Region by Season Age Correction Factors for Adjusting Milk Records to Mature Basis in Buffaloes

A.S. Abdel-Aziz and M.K. Hamed

Department of Animal Production, Faculty of Agriculture, Cairo University, Giza, Egypt.

A total number of 4903 milk records of 1755 buffaloes calving during the period from 1931 to 1972 at six farms were used in this study. Buffaloes were usually milked twice a day. The records were adjusted to 365—day basis after absorbing year effects .

The corrected records were classified into eight region X season subclasses (two region x four seasons of calving). Polynomials of the record degree were fitted to the data to determine the yield-age relationship within each subclass. Eight sets of gross multiplicative factors were then developed for adjusting complete lactation yield to a mature basis. The accuracy of the regression equations used in the estimation of the mature equivalent records ranged from 83 % to 90 % .

The purpose of age adjustment to a mature equivalent basis is to correct milk records for age only, that is to estimate the production of cows under essentially the same environmental conditions at maturity. The magnitude of the age effects varies with breed, geographical region, season of calving and probably with other intangible variables. Most of the recent studies were concerned with the quantitative evaluation of the sources of variability affecting the ageyield relation, choice of the appropriate models, and the estimation of more accurate mature-equivalent records. Milk records of buffaloes received little effort in this context.

Genetic evaluations of cows and sires are applied within contemporary groups. Gross age correction factors were found by Miller *et al.* (1966) to be more accurate than those from paired comparisons. Multiplicative factors usually have been been preferred over additive adjustments because variance of milk records is closely related to herd average. Additive adjustment factors may vary with production of the herd, but multiplicative factors do not (Miller, 1973). Reasons for choosing the age at maturity as the base for age correction was probably because it would make milk yield the highest, and an animal's highest record was often the measure of its breeding value.

In this paper, eight sets of gross multiplicative factors were developed for adjusting complete lactation milk records of buffaloes to mature equivalent basis.

Material and Methods

The data used in this study comprised a total number of 4903 milk records made by 1755 buffaloes over a period of 42 years (1931-1972), and representing all available record in six forms, three of which were located north to Cairo (region 1), and the other three were south to Cairo (region 2). Four seasons of calving were defined: autumn (September,1 to November 30), winter (December 1 to February 28), spring (March 1 to May 31), and summer (June 1 to August 31). It was a common practice in all farms to milk buffaloes twice a day.

Least squares analysis of variance (Harvey, 1960) was performed on the data after extending part lactation records to 365-day basis (Abdel-Aziz *et al.*, 1973).

The analysis revealed significant effects (P<0.05) of region, year and season of calving, and the interaction between region and season on total milk yield (Abdel-Aziz and Hamed, 1978).

The year effects were absorbed from the model by correcting all records for year-to -year differences using least squares constants of the year classes. Gross interaction between region and seacon of calving was accounted for by estimating milk yield means for age at calving in months within each region X season subclass. The constants arrived at would allow for the age at maximum production to be more precisely located for each subclass.

Region X season subclass constants were fitted to a second degree polynomial to compute eight sets of multiplicative age correection factors to adjust milk records to a mature equivalent basis using the gross comparison method (Arave *et al.*, 1964). The computation procedure could be outlined as follows :

1. The average of all records started at a certain age was calculated at monthly intervals.

2. A second degree polynomial was fitted to the monthly average milk yield according to the following model :

$$Yi = \bar{Y} + b_1 X + b_2 X + ei \ldots (1)$$

Where :

Yi = the milk yield in kilograms at the ith age of calving in months,

$\bar{Y}$ = a constant for all Y_i 's.

b_1 and b_2 = are the linear and quadratic components of the relationship between milk yield and age,

X = age of cow at calving in months,

e_i = a random error associated with the yield started at the ith age in months.

3. From such model b_1 and b_2 were estimated for the pooled data and for each region X season of calving set records.

4. The age at maximum production was located by settling the first derivative of $\hat{Y} = \hat{b}_1 X + \hat{b}_2 X$ with respect to X equals to zero and solving for X.

5. Maximum production ($\hat{Y}m$) was obtained by substituting the value of X back in to equation 1.

6. Age-correction factors to mature equivalen basis were then calculated as follows :

$$Fi = \frac{\hat{Y}m}{\hat{Y}i} \qquad (2)$$

Where :

Fi = the multiplicative age -correction factor for milk records begun at the $i\,th$ age in months,

$\hat{Y}m$ = the maximum milk yield, and

$\hat{Y}i$ = the yield at the ith age in months.

Results and Discussion

In dairy animals, milk yield increases with age till maturity is reached, and then declines. Adjusting milk records for age differences in necessary to compare genetic merits of animals of different ages. Genetic evaluations are usually done within contemporary groups. Seasonal and regional differences were found to be associated with variation in milk yield and, therefore, would, affect the relation between age and milk production (Miller *et al.*, 1970, and Miller, 1973). The magnitude of the appropriate adjustment for age would vary from season of calving to another and from region to region. A separate set of factors for each reaion X season combination was suggested by MC Daniel (1973). Calculation of age correction factors within each region X season subclass would simultaneously adjust for age, season and region differences to minimize errors caused by the interactions of age x season and age X region.

The results would be age corrected records that are more accurately comparable.

Age correction factors are usually calculated so as to convert production at a certain age of calving to its mature equivalent. Gross factors of age adjustment were found by (Miller *et al.*, 1966) to be more accurate than those obtained from paired comparisons. Miller (1973), stated that multiplicative adjustment factors were less variable than additive factors.

The construction of age adjustment factors is straight forward if the average production of buffaloes of each age is known and if the yield-age relations remains essentially constant for the situation in which factors will be applied.

