Journal of Animal and Veterinary Advances 7 (9): 1056-1060, 2008
ISSN: 1680-5593

Estimation of Adjustment Factors for Standardizing Lactations to Mature Age and 305 Day of Milk Yield of Holstein Cattle Reared at Polatli State Farm in Turkey

Süleyman Çilek
Department of Animal Breeding, Faculty of Veterinary Medicine,
University of Kırıkkale, Yahşihan, 71451 Kırıkkale, Turkey

Abstract: In this study, adjustment factors of lactation milk yield to mature age and 305 day of milk yield were estimated for Holstein cattle reared in Polatli State Farm. A total of 3184 lactation records of Holstein cattle reared in Polatli State Farm between 1993 and 2006 were used. The factors for standardizing incomplete lactations to 305 day were estimated by taking into consideration nine calving age groups (2, 3, 4, 5, 6, 7, 8, 9, 10 and older years of age). The factors for standardizing to mature equivalent estimated by polynomial regression method are between the 20th month and 145th and older. For lactations less than 305 days, average of adjustment factors for 30, 60, 90, 120, 150, 180, 210, 240, 270, 300 and 305th days, were 8.70, 4.32, 2.82, 2.14, 1.69, 1.48, 1.31, 1.18, 1.09, 1.01 and 1.00, respectively. For lactations more than 305 days, the average of adjustment factors for 310, 340, 370, 400, 430, 460, 490, 520, 550, 580 and 600th days were 0.99, 0.93, 0.88, 0.84, 0.80, 0.77, 0.74, 0.72, 0.69, 0.67 and 0.65, respectively. Adjustment factors were estimated as 1.14 and 1.51 for the youngest cows (calving in 24th month) and for oldest cows (calving in 145th month), respectively.

Key words: Cattle, holstein, milk yield, adjustment factors, 305 day, mature age

INTRODUCTION

In cattle breeding, selection is one of the important ways to improve milk yield. For the accurate selection of bulls and cows which will be given an opportunity of calving in next generation, yield records must be taken. Before yield records are used for selection, it must be standardized according to known environmental factors. The most important environmental factors in selection for milk yield are lactation duration, calving age and milking frequency. Standardized records according to these factors will raise accuracy in selection as they appear the genetic structure of animals. In addition to this, standardized records are used in estimation of heritability, repeatability and breeding value.

When breeding values of bulls are estimated, lactations of some daughters and mothers may not be completed. Not taking into consideration of these records may cause errors in evaluation of bulls. Therefore, incomplete lactation milk yields must be standardized to 305 day basis (Alpan, 1994). Adjustment factors to mature age and 305 day were estimated previous researches (Lamb and McGilliard, 1967; McDaniel *et al*., 1967; Eker *et al*., 1982; Kesici *et al*., 1986; Martinez *et al*., 1990; Şekerden, 1991; Kocabaş, 1994; Aydın, 1996; Gökkuş, 1999). We estimated adjustment factors fof Simmental cows (Çilek and Tekin, 2006a) and for Brown Swiss (Çilek and Tekin, 2006b) in different farms at steppe climate conditions in Anatolia. For 2 years old cows calving in winter, adjustment factors to 305 day for 30, 152 and 274 day milk yields were estimated respectively as 7.30, 1.60 and 1.00 for Brown Swiss by Eker *et al*. (1982), 7.51, 1.66 and 1.05 for Holstein by Kesici *et al*. (1986), 8.08, 1.69 and 1.08 for Jersey by Şekerden (1991), 7.16, 1.81, 1.10 for Holstein by Gökkuş (1999), 8.85, 1.87, 1.10 for Simmental by Çilek and Tekin (2006a), 8.84, 1.80, 1.09 for Brown Swiss by Çilek and Tekin (2006b).

Milk yield increases from the youngest age to mature age and decreases after mature age (Çilek and Tekin, 2005). Therefore, if it is asked to compare genetic merit of different aged cows, milk yield must be standardized according to their calving ages. Adjustment factors to mature age for milk yield were, respectively estimated for 25, 80 and 100th months of calving age for Brown Swiss 1.49, 1.00 and 1.10 by Eker *et al*. (1982), for 25, 75 and 100th months of calving age for Holstein 1.57, 1.00 and 1.07 by Kesici *et al*. (1986), for 25, 75, 84 and 100th months of calving age for Brown Swiss 1.31, 1.01, 1.00 and 1.06 by Aydın (1996), for 25, 75 and 100th months of calving age for Holstein 1.61, 1.00, 1.18 for Holstein by Gökkuş (1999), for 25, 75 and 100th months of calving age for Simmental 1.29, 1.03 and1.00 by Çilek and Tekin (2006a), for 25, 75 and 100th months of calving age for Brown Swiss 1.13, 1.00 and 1.02 by Çilek and Tekin (2006b).

