Characterization of Milk Constituents of *Bos Taurus* and *Bos Indicus* × *Bos Taurus* Breed Types

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CHARACTERIZATION OF MILK CONSTITUENTS OF *BOS TAURUS* AND *BOS INDICUS* X *BOS TAURUS* BREED TYPES

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SUMMARY

Milk from eight *Bos taurus* and *Bos indicus* X *Bos taurus* breed types (n=128) was evaluated for percentage butterfat, protein, lactose and solids-non-fat. Milk samples were collected at approximately 60, 105, and 150 d after the onset of lactation by hand-milking the left front quarter following a 30-IU injection of oxytocin. Breed type variation was significant for some milk component traits at each stage of lactation. Brahman X Angus dams increased in component yields (kg) as lactation progressed; production levels of other breed types remained approximately the same or declined. Sex of calf influenced (P<.05) yield (kg) of protein, butterfat and solids-non-fat at 105 d only. Mastitis effects caused a reduction (P<.01) in percentage of lactose. Residual correlations between yield (kg) of milk components and weaning weight were all positive and significant.

INTRODUCTION

Research with beef cattle of European origin has demonstrated the importance of breed variation in milk yield of dams, and that the amount of milk produced at various stages of lactation has a strong influence on calf growth rate during the preweaning period (Neville, 1962, Notter et al., 1978, Mondragon et al., 1983). Although zebu-cross cattle are used extensively in the United States and in other countries throughout the world, there is a paucity of information concerning milk composition of zebu-type dams. Data on milk characteristics of zebu-cross dams are needed to develop breeding strategies for commercial beef herds. The objectives of the present study were to compare butterfat, protein, lactose and solids-non-fat content of milk from divergent beef breed types, including *Bos indicus* crosses, and to determine the effect of these components on calf weaning weight.

MATERIALS AND METHODS

This study was conducted at the University of Nevada Main Station Field Laboratory, Reno as a part of a long-term, complete life-cycle experiment. Eight dam breed types, including Hereford, Red Poll, Hereford X Red Poll, Red Poll X Hereford, Angus X Hereford, Angus X Charolais, Brahman X Hereford, and Brahman X Angus were evaluated. Four cow age groups (7 to 10 yr) representing the eight breed types were used. All cows were bred to Limousin sires and calved from late February to mid-April, 1985. A complete description of the genetic background of these dams and management practices was presented by Dow et al., (1982).

Milk samples were collected during the months of May, July, and August, 1985, at approximately 60, 105, and 150 d, respectively, after the onset of lactation. Sampling times were identified as Cycle I, II, and III respectively. Cows were separated from their calves for 4.5 to 7 h following collection of milk yield data by the weigh-suckle-weigh method. Samples were collected by hand-milking the left front quarter completely after a 30-IU intramuscular injection of oxytocin.

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Milk samples were sent in refrigerated containers to the California Central Valley DHIA Laboratory where they were analysed by an Infra-red Fause Milko Scan for butterfat, protein, lactose, and solids-non-fat percentage. A somatic cell-count test was performed to determine which cows had mastitis. Daily milk component yields were estimated by multiplying the 24-h corrected milk yield by the percentage of each component.

Data were analysed by least-squares procedures (Harvey, 1979). Cycle interactions were significant in preliminary analyses; hence, data from each cycle were analysed separately. Terms in the model were: dam birth year, dam breed, sex of calf and mastitis; calf age was included as a continuous, independent variable. Results of preliminary analyses indicated that first-order interactions between these effects were not significant.

RESULTS

CYCLE I. Table 1 shows mean squares for milk component traits for each cycle. Daily lactose production differed significantly among breed types. Angus X Hereford dams were highest ($P<.05$) for this component, while Brahman X Hereford and Brahman X Angus were lowest (table 3). Breed effects for other milk traits were nonsignificant.

Sex effects were not important ($P>.05$) for any of the milk traits that were evaluated in the first cycle. Mastitis effects, however, proved to be highly significant for percentage of lactose, butterfat and protein. Dams that had mastitis in the tested quarter had a higher percentage of butterfat and protein in their milk but percentage of lactose decreased. Calf age had a positive effect ($P<.05$) upon percentage of lactose.