Age is expected to produce consistent and repeatable effects from year to year when records of animals from the same breed, region and season of calving are considered (Miller, 1973).

Region, season and region X season interaction effects on milk yield showed evidence of statistical significance when the same data used in this study were analysed (Abdel-Aziz and Hamed, 1978). Age correction factors calculated and used within region X season subclasses are expected to eliminate these effects.

In this paper, eight sets of gross multiplicative factors for adjusting milk records to mature basis were derived using 365-day milk records corrected for year effects and produced by buffaloes milked twice a day. On overall set of factors was also calculated from the pooled data for purposes of comparisons. Multiple regression equations of the form presented in equation 1 were used to calculate the constants used in the estimation of mature equivalent records. The constants are given in Table 1. The mean total milk yield $(\overline{Y})$ overall regions and seasons was 1969.87 kg, with all seasons of region 2 having higher means than in region 1. The amount of variability accounted for by the regression equations are judged by the R^2 values which ranged from 83% to 90%.

TABLE 1.—Constants of the regression equation $(\overline{Y} = \overline{Y} + \hat{b}_1 x + \hat{b}_2 x^2)$ used in the estimation of mature equivalent records.

Classification	$\overline{Y}$ (kg)	$\hat{b}_1$ (kg)	$\hat{b}_2$ (kg)	$R^2(\%)$
Overall	1969.87	19.658	—0.077	86
Region 1				
Autumn	1837.22	13.472	—0.043	84
Winter	1979.96	16.342	—0.059	83
Spring	1828.05	18.663	—0.064	86
Summer	1006.85	17.687	—0.064	86
Region 2				
Autumn	2016.55	15.014	—0.059	85
Winter	2056.87	20.536	—0.086	89
Spring	2097.47	29.648	—0.125	90
Summer	2073.65	21.125	—0.078	88

Age at maximum production (Xm) was defined by selving the first derivatives of the regression equations equal to zero, and solving for X. Values of Xm are given in Table 2.

TABLE 2. Age at maximum production months in (Xm) for region Months X season subclasses.

Classification	N	Xm
Overall	4903	127 64
Region 1		
Autumn	938	156.65
Winter	847	140.19
Spring	632	145.80
Summer	570	138 18
Region 2		
Autumn	688	127.24
Winter	565	119.40
Spring	313	118.59
Summer	350	135 42

Buffaloes in region 2 would reach maximum production at an earlier age than in region 1, but the differences seemed to be not independent from season of calving.

Maximum milk yield was calculated for each region x season subclass by subs- tituting values of Xm back into the respective regression equations.

Multiplicative factors for adjusting milk records to mature equivalent basis were computed by dividing maximum milk yield into the yield at a given age.

The overall set of age correction factors is presented in Table 3. Region X season sets are given in Tables 4- 11. The array of ages for which correction factors were derived ranges from 20 months to 204 months which may seem a rather wide range. El-Itriby (1974) in his review of the buffaloes of Egypt stated that age at first calving at the Ministry of Agriculture experimental farms, the data of which was involved in this study, showed that 30% of the buffaloes population calved for the first time between 24 and 35 months, 50% between 36 and 43 months, and 20% between 44 and 56 months. It is rare for a buffalo to calve for the first time as early as 22 months or later than 56 months of age. The age of 38 months was accepted as a reasonable aver-

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age for age at first calving. In the same review, calving interval was reported to range from 15.4 to 19.2 months. Six to eight lactations were safely assumed as the range of longivity for buffaloes under Egyptian village conditions. However, buffaloes producing up to 10 records were not rare in the recent data.

TABLE 3. Age correction factors (F) for 365-day milk production records overall regions and seasons of calving.

Age (mo)	F°	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F
20	1.381	40	1.225	60	1.123	80	1.057	100	1.019
21	1.373	41	1.218	61	1.119	81	1.051	101	1.017
22	1.363	42	1.212	62	1.115	82	1.052	102	1.016
23	1.354	43	1.206	63	1.111	83	1.050	103	1.015
24	1.345	44	1.201	64	1.107	84	1.048	104	1.014
25	1.336	45	1.195	65	1.103	85	1.045	105	1.012
26	1.327	46	1.189	66	1.099	86	1.043	106	1.011
27	1.319	47	1.184	67	1.096	87	1.041	107	1.010
28	1.310	48	1.179	68	1.093	88	1.039	108	1.009
29	1.303	49	1.173	69	1.089	89	1.037	109	1.008
30	1.295	50	1.169	70	1.086	90	1.035	110	1.007
31	1.287	51	1.161	71	1.083	91	1.033	111	1.006
32	1.280	52	1.158	72	1.080	92	1.031	112	1.005
33	1.272	53	1.153	73	1.077	93	1.027	113	1.005
34	1.265	54	1.149	74	1.074	94	1.027	114	1.004
35	1.258	55	1.144	75	1.071	95	1.026	115	1.003
36	1.251	56	1.140	76	1.068	96	1.025	116	1.003
37	1.244	57	1.130	77	1.065	97	1.023	117	1.002
38	1.237	58	1.133	78	1.063	98	1.022	118	1.002
39	1.231	59	1.127	79	1.060	99	1.019	119	1.001
120	1.001	140	1.003	160	1.026	180	1.070	200	1.143
121	1.001	141	1.004	161	1.027	181	1.073	201	1.147
122	1.000	142	1.005	162	1.028	182	1.076	202	1.152
123	1.000	143	1.005	163	1.030	183	1.079	203	1.157
124	1.000	144	1.006	164	1.033	184	1.082	204	1.163
125	1.000	145	1.007	165	1.034	185	1.085		
126	1.000	146	1.008	166	1.036	186	1.088		
127	1.000	147	1.009	167	1.038	187	1.092		
128	1.000	148	1.009	168	1.040	188	1.095		
129	1.000	149	1.011	169	1.043	189	1.099		
130	1.000	150	1.012	170	1.045	190	1.102		
131	1.000	151	1.013	171	1.047	191	1.106		
132	1.000	152	1.014	172	1.049	192	1.110		
133	1.000	153	1.015	173	1.052	193	1.114		
134	1.001	154	1.016	174	1.054	194	1.117		
135	1.001	155	1.018	175	1.057	195	1.121		
136	1.001	156	1.019	176	1.059	196	1.126		
137	1.001	157	1.020	177	1.062	197	1.130		
138	1.002	158	1.022	178	1.064	198	1.134		
139	1.003	159	1.024	179	1.067	199	1.138		