Milking frequency is another important environmental factor which effects milk yield. If milking frequency increases, milk yield increases.

In this study, adjustment factors for milking frequency are not needed, because the cows in this farm have been milked twice in a day.

The aim of the present study was to estimate the adjustment factors for standardizing lactations to mature age and 305 day of standardized milk yield for the Holstein cattle reared at Polatli State Farm in central Anatolia had steppe climate in Turkey.

MATERIALS AND METHODS

In this study, between 1993 and 2006, lactation records of Holstein reared in Polatli State Farm, Ankara in Turkey, which is owned by Ministry of Agriculture were used. Using formulas below, lactation milk yield and lactation duration were calculated by taking results of monthly milk yield tests in the farm with The Holland method (Çilek, 2002; Çilek and Tekin, 2006a).

$$X=\left(\sum_{i=1}^{n}\frac{K_i}{n}\right)\times L$$

L = n × 30.4-(15.2-A).
L = Lactation duration (day).
n = Test day number.
A = Time from calving to first test (day).
X = Lactation milk yield (kg).
K_i = Milk yield of ith test day (kg).

Adjustment factors to 305 day basis were calculated by using 3184 lactation records. Lactations that tested less than 7 were not used in calculation. In lactations tested more than 10, milk yields were calculated from the first 10 test milk yield. Lactations which were completed before 305 days due to entering dry off spontaneously were accepted as 305 day milk yield.

To find out adjustment factors to 305 day for different ages, nine groups were made based on lactation started at 2, 3, 4, 5, 6, 7, 8, 9, 10 and older years of ages. From milk yield records, ten test day milk yields were obtained for each month. After that for every group, 1st, 2nd, 3rd ... 9 and 10th test day milk yield averages were calculated. Then average of each group was accumulated subsequently as follow. Afterwards, all averages for ten test day milk yields were added to obtain sum of averages (total).

$$\frac{\text{Total}}{\text{1st test}},\frac{\text{Total}}{\text{1st}+\text{2nd test}},\ldots,\frac{\text{Total}}{\text{1st}+\text{2nd}+\ldots+\text{10th test}}$$

Finally, sum of averages for all test days milk yield was divided to each accumulated averages to estimate rate for each test day. These ratios were adjustment factors to 305 day milk yield respectively for 30, 61, 91, 122, 152, 182, 213, 243, 274 and 305 day milk yields. For the other days (40, 50, 60 ... 290 and 300th) which were not taken into consideration adjustment factors were calculated by linear interpolation method. Like that; for lactations longer than 305 days, adjustment factors to 305 day were calculated with ten day intervals and as number of animals in age groups were fewer, age groups were not taken into consideration (Çilek and Tekin, 2006b).

Adjustment factors to mature age were estimated by using regression analysis in Minitab package program. Adjustment factors to mature age were calculated by polynomial regression method and 3184 lactation records were used in calculation. For calculation of adjustment factors to mature age, 126 age groups beginning from 20th month and finishing at the 145th month were formed.

RESULTS AND DISCUSSION

For lactations less than 305 days, adjustment factors to 305 day milk yield, for nine age groups and from 30th day for each ten days to 305th day, were presented in Table 1. Means of adjustment factors for 30th day was 8.70 and for 305th day was 1.00 as expected. For lactations more than 305 days, adjustment factors to 305 day milk yield were presented in Table 2. Means of adjustment factors for 600th day was 0.65 and for 305th day was 1.00 as expected.

In calculation for adjustment factors to mature age, the regression equation was determined as:

$$\text{Milk Yield} = 4650 + 45.0x - 0.338x^2$$

For monthly age groups (X), expected milk yield and adjustment factors to mature age were presented in Table 3. The highest milk yield (6148 kg) was in 66-67th month ages and this yield was accepted as mature age yield. This yield was divided milk yield of other monthly ages and adjustment factors to mature age for each age group were calculated. Adjustment factors to mature age were found as 1.14 for a cow which calved in 20th month and 1.51 for another cow which calved in 145th month. This finding suggested that milk yield of the youngest cattle will be multiplied by 1.14; milk yield of the oldest cattle (calving in 145th) will be multiplied by 1.51 to estimate the milk yield at mature age.

