X\mu) + bQ (X_i - X\mu)^2 + ei \text{ .... } (1).$$

Where Y_i = milk production at i th age interval, μ = overall mean adjusted for effects included in the model, b_L & bQ = estimates of partial linear and quadratic regression coefficients of a given milk trait on age at calving, X_i = subclass of i th age in months, $X\mu$ = usually equal to mean of age and e = an error term. Then the first derivatives of $Y_i = \mu + b_L (X_i - X\mu) + bQ (X_i - X\mu)^2$ with respect tox was obtained and the resulting equation set to zero to find X at which Y is maximum. Different sets of age correction factors for 90DY, 305DY and TY using gross comparison method were constructed as $C_i = Y_m/Y_i$, where Y_m = the predicted average of milk at maximum production and Y_i = the least - square mean of milk yield at each class of age. Secondly, age correction factors for lactation traits were constructed by smoothing the curve representing the relationship between least-squares means of milk yield and classes of age using polynomial regression analysis of third degree (PRA). In the case of nonsignificant partial cubic regression coefficient, the polynomial regression of the 2nd degree was used and if the quadratic term was not significant the relationships between age and lactation traits were examined for linearity. The prediction equations of adjusted - lactation traits were estimated as:

$$Y = \mu + b_L(X - X\mu) + b_Q (X - X\mu)^2 + b_C (X - X\mu)^3 \text{ .... } (2)$$

Where Y = the predicted value of trait; μ = overall least - square mean of a given lactation trait adjusted for effects in the model; b_L & b_Q & $8b_{QC}$ = estimates of partial linear, quadratic and cubic regression coefficients of a given lactation trait on age; X = value of age subclass; $X\mu$ = usually equal to the mean of age. The multiplicative age correction factors for lactation traits were computed as: $C_i = \mu_m/ \mu_i$; Where C_i = the multiplicative age correction factors; μ_m = the least - square mean of a given lactation trait at maximum production, and μ_i = The predicted average of milk at each class of age; as indicated from the previous prediction equation.

Do and LP correction factors for 305DY and TY were constructed by smoothing the curve representing the relationship between least-squares means of milk yield with classes of DO or LP using PRA of third degree (equation 2). The multiplicative DO or LP correction factors for 305DY and TY were computed on the basis of modal class (the most frequent class) or on the basis of maximal - production class as: $C_i = \mu_m / \mu_i$, where C_i = the multiplicative DO or LP correction factor; μ_m= the least - square mean of a given milk yield at modal class or maximal - production class, and μ_i = the predicted average of milk at each class of DO or LP.

Estimation of variance components and repeatability

By equating mean squares of random effects to their expectations, estimates of variance components for cow-within herd ($\delta^2 C:H$) and remainder (δe^2) were obtained. Accordingly, repeatability or intra-class correlation (t) was estimated as:

$$t = \frac{\delta\varepsilon^2 C:H}{\delta^2 C:H + \delta^2 e}$$

Where δ^2 C:H = the sum of genetic and permanent environmental variance among cows and δ^{2e} = the temporary environmental effects associated with each lactation. Approximate standard errors for repeatability estimates were computed by the LSMLMW program of Harvey (1987). These approximate standard errors were computed according to procedures described by Swiger *et al* (1964).

Results and Discussion

Correction Factors

(i) Age - correction factors. Age - correction factors are usually calculated to convert the milk production of the cow at a certain age to mature equivalent base. Results of polynomial regression analysis of 90DY, 305DY and TY on age at calving (Model 1) are presented in Table 2. These partial regression coefficients of 90DY, 305DY and TY on age calving showed curvilinear relationships ($P < 0.001$) between milk yield and age at calving. Second degree polynomial equations calculated for gross comparison method were:

$Y = -638 + 58.84X - 0.36X^2$ for 90DY:

$Y = -365 + 114.08X - 0.67X^2$ for 305DY;

$Y = -130 + 115.42X - 0.68X^2$ for TY.

TABLE 2 . Estimates of polynomial regression analysis (b) for 305DY ,TY and LP on days open .

Trait	Partial regression coefficient of third degree		
	Linear	Quadratic	Cubic
	b±SE	b±SE	b±SE
Age at calving :			
90DY (kg)	17.8±3.6***	-0.357±0.031***	0.0097±0.0018***
305DY (kg)	37.7±9.7***	-0.666±0.085***	0.0051±0.0048ns
TY (kg)	37.9±11.4***	-0.679±0.090***	0.0032±0.0056ns
Days open :			
305DY (kg)	4.299±0.7745***	-0.03966±0.01469**	-0.000095±0.00036ns
TY (kg)	9.540±0.8856***	0.01394±0.01680ns	0.000385±0.00041ns
LP (days)	0.9698±3.0413***	0.002432±0.00065***	0.000023±0.00006ns
Days of lactation :			
305DY	7.5±0.41***	-0.048±0.004***	0.0002±0.00004***
TY	12.9±0.42***	-0.019±0.004***	0.0003±0.00004***

ns= non-significant (P>0.05); **=P<0.01; ***=P<0.001 .