TABLE 4. Age- correction factors (F) for 365-day milk production records for autumn calving buffaloes in region 1.

Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F
20	1.384	40	1.254	60	1.161	80	1.096	100	1.050
21	1.377	41	1.248	61	1.157	81	1.093	101	1 048
22	1.369	42	1.243	62	1.154	82	1.090	102	1.046
23	1.362	43	1.238	63	1.150	83	1.088	102	1.045
24	1.354	44	1.233	64	1.146	84	1.085	104	1.043
25	1.347	45	1.227	65	1.142	85	1 083	105	1.041
26	1.340	46	1.223	66	1.139	86	1.080	106	1.040
27	1.333	47	1.218	67	1.136	87	1.078	107	1.038
28	1.326	48	1.213	68	1.132	88	1.075	108	1.036
29	1.320	49	1.208	69	1.129	89	1.073	109	1.035
30	1.313	50	1.204	70	1.126	90	1.071	110	1.033
31	1.307	51	1.199	71	1.122	91	1.068	111	1.032
32	1.300	52	1.194	72	1.199	92	1.066	112	1.031
33	1.294	53	1.190	73	1.116	93	1.604	113	1.029
43	1.288	54	1.186	74	1.113	94	1.062	114	1.028
35	1.282	55	1.181	75	1.110	95	1.060	115	10.26
36	1.276	56	1.177	76	1.107	96	1.058	116	1.025
37	1.270	57	1.173	77	1.104	97	1.056	117	1.024
38	1.265	58	1.169	78	1.101	98	1.054	118	1 023
39	1.259	59	1.165	79	1.098	99	1.052	119	1.022
120	1.020	140	1.004	160	1.000	180	1.008	200	1.029
121	1.019	141	1.004	161	1.000	181	1.009	201	1.030
122	1.018	142	1.003	162	1.000	182	1.010	202	1.032
123	1.017	143	1.003	163	1.000	183	1.010	203	1.033
124	1.016	144	1.002	164	1001	184	1.011	204	1.034
125	1.015	145	1.002	165	1.001	185	1.012		
126	1.014	146	1.002	166	1.001	186	1.013		
127	1.013	147	1.001	167	1.002	187	1.014		
128	1.012	148	1.001	168	1.002	188	1.015		
129	1.011	149	1.001	169	1.002	189	1.016		
130	1.011	150	1.001	170	1.003	190	1.017		
131	1.010	151	1.000	170	1.003	191	1.018		
132	1.009	152	1.000	172	1.004	192	1.019		
133	1.008	153	1.000	173	1.004	193	1.020		
134	1.008	154	1.000	174	1.005	194	1.021		
135	1.007	155	1.000	175	1.005	195	1.022		
136	1.006	156	1.000	176	1.006	196	1.024		
137	1.006	157	1.000	177	1.006	197	1.025		
138	1.005	158	1.000	178	1.007	198	1.026		
139	1.005	159	1.000	179	1.007	199	1.027		

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TABLE 5. Age correction factors (F) for 365—day milk production records for autumn calving buffaloes in region 2.

Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F
20	1.296	40	1.178	60	1.099	80	1.046	100	1.015
21	1.289	41	1.173	61	1.095	81	1.044	101	1.014
22	1.282	42	1.169	62	1.092	82	1.042	102	1.013
23	1.275	43	1.164	63	1.089	83	1.040	103	1.012
24	1.268	44	1.159	64	1.086	84	1.038	104	1.011
25	1.262	45	1.155	65	1.083	85	1.037	105	1.010
26	1.255	46	1.151	66	1.080	86	1.035	106	1.009
27	1.249	47	1.147	67	1.078	87	1.033	107	1.008
28	1.243	48	1.142	68	1.075	88	1.032	108	1.007
29	1.237	49	1.138	69	1.072	89	1.030	109	1.007
30	1.231	50	1.134	70	1.070	90	1.028	110	1.006
31	1.225	51	1.130	71	1.067	91	1.027	111	1.005
32	1.220	52	1.127	72	1.064	92	1.025	112	1.005
33	1.214	53	1.123	73	1.062	93	1.024	113	1.004
34	1.209	54	1.119	74	1.060	94	1.022	114	1.003
35	1.203	55	1.116	75	1.057	95	1.021	115	1.003
36	1.198	56	1.112	76	1.055	96	1.020	116	1.003
37	1.193	57	1.109	77	1.053	97	1.018	117	1.002
38	1.188	58	1.105	78	1.051	98	1.017	118	1.002
39	1.183	59	1.102	79	1.048	99	1.016	119	1.001
120	1.001	140	1.003	160	1.022	180	1.059	200	1.117
121	1.001	141	1.004	161	1.023	181	1.061	201	1.121
122	1.001	142	1.004	162	1.025	182	1.063	202	1.125
123	1.000	143	1.005	163	1.026	183	1.066	203	1.129
124	1.000	144	1.006	164	1.028	184	1.068	204	1.132
125	1.000	145	1.006	165	1.027	185	1.071		
126	1.000	146	1.007	166	1.031	186	1.071		
127	1.000	147	1.008	167	1.032	187	1.076		
128	1.000	148	1.009	168	1.034	188	1.079		
129	1.000	149	1.009	169	1.036	189	1.082		
130	1.000	150	1.010	170	1.038	190	1.085		
131	1.000	151	1.011	171	1.040	191	1.088		
132	1.000	152	1.012	172	1.041	192	1.091		
133	1.000	153	1.013	173	1.043	193	1.094		
134	1.000	154	1.014	174	1.045	194	1.097		
135	1.001	155	1.016	175	1.047	195	1.100		
136	1.002	156	1.017	176	1.050	196	1.104		
137	1.002	157	1.018	177	1.052	197	1.107		
138	1.002	158	1.019	178	1.054	198	1.110		
139	1.003	159	1.020	179	1.056	199	1.114		