Table 1: For lactations less than 305 days, adjustment factors to 305 day milk yield

Lactation duration (day)	Calving age of cow (year)									
	2	3	4	5	6	7	8	9	10+	Means*
30	9.01	8.73	8.67	8.67	8.38	8.45	8.01	9.03	9.37	8.70
40	7.52	7.29	7.23	7.22	6.99	7.05	6.70	7.47	7.70	7.24
50	6.04	5.85	5.79	5.77	5.60	5.65	5.38	5.91	6.04	5.78
60	4.55	4.41	4.35	4.32	4.22	4.25	4.07	4.35	4.38	4.32
70	3.96	3.84	3.79	3.76	3.67	3.69	3.55	3.77	3.76	3.75
80	3.48	3.37	3.32	3.29	3.21	3.24	3.12	3.30	3.25	3.29
90	2.99	2.90	2.85	2.82	2.76	2.78	2.70	2.83	2.75	2.82
100	2.74	2.65	2.61	2.58	2.53	2.54	2.47	2.58	2.50	2.58
110	2.51	2.43	2.39	2.36	2.32	2.32	2.28	2.37	2.28	2.36
120	2.28	2.21	2.17	2.15	2.11	2.10	2.08	2.15	2.06	2.14
130	2.12	2.05	2.01	2.00	1.97	1.96	1.94	2.00	1.92	2.00
140	1.98	1.92	1.87	1.87	1.84	1.84	1.81	1.88	1.80	1.87
150	1.78	1.73	1.68	1.68	1.67	1.66	1.64	1.70	1.64	1.69
160	1.74	1.69	1.64	1.64	1.63	1.62	1.60	1.66	1.61	1.65
170	1.65	1.60	1.56	1.56	1.55	1.54	1.53	1.58	1.54	1.57
180	1.56	1.52	1.48	1.48	1.47	1.46	1.45	1.49	1.47	1.48
190	1.49	1.45	1.42	1.41	1.41	1.40	1.39	1.43	1.41	1.42
200	1.42	1.39	1.36	1.36	1.35	1.35	1.34	1.37	1.36	1.37
210	1.36	1.33	1.31	1.30	1.29	1.30	1.28	1.32	1.31	1.31
220	1.31	1.28	1.26	1.26	1.25	1.26	1.24	1.27	1.26	1.27
230	1.26	1.24	1.22	1.21	1.21	1.21	1.20	1.22	1.22	1.22
240	1.21	1.19	1.18	1.17	1.17	1.17	1.16	1.18	1.18	1.18
250	1.17	1.16	1.15	1.14	1.14	1.14	1.13	1.15	1.15	1.15
260	1.14	1.13	1.12	1.11	1.11	1.11	1.11	1.12	1.12	1.12
270	1.10	1.09	1.09	1.08	1.08	1.08	1.08	1.09	1.09	1.09
280	1.07	1.06	1.06	1.06	1.06	1.06	1.05	1.06	1.06	1.06
290	1.04	1.04	1.04	1.03	1.03	1.04	1.03	1.04	1.04	1.04
300	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
305	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

*: Adjustment factors which were calculated not taken into consideration age groups

Table 2: For lactations more than 305 days, adjustment factors to 305 day milk yield

Lactation duration (day)	Adjustment factors	Lactation duration (day)	Adjustment factors	Lactation duration (day)	Adjustment factors
310	0.99	410	0.82	510	0.72
320	0.97	420	0.81	520	0.71
330	0.95	430	0.80	530	0.70
340	0.93	440	0.79	540	0.69
350	0.91	450	0.78	550	0.68
360	0.90	460	0.77	560	0.68
370	0.88	470	0.76	570	0.67
380	0.87	480	0.75	580	0.66
390	0.85	490	0.74	590	0.65
400	0.84	500	0.73	600	0.65

Although, there were some differences between adjustment factors estimated in this study and in other studies (Lamb and McGilliard, 1967; McDaniel *et al*., 1967; Eker *et al*., 1982; Kesici *et al*., 1986; Martinez *et al*., 1990; Şekerden, 1991; Kocabaş, 1994; Aydın, 1996; Gökkuş, 1999), results were approximately similar. Adjustment factor to 305 day estimated in this study for 30th day was 1.85 higher than Holstein (Gökkuş, 1999) and 0.56 higher from Simmental (Çilek and Tekin, 2006a). As lactation duration increases, these differences of adjustment factors decline.