Age at maximum production used in calculation of correction factors derived by GC method was estimated at X= 81.7, 85.1 and 84.9 months for 90DY, 305DY and TY, respectively. Consequently, predicted estimates of maximum production (after substituting for X) are 1766, 4491 and 4768 Kg for 90DY, 305DY and TY, respectively. Maximum production used in the calculation of correction factors derived by PRA was 1806 kg for 90DY, 4481 for 305DY and 4835 for TY at 81 - 83, 78 - 80 and 78 - 80 months of age, respectively. Multiplicative age-correction factors of 90DY, 305DY and TY constructed by the two methods are presented in Table 3. Magnitude of age correction factors for yield traits constructed by PRA is higher than of computed by the GC method at younger ages (ages preceding maturity of cow) while the reverse trend is observed for older ages (ages after maturity). Adjustment factors in each method of estimation showed similar trends for 90DY, 305DY and TY (Table 3). These estimates also indicate that age - correction factors for milk yield of young cow were generally higher than those of older ones. This trend was similar to that reported by other investigators working on Holstein or Friesian cattle (*e.g.* Searle and Henderson, 1959; Miller *et al.,* 1970; Galal *et al.,* 1974; Cooper and Hargrove, 1982; Hansen *et al.,* 1983). Also, Lobo *et al* (1984) with Pitangueiras cattle and Soliman *et al* (1989) with Pinzgauer cattle gave an evidence for this trend.

Comparing correction factors obtained here with those in the literature (*e.g.* Galal *et al.,*1974; Hansen *et al.,* 1983; Soliman *et al.,* 1989) showed that differences were relatively small. These factors did not exhibit large differences between consecutive classes of calving at younger ages while relatively large differences between consecutive classes of calving at older ages were observed (Table 3). This higher increments at older ages may be due to that culling of cows at older ages was mainly performed on the basis of fertility and health. Small number of records associated with age classes at older ages makes comparison between the two methods at older ages less reliable.

The differences in age-correction factors were inconsistent across traits (Table 3). However, factors used for adjusting 305DY could perhaps be applied to TY without substantial loss in accuracy. Similar observation was observed by Hansen *et al* (1983).

(ii) Days - open correction factors. The modal values of 80 - 99 days of DO are observed in the present study. Schaeffer and Henderson (1972) reported that correction factors for DO could be computed to any desirable base. However, 80 days is

TABLE 3 . Age correction factors for milk yield using the methods of gross comparison (GC) and polynomial regression analysis (PRA) of estimation .

Age-class (months)	N	90DY		305DY		TY	
		GC	PRA	GC	PRA	GC	PRA
≤24	54	2.002	3.185	1.550	2.254	1.492	2.152
25-27	168	1.756	2.625	1.437	2.012	1.412	1.943
28-30	148	1.554	2.249	1.354	1.825	1.312	1.778
31-33	53	1.522	2.105	1.289	1.678	1.315	1.647
34-36	48	1.229	1.783	1.276	1.559	1.285	1.539
37-39	132	1.178	1.627	1.159	1.462	1.125	1.450
40-42	151	1.136	1.507	1.129	1.381	1.118	1.375
43-45	58	1.239	1.411	1.269	1.313	1.318	1.312
46-48	66	1.072	1.331	1.112	1.256	1.094	1.259
49-51	96	1.065	1.266	1.085	1.207	1.065	1.213
52-54	117	1.075	1.207	1.078	1.172	1.067	1.174
55-57	64	1.083	1.168	1.074	1.131	1.084	1.141
58-60	48	0.984	1.131	1.007	1.166	0.986	1.113
61-63	76	1.077	1.101	1.050	1.076	1.059	1.089
64-66	64	1.057	1.077	1.026	1.055	0.992	1.069
67-69	35	1.092	1.057	1.140	1.038	1.152	1.053
70-72	37	1.032	1.043	1.005	1.024	1.033	1.039
73-75	38	1.025	1.032	1.094	1.013	1.057	1.029
76-78	39	1.005	1.025	1.000	1.005	0.986	1.022
79-81	24	0.978	1.023	1.012	1.000	0.995	1.016
82-84	27	1.050	1.023	1.073	0.998	1.098	1.015
85-87	26	1.034	1.028	1.103	0.998	1.096	1.015
≥88	77	0.996	1.037	1.094	1.001	1.081	1.018

desirable for economic production in Egypt. In practice, commercial breeders will inseminate their low performance cows as early as possible and consequently an open period of 80 days is recommended. Bar - Anan and Soller (1979) indicated that Friesian cows should be mated as early as possible for maximum production, 70 - 100 days open for heifers and 30 - 50 days open for cows in subsequent lactations.