TABLE 6. Age correction factors (F) 356-day milk production records for winter-calving buffaloes in region 1.

Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F
20	1.373	40	1.232	60	1.137	80	1.073	100	1.031
21	1.364	41	1.227	61	1.134	81	1.070	101	1.030
22	1.356	42	1.221	62	1.130	82	1.069	102	1.028
23	1.348	43	1.216	63	1.126	83	1.065	103	1.027
24	1.340	44	1.210	64	1.122	84	1.063	104	1.025
25	1.332	45	1.205	65	1.119	85	1.061	106	1.024
26	1.325	46	1.200	66	1.115	86	1.058	106	1.022
27	1.317	47	1.195	67	1.112	87	1.056	107	1.021
28	1.310	48	1.190	68	1.109	88	1.054	108	1.0220
29	1.303	49	1.185	69	1.105	89	1.052	109	1.019
30	1.296	50	1.180	70	1.102	90	1.050	110	1.017
31	1.289	51	1.176	71	1.099	91	1.048	111	1.016
32	1.282	52	1.171	72	1.096	92	1.046	112	1.015
33	1.275	53	1.167	73	1.093	93	1.044	113	1.014
34	1.269	54	1.162	74	1.090	94	1.042	114	1.013
35	1.263	55	1.158	75	1.087	95	1.040	115	1.012
36	1.256	56	1.154	76	1.084	96	1.038	116	1.011
37	1.250	57	1.149	77	1.081	97	1.036	117	1.010
38	1.244	58	1.145	78	1.078	98	.0355	118	1.090
39	1.238	59	1.142	79	1.076	99	1.033	119	1.008
120	1.008	140	1.000	160	1.007	180	1.031	200	1.072
121	1.007	141	1.000	161	1.008	181	1.032	201	1.075
122	1.006	142	1.000	162	1.009	182	1.034	202	1.077
122	1.006	143	1.000	163	1.010	183	1.036	203	1.080
124	1.005	144	1.000	164	1.011	184	1.037	204	1.083
125	1.004	145	1.000	165	1.012	185	1.039		
126	1.004	146	1.001	166	1.013	186	1.041		
127	1.003	147	1.001	167	1.014	187	1.043		
128	1.003	148	1.001	168	1.015	188	1.045		
129	1.002	149	1.001	169	1.016	189	1.047		
130	1.002	150	1.002	170	1.0	190	1.049		
131	1.002	151	1.002	171	1.018	191	1.051		
132	1.001	152	1.003	172	1.019	192	1.053		
133	1.001	153	1.003	173	1.021	193	1.055		
134	1.001	154	1.004	174	1.022	194	1.058		
135	1.001	155	1.004	175	1.023	195	1.060		
136	1.000	156	1.005	176	1.025	196	1.062		
137	1.000	157	1.005	177	1.026	197	1.065		
138	1.000	148	1.006	178	1.028	198	1.067		
139	1.000	159	1.007	179	1.029	199	1.070		

TABLE 7. Age correction factors (F) for 365-day milk production records for winter-calving buffaloes in region 2.

Age (mo.)	F	Age (mo.)	F	Age (mo.)	F F	Age (mo,)	F	Age (mo.)	F
20	1.349	40	1.198	60	1.102	80	1.042	100	1.010
21	1.340	41	1.192	61	1.098	81	1.040	101	1.009
2z	1.331	42	1.186	62	1.094	82	1.038	102	1.008
23	1.322	43	1.180	63	1.091	83	1.036	103	1.007
24	1.313	44	1.175	64	1.087	84	1.034	104	1.006
25	1.305	45	1.170	65	1.084	85	1.032	105	1.005
26	1.296	46	1.164	66	1.081	86	1.030	106	1.005
27	1.288	47	1.159	67	1.077	87	1.028	107	1.004
28	1.280	38	1.154	68	1.074	88	1.027	108	1.003
29	1.272	49	1.149	69	1.071	89	1.025	109	1.003
30	1.265	50	1.144	70	1.068	90	1.023	110	1.002
31	1.257	51	1.140	71	1.065	91	1.022	111	1.002
32	1.250	52	1.135	72	1.063	92	1.020	112	1.001
33	1.243	53	1.131	73	1.060	93	1.019	113	1.001
34	1.236	54	1.126	74	1.057	94	1.017	114	1.001
35	1.229	55	1.122	75	1.054	95	1.016	115	1.001
36	1.229	56	1.118	76	1 052	96	1.015	116	1.000
37	1.216	57	1.114	77	1.049	97	1.013	117	1.000
38	1.210	58	1.110	78	1.047	98	1.012	118	1.000
39	1.204	59	1.106	79	1.045	99	1.011	119	1.000
120	1.000	140	1.011	160	1.045	180	1.106	200	1.205
121	1.000	141	1.012	161	1.047	181	1.110	201	1.211
122	1.000	142	1.014	162	1.050	182	1.114	202	1.218
123	1.000	143	1.015	163	1.052	183	1.119	203	1.224
124	1.001	144	1.016	164	1.055	184	1.123	204	1.231
125	1.001	145	1.017	165	1.058	185	1.127		
126	1.001	146	1.019	166	1.060	186	1.131		
127	1.002	147	1.020	167	1.063	187	1.136		
128	1.002	148	1.022	168	1.066	188	1.141		
129	1.002	149	1.023	169	1.069	189	1.145		
130	1.003	150	1.025	170	1.072	190	1.150		
131	1.004	151	1.027	171	1.075	191	1.155		
132	1.004	152	1.029	172	1.078	192	1.160		
133	1 000	153	1.030	173	1.081	193	1.165		
134	1.000	154	1.032	174	1.085	194	1.171		
135	1.006	155	1.034	175	1.088	195	1.176		
136	1.007	156	1.036	176	1.092	196	1.182		
137	1.008	157	1.038	177	1.095	197	1.187		
138	1 009	158	1.041	178	1.099	198	1.193		
139	1.010	159	1.043	179	1.103	199	1.199		