CYCLE II. Breed effects were highly significant for percentage protein and solids-non-fat, and for kg of lactose. Hereford, Brahman X Hereford, and Brahman X Angus dams had the highest percentage of butterfat but the lowest daily yield. These three breed types also excelled in percentage of protein and solids-non-fat (table 2). Angus X Charolais dams had the highest daily yield in lactose; Brahman X Hereford were the lowest.

Dams with bull calves produced more ($P<.05$) total butterfat and solids-non-fat per day but less protein when compared with cows that raised heifer calves. Mastitis was a significant source of variation in percentage of protein and lactose, and kg of protein. Dams with mastitis yielded (kg) more protein in their milk but lactose percentage decreased. Calf age was significant for percentage of solids-non-fat having a positive effect.

CYCLE III. Breed effects were significant for kg protein, kg lactose and solids-non-fat. Brahman X Angus and Angus X Charolais yielded the most protein (kg), while Hereford dams produced the least amount of protein per day. Brahman X Angus and Angus X Charolais also produced the most kg lactose and kg solids-non-fat on a daily basis. Hereford and Brahman X Hereford dams yielded the smallest amount of these components per day.

Sex of calf did not affect any of the milk traits in the last cycle; however, dams that had mastitis in the tested quarter produced less lactose ($P<.01$). Percentage of protein and solids-non-fat increased ($P<.05$) with calf age but yield (kg) of lactose decreased.

DISCUSSION

Overall butterfat percentages for the three cycles were higher than th estimated by Chenette and Frahm (1981) and Jeffery and Berg (1971). This m be due to differences between experiments in breed types, milk sampling proc dures, stage of lactation, and (or) seasonal effects. Cows in the prese study were separated from their calves for 4.5 to 7 h after a weigh-suckl weigh test that followed a 14-h separation. Chenette and Frahm (198 reported that the estimates for all milk traits decreased as the length time of separation increased.

Protein percentages were lower than estimates given for similar bre types by Butson and Berg (1984), but similar to estimates of Chenette a Frahm (1981) for kg of protein. Lactose was similar in percentage but high in kg yield than values reported by Butson and Berg in 1984.

Brahman X Angus dams increased in component yields as lactation pro gressed, and they had the highest yield (kg) in the final cycle for all mil traits. Component yields for dams of other breed types remained at approx mately the same level, or decreased at later stages of lactation.

Residual correlations between percentages of milk constituents an weaning weight were not significant except for solids-non-fat in Cycle II Daily yields (kg) of milk components, however, were significantly correlat with weaning weight, with correlation coeficients ranging from .21 to .4 These estimates were slightly higher than those observed by Chenette and Fra (1981), and indicate that some of the variation in calf weaning weight can b accounted for by differences in milk component yields.

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TABLE 1. MEAN SQUARES OF MILK COMPONENTS

Item	Year	Dam Breed	Calf Sex	Mastitis	Calf Age	Residual
Cycle 1						
%BFat	9.851**	3.090	0.849	8.458*	1.590	1.839
%Protein	0.803*	0.276	0.232	0.665*	0.349	0.136
%Lactose	1.132**	0.074	0.016	6.087**	0.822	0.177
%SNF	0.408	0.416	0.516	0.129	0.004	0.203
kg BFat[a]	0.797	0.616	0.398	0.711	0.181	0.354
kg Protein[a]	0.300**	0.060	0.048	0.107	0.003	0.047
kg Lactose[a]	0.174	0.378*	0.277	0.383	0.010	0.154
kg SNF[a]	0.988	0.804	0.682	0.011	0.032	0.390
Cycle 2						
%BFat	5.032*	2.901	0.866	0.727	3.367	1.505
%Protein	0.824**	0.306**	0.030	1.018**	1.008	0.100
%Lactose	0.207	0.043	0.142	4.263**	0.024	0.100
%SNF	0.859**	0.456**	0.012	0.000	1.572**	0.147
kg BFat[a]	2.042**	0.068	1.231*	0.833	0.243	0.304
kg Protein[a]	0.372**	0.066	0.215*	0.231*	0.041	0.044
kg Lactose[a]	0.844**	0.332*	0.427	0.067	0.027	0.139
kg SNF[a]	2.654**	0.664	1.670*	0.359	0.020	0.363
Cycle 3						
%BFat	2.363	0.699	3.208	0.201	1.553	1.864
%Protein	0.587**	0.150	0.018	0.334	0.532*	0.109
%Lactose	0.160	0.147	0.003	2.875**	0.033	0.147
%SNF	1.359**	0.312	0.022	0.168	1.120*	0.182
kg BFat[a]	0.072	0.434	0.351	0.162	0.496	0.330
kg Protein[a]	0.042	0.190*	0.003	0.026	0.100	0.074
kg Lactose[a]	0.145	0.533**	0.003	0.110	0.678*	0.166
kg SNF[a]	0.324	1.479**	0.002	0.000	1.417	0.520