Results of polynomial regression analysis of 305DY and TY on days open (Model 3) presented in Table 2. As expected, milk yield increased linearly (P < 0.001) with the increase of DO. It was observed that the curves for 305DY were similar to the curve of TY. Significant linear relationship between milk yields and Do for Holstein or Friesian cattle were reported by some investigators (*e.g.* Schaeffer *et al.,* 1973; Khattab and Ashmawy, 1988). In Egypt, delaying of DO may be caused by several factors, *e.g.* the breeder's decision and selection policy. Accordingly, the breeders were likely to inseminate high-yielding cows later than moderate or low-producing ones. This could automatically produce an antagonistic relation between milk traits and DO. It is also possible that high-producing cows will be afforded more chances of conceiving than low-producing ones.

Adjustment factors for DO across all lactations are shown in Table 4. These factors indicate that DO correction factors based on modal class or maximal production for all traits studied decreased with the increase of DO. This trend was reported previously by other investigators for Friesian or Holstein cattle (*e.g.* Schaeffer and Henderson, 1972; Schaeffer *et al.,*1973; Khattab and Ashmawy, 1988).

(iii) Lactation length correction factors. Form Model 4, the partial linear and quadratic regressions (Table 2) of 305DY and TY on lactation length were significant (P< 0.001). A significant linear relationships between milk yield with lactation length were reported by Lobo *et al* (1984).

The modal class of 320 - 349 days in lactation is observed in the present study. LP correction factors based on modal class or maximal production for 305DY and TY are presented in Table 4. The factors show a general trend indicating that these factors decreased with the increase of days in lactation. The trend reported by Lobo *et al* (1984) is also evidenced this trend. However, the small variation in magnitude of estimates obtained here and those reported in the literature may be due to differences in methods and models of analysis used.

TABLE 4 . Days - open and days of lactation correction factors (CF) for lactation traits using the method of polynomial regression analysis based on modal class or maximal production in their calculatios .

CF	N	305DY		TY	
		Modal class	Maximal production	Modal class	Maximal production
Days open (Model 3)					
40- 59	81	1.154	1.297	1.103	1.436
60- 79	243	1.089	1.223	1.058	1.376
80- 99	244	1.040	1.168	1.013	1.319
100-119	207	1.003	1.126	0.969	1.261
120-139	110	0.977	1.097	0.926	1.206
140-159	83	0.960	1.078	0.884	1.152
160-179	53	0.950	1.066	0.849	1.105
180-199	45	0.949	1.065	0.816	1.062
≥200	118	0.955	1.072	0.784	1.021
Days of lactation (Model 4)					
200-229	69	3.372	3.860	2.577	4.271
230-259	62	2.093	2.397	1.840	3.050
260-289	254	1.578	1.807	1.451	2.405
290-319	344	1.309	1.499	1.212	2.008
320-349	381	1.151	1.318	1.051	1.742
350-379	247	1.055	1.208	0.936	1.551
380-409	111	0.999	1.144	0.851	1.410
410-439	69	0.971	1.112	0.786	1.303
440-469	36	0.968	1.108	0.735	1.218
470-499	19	0.990	1.133	0.696	1.153
≥500	54	1.040	1.191	0.665	1.102

Evaluation of methods of estimating the correction factors

To decide which the two sets of age correction factors could best remove the effect of age on milk yield, the two sets were applied on the actual lactation records. Then, two correlations were estimated to compare the efficiency of correction factors derived by the two methods as: (1) intra-cow phenotypic correlation (ICC) between age of cow and age-corrected yield, both variables adjusted for effects included in the model, and (2) residual correlation (RC) between the residual of the model of age and that of the model of age-corrected yield. These correlations between age-corrected yield and age were computed for each of the two methods by applying the same model of analysis (Model 1). All estimates of correlations were very low and nonsignificant (Table 5). These low estimates of correlations indicate that the two methods were successful in removing the effect of age on milk production of this particular set of Friesian data. Estimates of R^2 obtained from using GC and PRA procedures (Table 5) showed that $1-R^2$ of PRA are lower than those estimates of R^2 for GC method ($1-R^2$ of 90DY, 305DY and TY were 0.29, 0.33 and 0.35 for

TABLE 5. Estimates of intra-cow phenotypic (ICC) and residual (RC) correlations between age at calving and age-corrected milk yield and coefficients of determination (R^2) obtained from using GC and PRA methods .