TABLE 8. Age correction factors (F) for 365-day milk production records for spring calving buffaloes in region 1.

Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F
20	1.453	40	1.283	60	1.170	80	1.093	100	1.043		
21	1.443	41	1.276	61	1.165	81	1.090	101	1.041		
22	1.433	42	1.269	62	1.161	82	1.087	102	1.039		
23	1.423	43	1.263	63	1.156	83	1.084	103	1.037		
24	1.413	44	1.257	64	1.152	84	1.081	104	1.036		
25	1.404	45	1.250	65	1.148	85	1.078	105	1.034		
26	1.394	46	1.244	66	1.143	86	1.076	106	1.032		
27	1.385	47	1.238	67	1.139	87	1.073	107	1.031		
28	1.376	48	1.232	68	1.135	88	1.070	108	1.029		
29	1.368	49	1.226	69	1.131	89	1.068	109	1.027		
30	1.359	50	1.221	70	1.128	90	1.065	110	1.026		
31	1.351	51	1.215	71	1.124	91	1.063	111	1.024		
32	1.343	52	1.210	72	1.120	92	1.060	112	1.023		
33	1.335	53	1.204	73	1.117	93	1.058	113	1.022		
34	1.327	54	1.199	74	1.113	94	1.056	114	1.020		
35	1.319	55	1.194	75	1.110	95	1.054	115	1.019		
36	1.312	56	1.189	76	1.106	96	1.051	116	1.018		
37	1.304	57	1.184	77	1.103	97	1.049	117	1.017		
38	1.297	58	1.179	78	1.100	98	1.047	118	1.015		
39	1.290	59	1.174	79	1.096	99	1.045	119	1.014		
120	1.013	140	1.001	160	1.004	180	1.024	200	1.061		
121	1.012	141	1.000	161	1.005	181	1.025	201	1.064		
122	1.011	142	1.000	162	1.005	182	1.026	202	1.066		
123	1.010	143	1.000	163	1.006	183	1.028	203	1.069		
124	1.009	144	1.000	164	1.007	184	1.030	204	1.071		
125	1.009	145	1.000	165	1.007	185	1.031				
126	1.008	146	1.000	166	1.008	186	1.033				
127	1.007	147	1.000	167	1.009	187	1.035				
128	1.006	148	1.000	168	1.010	188	1.036				
129	1.006	149	1.000	169	1.011	189	1.038				
130	1.005	150	1.000	170	1.012	190	1.040				
131	1.004	151	1.001	171	1.013	191	1.042				
132	1.004	152	1.001	172	1.014	192	1.044				
133	1.003	153	1.001	173	1.015	193	1.046				
134	1.003	154	1.001	174	1.016	194	1.048				
135	1.002	155	1.002	175	1.017	195	1.050				
136	1.002	156	1.002	176	1.018	196	1.052				
137	1.002	157	1.002	177	1.020	197	1.054				
138	1.001	158	1.003	178	1.021	198	1.056				
139	1.001	159	1.003	179	1.022	199	1.059				

TABLE 9. Age correction factors (F) for 365—day milk prodction records for spring-calving buffaloes in region 2.

Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F
20	1.460	40	1.250	60	1.125	80	1.051	100	1.011
21	1.447	41	1.243	61	1.120	81	1.048	101	1.010
22	1.436	42	1.235	62	1.116	82	1.045	102	1.009
23	1.421	43	1.227	63	1.111	83	1.043	103	1.008
24	1 409	44	1.220	64	1.107	84	1.040	104	1.007
25	1.397	45	1.213	65	1.103	85	1.038	105	1.006
26	1.385	46	1.206	66	1.099	86	1.036	106	1.005
27	1.374	47	1.199	57	1.094	87	1.033	107	1.004
28	1.363	48	1.193	68	1.090	88	1.031	108	1.004
29	1.352	49	1.186	69	1.087	89	1.029	109	1.003
30	1.341	50	1.180	70	1.083	90	1.027	110	1.002
31	1.331	51	1.174	71	1.079	91	1.025	111	1.002
32	1.321	52	1.168	72	1.076	92	1.023	112	1.001
33	1.312	53	1.162	73	1.072	93	1.022	113	1.001
34	1.302	54	1.156	74	1.069	94	1.020	114	1.001
35	1.293	55	1.151	75	1.066	95	1.018	115	1.000
36	1.284	56	1.146	76	1.062	96	1.017	116	1.000
37	1 275	52	1.140	77	1.059	97	1 015	117	1.000
38	1.267	58	1.135	78	1.056	98	1.014	118	1.000
39	1.258	59	1.130	79	1.054	99	1.013	119	1.000
120	1.000	140	1.015	160	1.059	180	1.139	200	1.274
121	1.000	141	1.017	161	1.062	181	1.145	201	1.283
122	1.000	142	1.018	162	1.065	182	1.150	202	1.291
123	1.001	143	1.020	163	1.068	183	1.155	203	1.300
124	1.001	144	1.021	164	1.072	184	1.161	204	1.310
125	1.001	145	1.023	165	1.075	185	1.167		
126	1.002	146	1.025	166	1.079	186	1.173		
127	1.002	147	1.027	167	1.082	187	1.179		
128	1.003	148	1.029	168	1.086	188	1.185		
129	1.004	149	1.031	169	1.090	189	1.192		
130	1.004	150	1.033	170	1.093	190	1.198		
131	1.005	151	1.035	170	1.098	191	1.205		
132	1.006	152	1.038	173	1.102	192	1.212		
133	1.007	153	1.040	173	1.106	193	1.219		
134	1.008	154	1.042	174	1.111	194	1.226		
135	1.009	155	1.045	175	1.115	195	1.233		
136	1.010	156	1.048	176	1.120	196	1.241		
137	1.011	157	1.050	177	1.124	197	1.249		
138	1.012	158	1.053	178	1.129	198	1.257		
139	1.014	159	1.056	179	1.134	199	1 265		

TABLE 10. Age correction factors (F) for 365-day milk production records for summer-calving buffaloes in region 1.

Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F
20	1.419	40	1.256	60	1.148	80	1.077	100	1.032
21	1.409	41	1.249	61	1.144	81	1.074	101	1.030
22	1.399	42	1.243	62	1.140	82	1.071	102	1.028
23	1.390	43	1.237	63	1.136	83	1.069	103	1.027
24	1.380	44	1.231	64	1.132	84	1.066	104	1.025
25	1.371	45	1.225	65	1.128	85	1.064	105	1.024
26	1.362	46	1.219	66	1.124	86	1.061	106	1.022
27	1.354	47	1.213	67	1.120	87	1.059	107	1.021
28	1.345	48	1.207	68	1.116	88	1.056	108	1.020
29	1.337	49	1.202	69	1.113	89	1.054	109	1.018
30	1.329	50	1.197	70	1.109	90	1.052	110	1.017
31	1.320	51	1.191	71	1.105	91	1.049	111	1.016
32	1.313	52	1.186	72	1.102	92	1.047	112	1.015
33	1.305	53	1.181	73	1.099	93	1.045	113	1.014
34	1.298	54	1.176	74	1.095	94	1.043	114	1.013
35	1.290	55	1.171	75	1.092	95	1.041	115	1.012
36	1 283	56	1.166	76	1.089	96	1.039	116	1.011
37	1.276	57	1.162	77	1.086	97	1.037	117	1.010
38	1.269	58	1.157	78	1.083	98	1.035	118	1.009
39	1.262	59	1.153	79	1.080	99	1.034	119	1.008
120	1.007	140	1.000	160	1.010	180	1.038	200	1.088
121	1.006	141	1.000	161	1.011	181	1.040	201	1.091
122	1.006	142	1.000	162	1.012	182	1.042	202	1.094
123	1.006	143	1.000	163	1.013	183	1.044	203	1.097
124	1.004	144	1.000	164	1.014	184	1.046	204	1.101
125	1.004	145	1.001	165	1.015	185	1.049		
126	1.003	146	1.001	166	1.017	186	1.051		
127	1.003	147	1.001	167	1.018	187	1.053		
128	1.003	148	1.002	168	1.019	188	1.055		
129	1.002	149	1.002	169	1.020	189	1.058		
130	1.002	150	1.002	170	1.022	190	1.060		
131	1.001	151	1.003	171	1.023	191	1.063		
132	1.001	152	1.003	172	1.025	192	1.065		
133	1.001	153	1.004	173	1.026	193	1.068		
134	1.001	154	1.005	174	1.028	194	1.070		
135	1.000	155	1.005	175	1.029	195	1.073		
136	1.000	156	1.006	176	1.031	196	1.076		
137	1.000	157	1.007	177	1.033	197	1.079		
138	1.000	158	1.008	178	1.035	198	1.082		
139	1.000	159	1.009	179	1.036	199	1.085		

TABLE 11. Age correction factors (F) for 365-day milk production records for summer calving buffaloes in region 2.

Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F	Age (mo.)	F
20	1.422	40	1.254	60	1.145	80	1.073	100	1.029
21	1.411	41	1.248	61	1.141	81	1.071	101	1.027
22	1.401	42	1.241	62	1.136	82	1.068	102	1.025
23	1.391	43	1.235	63	1.132	83	1.065	103	1.024
24	1.382	44	1.229	64	1.128	84	1.062	104	1.022
25	1.372	45	1.222	65	1.124	85	1.060	105	1.021
26	1.363	46	1.217	66	1.120	86	1.057	106	1.020
27	1.354	47	1.211	67	1.116	87	1.055	107	1.018
28	1.346	48	1.205	68	1.113	88	1.053	108	1.017
29	1.337	49	1.199	69	1.109	89	1.050	109	1.016
30	1.329	50	1.194	70	1.105	90	1.048	110	1.015
31	1.320	51	1.189	71	1.102	91	1.046	111	1.013
32	1.312	52	1.183	72	1.098	92	1.044	112	1.012
33	1.305	53	1.178	73	1.095	93	1.042	113	1.011
34	1.297	54	1.173	74	1.091	94	1.040	114	1.010
35	1.289	55	1.168	75	1.088	95	1.038	115	1.009
36	1.282	56	1.163	76	1.085	96	1.036	116	1.008
37	1.275	57	1.159	77	1.082	97	1.034	117	1.008
38	1.268	58	1.154	78	1.079	98	1.032	118	1.007
39	1.261	59	1.149	79	1.076	99	1.030	119	1.006
120	1.005	140	1.000	160	1.014	180	1.046	200	1.102
121	1.005	141	1.001	161	1.015	181	1.048	201	1.106
122	1.004	142	1.001	162	1.016	182	1.051	202	1.109
123	1.003	143	1.001	163	1.017	183	1.053	203	1.113
124	1.003	144	1.002	164	1.019	184	1.055	204	1.117
125	1.002	145	1.002	165	1.020	185	1.058		
126	1.002	146	1.002	166	1.021	186	1.060		
127	1.002	147	1.003	167	1.023	187	1.063		
128	1.001	148	1.004	168	1.024	188	1.066		
129	1.001	149	1.004	169	1.026	189	1.068		
130	1.001	150	1.005	170	1.027	190	1.071		
131	1.000	151	1.005	171	1.029	191	1.074		
132	1.000	152	1.006	172	1.031	192	1.077		
133	1.000	153	1.007	173	1.032	193	1.080		
134	1.000	154	1.008	174	1.034	194	1.083		
135	1.000	155	1.009	175	1.036	195	1.086		
136	1.000	156	1.010	176	1.038	196	1.089		
137	1.000	157	1.010	177	1.040	197	1.092		
138	1.000	158	1.011	178	1.042	198	1.096		
139	1.000	159	1.013	179	1.044	199	1.099		

Manipulations of these figures would indicate that the earliest age at which a buffalo calves for the first time is 22 months. A buffalo can begin a new lactation when it is as old as 172 months or, in some cases, older. The range (20, 204 months) would, then, comprise possible ages at which a buffalo may start a new lactation. However, reduced tables involving factors for correcting lactations begun at ages from 30 to 185 months would be applicable in most cases.

The magnitude of the appropriate adjustment for age varies from season to season, and from one geographical region to another. Figure 1, shows the magnitude of the autumn-factors in region 1 and 2 relative to the overall factors.
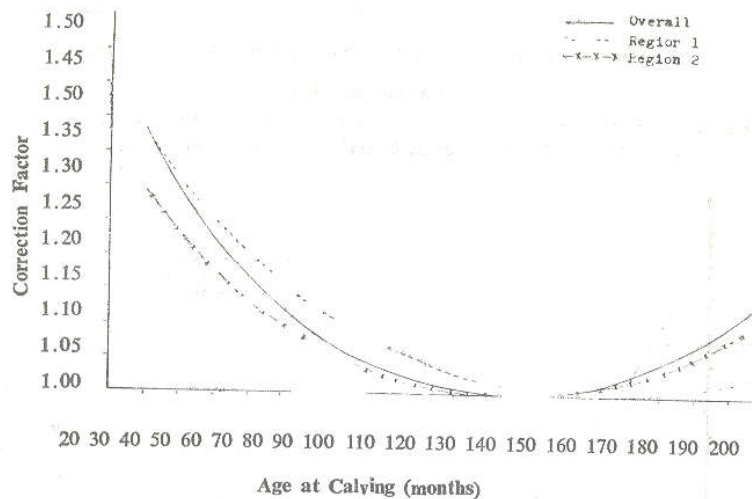
Fig. 1. A comparison of two sets of factors for adjustment to mature equivalent basis milk records in autumn in two regions.