[a]Mean Squares are multiplied by 10.
*P<.05.
**P<.01.

TABLE 2. LEAST-SQUARES MEANS FOR MILK COMPONENT PERCENTAGES ACCORDING TO BREED TYPE

Item	Mu	Hereford	Red Poll	Hereford X Red Poll	Red Poll X Hereford	Angus X Hereford	Angus X Charolais	Brahman X Hereford	Brahman X Angus
Butterfat									
Cycle 1	6.21	6.60	6.16	5.80	6.38	6.49	6.02	6.80	5.44
Cycle 2	5.63	6.23	5.36	5.25	5.37	5.40	5.21	6.32	5.91
Cycle 3	5.94	6.14	5.93	5.96	5.93	5.65	5.81	6.35	5.76
Protein									
Cycle 1	3.12	3.19	3.01	3.02	3.14	2.92	3.13	3.34	3.20
Cycle 2	2.97	3.20	2.77	2.95	3.01	2.81	2.84	3.09	3.05
Cycle 3	3.39	3.49	3.22	3.42	3.52	3.27	3.37	3.42	3.40
Lactose									
Cycle 1	5.00	5.08	5.09	4.96	5.00	5.05	5.00	4.98	4.88
Cycle 2	5.15	5.10	5.24	5.19	5.12	5.17	5.11	5.18	5.10
Cycle 3	5.04	4.96	5.15	5.09	5.06	4.84	5.09	5.07	5.08
SNF									
Cycle 1	8.89	9.04	8.80	8.70	8.95	8.73	8.87	9.19	8.83
Cycle 2	8.76	9.03	8.57	8.74	8.77	8.59	8.56	8.98	8.84
Cycle 3	9.19	9.26	9.07	9.26	9.34	8.91	9.18	9.32	9.22

TABLE 3. LEAST-SQUARES MEANS FOR MILK COMPONENT YIELD (KG) ACCORDING TO BREED TYPE

Item	Mu	Hereford	Red Poll	Hereford X Red Poll	Red Poll X Hereford	Angus X Hereford	Angus X Charolais	Brahman X Hereford	Brahman X Angus
Butterfat									
Cycle 1	0.538	0.530	0.552	0.504	0.614	0.625	0.550	0.496	0.433
Cycle 2	0.508	0.512	0.506	0.515	0.524	0.475	0.543	0.492	0.500
Cycle 3	0.482	0.375	0.517	0.496	0.501	0.428	0.528	0.476	0.534
Protein									
Cycle 1	0.267	0.258	0.267	0.263	0.295	0.284	0.286	0.235	0.250
Cycle 2	0.263	0.258	0.254	0.287	0.282	0.243	0.288	0.235	0.255
Cycle 3	0.267	0.205	0.285	0.279	0.285	0.238	0.299	0.238	0.309
Lactose									
Cycle 1	0.430	0.412	0.450	0.433	0.467	0.498	0.454	0.346	0.377
Cycle 2	0.458	0.406	0.483	0.499	0.485	0.452	0.523	0.387	0.430
Cycle 3	0.401	0.290	0.454	0.414	0.406	0.372	0.458	0.351	0.465
SNF									
Cycle 1	0.764	0.732	0.782	0.762	0.841	0.854	0.809	0.647	0.687
Cycle 2	0.779	0.725	0.790	0.845	0.829	0.749	0.872	0.680	0.742
Cycle 3	0.728	0.544	0.797	0.757	0.755	0.664	0.821	0.650	0.840