Data corrected for age	ICC		RC		R^2 of Model⁺	
	GC	PRA	GC	PRA	GC	PRA
90DY	-0.051	-0.023	-0.175	-0.113	0.59	0.71
305DY	-0.001	-0.016	-0.095	-0.090	0.56	0.67
TY	0.029	-0.076	-0.060	-0.151	0.57	0.65

⁺ **Remainder df for the model of analysis was 1104 .**

PRA vs 0.41, 0.44 and 0.43 for GC). These findings gave an evidence to that PRA seemed to be relatively the most successful in that respect, *i.e.* PRA is more efficient in correcting lactation records for age than GC method.

To compare the two sets of DO or LP which were based on modal class or maximal production in their calculations, the two sets were applied on the actual 305DY and TY, *i.e.* to detect which of the two sets could remove the effect of DO or LP on milk yield. Estimates of correlations (Table 6) between DO or LP and corrected milk

TABLE 6 . Estimates of intracow phenotypic (ICC) and residual (RC) among DO or LP corrected milk yield and co- correlations efficients of determination (R^2) obtained from using PRA based on modal class and maximal-production class.

Item	ICC	RC	R^2 of Model	Remainder mean squares⁺ Modal class	Maximal production
Data corrected for DO:					
305DY	0.032	-0.026	0.56	692500	873317
TY	0.069	-0.016	0.55	760973	1289417
Data corrected for LP :					
305DY	-0.191	-0.314	0.59	1986965	2604538
TY	-0.131	-0.284	0.61	950906	2612274

⁺ Remainder df for the model of analysis were 706 and 1150 for data corrected for DO and LP , respectively .

production were closely similar and low, indicating that the two procedures were similarly successful in removing the effect of DO or LP on milk production. These results confirmed the fact reported by Schaeffer and Henderson (1972) and Lobo *et al* (1984) who concluded that correction factors for DO or LP could be computed at any desirable base.

Genetic Aspects

*Cow effect.*Effects of cow within herd on productive and reproductive traits are given in Table 7 (Model 1). The cows within herd significantly ($P < 0.001$) affected all traits studied. Lobo *et al* (1984) and Soliman and Khalil (1989) reported that cow effects on milk yield and / or LP were significant ($P < 0.01$ or $P < 0.001$). Variances among cows in productive and reproductive performance may be due to sizable differences in genetic potentiality of cows along with some changes in the herd management (Camoens *et al.*, 1976).

Repeatability estimates. Repeatability (t) estimated for productive and reproductive traits are shown in Table 6. Repeatability estimated from Model 1 for different lactation traits of 90DY, 305DY, TY and LP were moderate in magnitude while the estimate of DP was low; all estimates had standard errors of values around 0.03. These estimates fall within the range of those obtained by many investigators (Everett *et al.*, 1966; Ruvuna *et al.*, 1984; Abubakar *et al.*, 1986; Milagres *et al.*, 1988a). On the other hand, some reviewed estimates were higher than those estimates reported here (Gacula *et al.*, 1968; Mather *et al.*, 1969; Camoens *et al.*, 1976; Hansen *et al.*, 1983; Soliman and Khalil, 1989).

Repeatability estimates for the two reproductive traits studied (*i.e.* CI and DO) were moderate (Table 7). This is important for the commercial breeders of dairy cattle in predicting the reproductive performance of cows at an earlier age. This gives an indication for culling of cows based on their reproductive performance. Estimates of the present study are similar to those obtained by some investigators (Everett *et al.*, 1966; El-Amin *et al.*, 1986; Milagres *et al.*, 1988b). On the contrary, higher estimate of 0.47 for DO was reported by Camoens *et al* (1976).

TABLE 7 . Estimates of variance component (δ^2) and repeatability estimates for pro-ductive and reproductive traits (model 2) .

Trait	Cow within herd⁺ (C:H)		Remainder (e)		Repeatability
	df	δ^2 C : H	df	δ^2e	
90DY	429	40751***	1138	108745	0.27±0.028
305DY	429	456155***	1138	790233	0.37±0.028
TY	429	622588***	1138	1065656	0.37±0.028
LP	429	1038***	1138	3379	0.23±0.027
DP	424	129***	783	1091	0.11±0.032
CI	424	1253***	783	2890	0.30±0.033
DO	421	1095***	694	2673	0.29±0.035

*** = (P<0.001) .

+K value was 3.64 for 90DY, 305DY, TY and LP ; 2.83 for DP and CI ; 2.6 for DO .