As it was expected, adjustment factors to mature age milk yield diminished from the youngest age to mature age, then slowly increased. Adjustment factors to mature age were estimated as the highest in 145th month, the smallest in mature age (66-67th month). Adjustment factor estimated in this study for 25th month was 0.01 and 0.28 less than for Brown Swiss (Çilek and Tekin, 2006b) and Holstein (Gökkuş, 1999). These differences reduced from young age to mature age.

Some researches was found adjustment factors to mature age as high level (Eker *et al*., 1982; Kesici *et al*., 1986, Gökkuş, 1999), it may be result of estimation of adjustment factors by using milk yields of cows in different many farms in Turkey. Adjustment factors to 305 day and mature age should be estimated for only one farm.

In this study, from young ages to mature age, adjustment factors to mature age were similar to adjustment factors estimated for Simmental (Çilek and

Table 3: Adjustment factors to mature age milk yield

Calving age (month)	Expected milk yield (kg)	Adjustment factors	Calving age (month)	Expected milk yield (kg)	Adjustment factors	Calving age (month)	Expected milk yield (kg)	Adjustment factors
20	5415	1.14	62	6141	1.00	104	5674	1.08
21	5446	1.13	63	6143	1.00	105	5649	1.09
22	5476	1.12	64	6146	1.00	106	5622	1.09
23	5506	1.12	65	6147	1.00	107	5595	1.10
24	5535	1.11	66	6148	1.00	108	5568	1.10
25	5564	1.11	67	6148	1.00	109	5539	1.11
26	5592	1.10	68	6147	1.00	110	5510	1.12
27	5619	1.09	69	6146	1.00	111	5481	1.12
28	5645	1.09	70	6144	1.00	112	5450	1.13
29	5671	1.08	71	6141	1.00	113	5419	1.13
30	5696	1.08	72	6138	1.00	114	5387	1.14
31	5720	1.07	73	6134	1.00	115	5355	1.15
32	5744	1.07	74	6129	1.00	116	5322	1.16
33	5767	1.07	75	6124	1.00	117	5288	1.16
34	5789	1.06	76	6118	1.00	118	5254	1.17
35	5811	1.06	77	6111	1.01	119	5219	1.18
36	5832	1.05	78	6104	1.01	120	5183	1.19
37	5852	1.05	79	6096	1.01	121	5146	1.19
38	5872	1.05	80	6087	1.01	122	5109	1.20
39	5891	1.04	81	6077	1.01	123	5071	1.21
40	5909	1.04	82	6067	1.01	124	5033	1.22
41	5927	1.04	83	6057	1.02	125	4994	1.23
42	5944	1.03	84	6045	1.02	126	4954	1.24
43	5960	1.03	85	6033	1.02	127	4913	1.25
44	5976	1.03	86	6020	1.02	128	4872	1.26
45	5991	1.03	87	6007	1.02	129	4830	1.27
46	6005	1.02	88	5993	1.03	130	4788	1.28
47	6018	1.02	89	5978	1.03	131	4745	1.30
48	6031	1.02	90	5962	1.03	132	4701	1.31
49	6043	1.02	91	5946	1.03	133	4656	1.32
50	6055	1.02	92	5929	1.04	134	4611	1.33
51	6066	1.01	93	5912	1.04	135	4565	1.35
52	6076	1.01	94	5893	1.04	136	4518	1.36
53	6086	1.01	95	5875	1.05	137	4471	1.38
54	6094	1.01	96	5855	1.05	138	4423	1.39
55	6103	1.01	97	5835	1.05	139	4375	1.41
56	6110	1.01	98	5814	1.06	140	4325	1.42
57	6117	1.01	99	5792	1.06	141	4275	1.44
58	6123	1.00	100	5770	1.07	142	4225	1.46
59	6128	1.00	101	5747	1.07	143	4173	1.47
60	6133	1.00	102	5723	1.07	144	4121	1.49
61	6137	1.00	103	5699	1.08	145	4069	1.51

Tekin, 2006a) and for Brown Swiss by Çilek and Tekin (2006b), it may be result of breeding at cows in same steppe climate condition in Turkey.