The numerical values of the factors were larger in region than in region 2 before the age of maximum production. After the mature age was reached, the factors became smaller in region than in region 2. Similar trends were observed in winter factors and spring-factors (Fig. 2 and 3, respectively). This indicated that relatively higher milk yield was usually produced by buffaloes in region before attaining the mature age, and that the production declines more sharply, thereafter. However, the differences between summer-factors in the two regions were very small (Fig. 4).
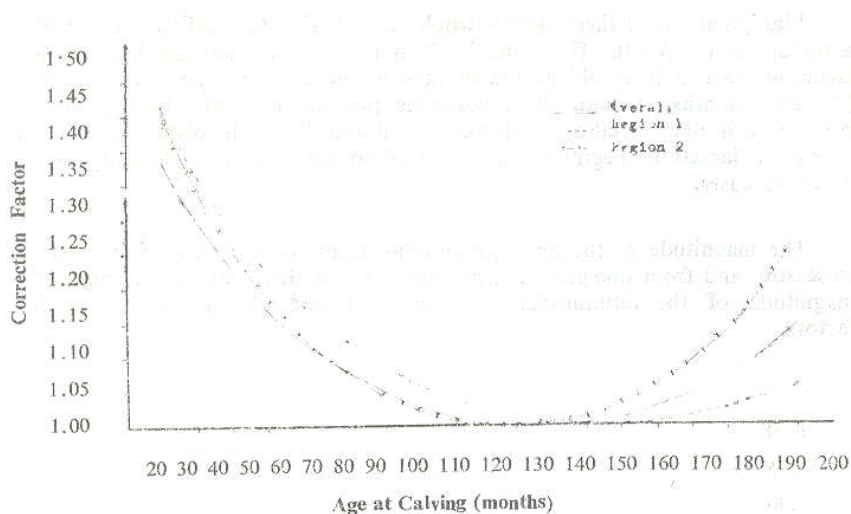
Fig. 2. A comparison of two sets of factors for adjustment to mature
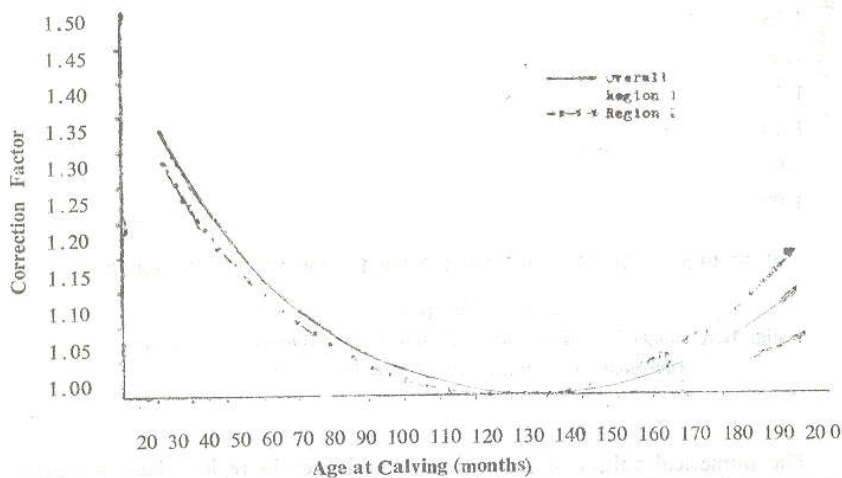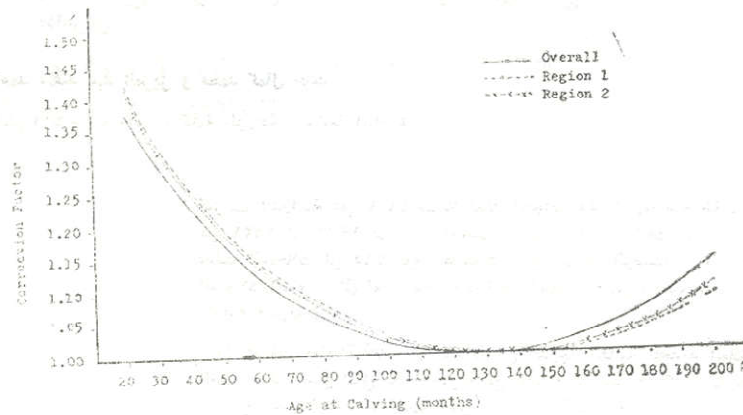equivalent basis milk records begun in winter in two regions.

Fig. 3. A comparison of two sets of factors for adjustment to mature
equivalent basis milk records begun in spring in two regions.

The same factors are usually used for both milk and fat yields when records
are expressed on a 365-day, two milkings a day, and mature equivalent basiss.
Since the factors are multiplicative, it makes no difference which factor is
applied first when two or more factors such as age and length of lactation are.
required for the dairy record.

Fig. 4. A comparison of two sets of factors for adjustment to mature equivalent basis milk records begun in summer in two regions.

References

Abdel-Aziz, A.S. and Hamed, M.K. (1978) The effect of region, season and year of calving on complete milk records of Egyptian buffaloes. *Egypt.J. Anim. Prod.* **18.**

Abdel-Aziz, A.S., Ragab, M.T. and Kamel ,A. (1973) Regression factors for extending part lactaiton milk records in buffaloes. *Egypt. J. Anim. Prod.,* 13, 109.

Arave, C,W., Laben, R.C. and Mead ,S.W. (1967) Measurement of genetic change in twelve California dairy herds. *J. Dairy Sci.* **47,** 278.

El-Itriby, A.A. (1974) The buffaloes of Egypt. The Husbandry and Health of the Domestic *Buffalo*, W.R. Cockrill (editor), Chapter 18, FAO, Rome, Italy.

Harvey, W.R. (1960) Least squares analysis of unequal subclass numbers. ARS-20-8, ARS, USDA, Beltasville, Ma, USA.

McDaniel, B.T. (1973) Merits and problems of adjusting to other than mature age. *J. Dairy Sci.* **56,** 959.

Miller, P.D. (1973) A recent study of age adjustment. *J. Dairy Sci.* **56,** 952.

Miller, P.D., Lentz, W.E.. and Henderson, C.R. (1970) Join influence of month and age of calving on milk yield of Holstein cows in the Northeaster United State.s *J. Dairy Sci.* **53,** 351.

Miller, R.H., Harvey, W.R., Tabler, K.A., Mc Daniel, B.T. and Corley E.L. (1966) Maximum Likelihood estimates of age effects *J. Dairy Sci.* **49,** 65.

معاملات تصحيح العمر لتعديل سجلات اللبن الى معادل النضج
فى الجاموس

احمد سعيد عبد العزيز و محمد كمال حامد

قسم الانتاج الحيوانى ، كلية الزراعة ، جامعة القاهرة

أجريت الدراسة على ٤٩٠٣ سجلا للبن أنتجتها ١٧٥٥ جاموسة خلال الفترة
من ١٩٣١ الى ١٩٧٢ فى ست محطات تحلب فيها الحيوانات مرتين يوميا .
عدلت السجلات الى ٣٦٥ يوم وصححت لتأثير سنة الوضع . وقد قسمت
السجلات المصححة الى ثمانى مجموعات تبعا للمنطقة وفصل الوضع (منطقتين ×
أربعة فصول) .

واستعملت معادلات الانحدار المتعددة من الدرجة الثانية لتحديد العلاقة بين
العمر وناتج اللبن الكلى لكل مجموعة على حدة . ثم حسبت لكل منها معاملات
تصحيح العمر لتعديل سجلات اللبن الى معادل النضج .

وقد تراوحت درجة دقة معادلات الانحدار المستعملة فى تقرير الانتاج عند
عمر النضج بين ٨٣٪ ، ٦٠٪ .