Conclusion

(1) Factors of PRA were more effective in correcting lactation records (or Friesian cattle raised in Egypt) for age compared to GC method. Also, PRA correction factors of DO and LP based on modal class or maximal production were closely similar in their efficiency to correct milk yield for DO or LP. Consequently, PRA correction factors could be computed with the same accuracy on the bases of modal class (the most frequent class) or maximal-production class. Accordingly, further studies are needed to give more light on evaluation of methods of estimating the correction factors in dairy cattle.

(2) Owing to moderate repeatabilities for lactation and reproductive traits (estimates ranged from 0.23 to 0.37), culling of cows based on a single record, as commonly practiced by commercial breeders of dairy cattle, would be recommended from a genetic standpoint. Therefore, assessment of several records are not required before selecting cows for lactation and reproductive traits.

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تقييم الابقار الفريزيان المستوردة والمولودة محليا تحت ظروف المزارع التجارية فى مصر

٢ ـ تقدير معاملات التعديل بسجلات اللبن وبعض التأثيرات الوراثية

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استخدمت فى هذه الدراسة سجلات ١٦٤٦ موسم حليب لماشية الفريزيان فى قطيعين من القطعان التجارية المصرية والتى تم جمعها خلال المدة من ١٩٨١ وحتى ١٩٨٨ وقد شملت هذه السجلات بيانات محصول اللبن خلال ٩٠ يوما من الإدرار ـ خلال ٣٠٥ يوما ـ وخلال موسم الإدرار الكلى ـ طول فترة الإدرار ـ فترة الجفاف ـ العمر عند أول ولادة ـ فترة الايام المفتوحة ـ والفترة بين ولادتين .

استخدمت كل من طريقة المقارنة الكلية وطريقة تحليل الانحدار متعدد الحدود لحساب عدة مجموعات لمعاملات التصحيح لعمر البقرة . كما تم حساب معاملات التصحيح لفترة الايام المفتوحة ولطول فترة الإدرار باستخدام تحليل معامل الإنحدار متعدد الحدود على أساس الفئة الاكثر تكرارا أو الفئة الأعلى إنتاجا .

أوضحت قيم معاملات التصحيح لعمر البقرة بأن الاختلافات بين معاملات تصحيح إنتاج اللبن خلال ٩٠ يوما وخلال ٣٠٥ يوما وخلال موسم الإدرار كله كانت ثابتة ، كما كانت الاختلافات بين معاملات التصحيح لإنتاج اللبن لكل من فترة الايام المفتوحة وفترة الإدرار ثابتة حيث كانت هذه المعاملات تتناقص مع زيادة طول أى من الفترتين . وجد أن معاملات التصحيح لعمر البقرة المحسوبة بطريقة تحليل معامل الانحدار متعدد الحدود كانت فى أغلب الاحوال اعلى من تلك المحسوبة بطريقة المقارنة الكلية فى الاعمار الصغيرة للبقرة وكان العكس تماما فى الاعمار الكبيرة .

اتضح أن معاملات التصحيح لتأثير العمر والمحسوبة بطريقة الانحدار المتعدد الحدود هى أنجح الطرق فى إزالة تأثير عمر البقرة على إنتاج اللبن . معاملات تصحيح تأثير فترة الايام المفتوحة أو فترة الإدرار المحسوبة على أساس الفئة الاكثر تكرارا أو الفئة الاكثر إنتاجا كانت متماثلة جدا فى إزالة أثر طول هاتين الفترتين على إنتاج اللبن . هذا وقد وجد أن جميع الطرق التى استخدمت فى هذه الدراسة لحساب معاملات التصحيح كانت ناجحة فى إزالة تأثير العمر وفترة الايام المفتوحة وفترة الإدرار على إنتاج اللبن .

تأثرت كل الصفات المدروسة معنويا بأثر البقرة داخل القطيع . كانت قيم المعامل التكرارى لانتاج اللبن خلال ٩٠ يوما ــ خلال ٣٠٥ يوما ــ خلال موسم الإدرار كله وفترة الإدرار متوسطة حيث تراوحت القيم بين ٢٣. ٠ إلى ٣٧. ٠ كذلك وجد أن القيم للفترة بين ولادتين وفترة الايام المفتوحة متوسطة القيمة حيث كانت ٣٠. ٠ و ٢٩. ٠ على التوالى . بينما كانت القيم منخفضة لفترة الجفاف (١١. ٠) .