Mature age changes on different breeds and different herds. Mature age for Holstein was earlier than Brown Swiss and Simmental in previous researches (Eker *et al*., 1982; Çilek and Tekin, 2006a); it might be the reason of, after mature age, adjustment factors to mature age for Holstein were 0.01 and 0.10 higher than other breeds. According to these results, adjustment factors to mature equivalent and 305 day basis must be estimated independently for breed, herd and area.

CONCLUSION

As estimated by using a wide range with 3184 lactation records, estimated adjustment factors to 305 day and mature age may be used reliably in the selection and culling of Holstein cattle reared in this farm. Adjustment factors to 305 day and mature age ought to be calculated for different breed, climate and herd. Adjustment factors for different breed, climate and herd are different. As these adjustment factors was estimated of Holstein cows reared at steppe climate in Central Anatolia, adjustment factors may be used for Holstein cows reared in other farms at step climate condition in Turkey. Standardized records according to these adjustment factors will raise accuracy in selection and culling, as they appear the genetic structure of cows.

REFRENCES

Alpan, O., 1994. Breding and feeding of cattle. Medisan Yayınevi, Ankara, pp: 193.

Aydın, R., 1996. Estimation of some genetic parameters and the genetic and pynotipic trend for milk yield of Brown Swiss and Holstein Frisian cattle reared in the research farm of the Agricultural Collage at Atatürk Üniversity. Ph.D Thesis. Atatürk University the Institute for Graduate Studies in Science and Engineering. Erzurum, Turkey, pp: 60-101.

Çilek, S., 2002. Estimation of factors for standardizing lactations to mature age and 305 day and heritabilty and repeatability of milk yield for Brown Swiss cattle reared at Ulaş State Farm. Ph.D. Thesis. Selçuk University the Institute for Health Sciences, Konya, Turkey, pp: 5-57.

Çilek, S. and M.E. Tekin, 2005. The environmental factors effecting milk yield and fertility traits of Simmental cattle raised at Kazova State Farm and phenotypic correlations between these traits. Turk. J. Vet. Anim. Sci., 29: 987-993.

Çilek, S. and M.E. Tekin, 2006a. Calculation of Adjustment Factors for Standardizing Lactations to Mature Age and 305 Day and Estimation of Heritability and Repeatability of Standardized Milk Yield of Simmental Cattle Reared on Kazova State Farm. Turk. J. Vet. Anim. Sci., 30: 283-289.

Çilek, S. and M.E. Tekin, 2006b. Estimation of factors for standardizing lactations to mature equivalent and 305 day basis for Brown Swiss cattle reared at Ulaş State Farm. Indian J. Anim. Sci., 76 (8): 621-624.

Eker, M., T. Kesici, E. Tuncel, S.M. Yener and F. Gürbüz, 1982. Estimation of factors for standardizing lactations to mature equivalent and 305 day basis for Brown cattle raised at the state farms of the Central Anatolia. Doğa Turk. J Anim. Sci., 6: 25-34.

Gökkuş, Ş., 1999. Calculating adjustment factors of milk yield to mature age and 305 day lactation milk yield for Holstein cows. Ph.D. Thesis. Selçuk University the Institute for Health Sciences Konya, Turkey, pp: 4-22.

Kesici, T., S.M. Yener and F. Gürbüz, 1986. Estimation of factors for standardizing lactations to mature equivalent and 305 day basis for Holstein Frisian cattle raised at the state farms. Doğa Turk. J. Anim. Sci., 10: 45-58.

Kocabaş, F.Ö., 1994. Estimation of factors for standardizing lactations to mature equivalent and milk yield traits for Holstein Frisian and Brown Swiss raised at some state farms of the Central Anatolia. and Master Thesis. Trakya University the Institute for Graduate Studies in Science and Engineering, Edirne, Turkey, pp: 26-66.

Lamb, R.C. and L.D. McGilliard, 1967. Ratio factors to estimate 305 day production from lactation records in progress. J. Dairy Sci., 50: 1101-1108.

Martinez, M.L., A.J. Lee and C.Y. Lin, 1990. Multicative age-season adjustment factors by maximum likelihood, gross comparisions and paried comparisons. J. Dairy Sci., 73: 819-825.

McDaniel, B.T., R.H. Miller and E.L. Corley, 1967. Sources of variation in radios of total to part yield. J. Dairy Sci., 50: 1917-1924.

Şekerden, Ö., 1991. Determination of factors for standardizing lactations to mature equivalent and 305 day basis for jersey cattle raised at Gelemen and Karaköy state farms. Doğa Turk. J. Anim. Sci., 15: 22-32.