Evaluation of Mare's Milk Composition and Quality during Lactation

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Summary and Implications

Our objective was to evaluate changes in the composition and quality of mare's milk throughout lactation. Milk samples were obtained from fifteen mares immediately after foaling, and then once weekly from the first week of lactation up until the second through eighth week depending on the foaling date of each mare. Samples averaging 3 mL for colostrum samples, 3 mL for weekly sampling thereafter, and 2 oz. for DHI milk composition analysis, were collected after each teat was disinfected with a cotton ball that was moistened with 70% ethanol. Each 3 mL sample was examined for microbial growth via the application of approximately 0.1 mL milk sample on ¼ of a blood agar culture plate which was then incubated for 24 to 48 hours before being analyzed. Each 2 oz. sample was analyzed for fat, protein, lactose, milk urea nitrogen, and somatic cell count.

The concentrations of fat, protein, and somatic cell counts decreased as a whole throughout lactation, while lactose and milk urea nitrogen concentrations increased. The averages for fat, protein, lactose, milk urea nitrogen, and somatic cell count were 1.73%, 2.08%, 6.62%, 25.77mg/dl, and 79,000 cells/ml (39,000 cells/ml without 1 outlier sample), respectively for the collection period. No bacterial infections were found on the culture plates. A California Mastitis Test (CMT) was also conducted, of which no inflammatory results were found. All mares maintained good condition throughout lactation, and foals grew well. Overall, composition was similar to other studies with horses showing excellent mammary health and milk quality.

Introduction

Lactation is an important function in the mare. It provides nutrients in the form of milk to the growing foal, which will eventually result in a marketable product for the producer once the foal is weaned. Also, the health and quality of the milk and mammary gland is vital to foal growth and future mammary performance. It is therefore imperative that we as educators, buyers, and producers of the agricultural industry have a complete understanding of lactation in the mare. This is especially important now due to an increasing interest in the last several years in using mare's milk for human nutrition. Recently, mare's milk as also been looked at as a possible substitute for cow's milk or as formulas for allergic children.

Although several studies on milk composition are available, the majority of them are out of date, limited to only a few mares, and contradictory. There is a need for a larger scale study with updated figures to match some of the nutritional changes that have been made in our broodmares today. However, these previous studies are still useful as benchmark points and provide some valuable trends in regards to the composition of mares' milk. The objective of this trial was to evaluate milk composition and milk quality across lactation in mares at the ISU Horse farm in 2012. A similar study was completed in 2011.

Materials and Methods

A total of fifteen mares were used from the ISU Horse Barn for this project. They were of varying ages, sizes, and genetic background with foaling dates ranging from mid January to early April. Immediately after foaling, and then weekly thereafter, aseptic milk samples (3 mL) from each udder half were collected in 12 x 75 mm sterile tubes after disinfection of the teats with a cotton ball moistened with 70% ethanol. Following this, 2 oz. milk samples were collected from each udder half into sterile DHI plastic snap top vials. The aseptic milk samples (3 mL) were analyzed for microbial growth at ISU, while the DHI plastic snap top vials were sent to Dairy Lab Services in Dubuque, IA to be analyzed for fat, protein, lactose, milk urea nitrogen, and somatic cell counts. A California Mastitis Test (CMT) was also conducted. This is a qualitative measure test for measuring somatic cell count in milk, and is comprised of mixing a 2 mL milk sample with equal parts of a CMT detergent reagent. White blood cells react with the detergent causing a gelling reaction and the degree of gelling can estimate the somatic cell count. Bacteriological analysis of the aseptic udder half milk samples began with the application of approximately 0.1 mL milk samples on ¼ of a blood agar culture plate. These plates were then incubated for 24 to 48 hours at 37°C, after which initial colony counts and morphologies were recorded. In addition to this, the body condition score of the mares shortly after foaling were recorded and then reassessed weekly for any changes throughout lactation. A halter and a lead rope were used to restrain the mares while collecting milk samples. One person was in charge of holding the mare in her stall while the other collected the milk samples. If any complications arose, the mares were placed in stocks while they were collected to ensure the safety of all parties involved.

Results

On average for the eight weeks (Table 1), the milk composition of the mares was 1.73% fat, 2.08% protein, 6.65% lactose, 26.37mg/dl milk urea nitrogen, and 79,000 (39,000 without one outlier sample) somatic cells/ ml,. The concentrations of fat, protein, and somatic cells tended to decrease as a whole throughout lactation, while those for lactose and milk urea nitrogen increased. (Figures 1-5).

Very little bacterial growth or infections (2 coagulase negative (skin) staphylococcal infections in 2 individual udder halves on only 1 day each) were found during the culture plate analysis, and no inflammatory responses were present in our CMT results which would have been indicated via a detergent reagent gelling reaction. All mares maintained good condition and foals grew well throughout the collection period.

Table 1. Milk composition averages for each week.

Weeks	% Fat	% Protein	MUN	% Lactose	SCC
Day 3	2.215	2.960	19.736	6.131	78.292
Week 1	1.811	2.370	21.983	6.461	49.167
Week 2	1.697	2.118	23.675	6.370	37.133
Week 3	1.610	2.005	25.464	6.669	30.964
Week 4	1.812	2.004	27.065	6.705	42.600
Week 5	1.528	1.781	29.175	6.861	31.500
Week 6	1.367	1.825	27.467	6.831	43.250
Week 7	1.668	1.910	29.300	6.802	20.833
Week 8	1.828	1.748	28.100	6.772	377.500
St.Dev.	0.585	0.437	5.051	0.517	133.896

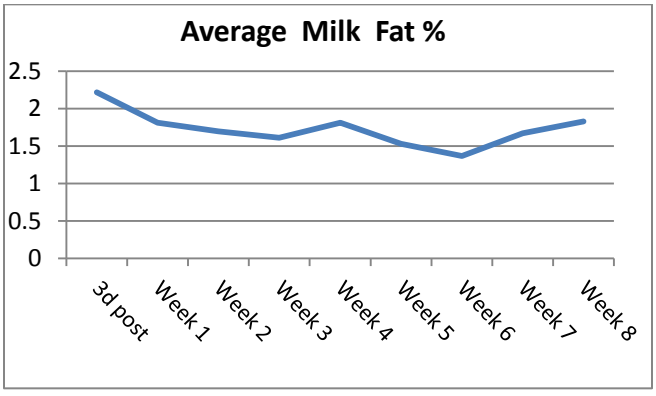

Figure 1. Average % fat over 8 weeks for 15 mares.

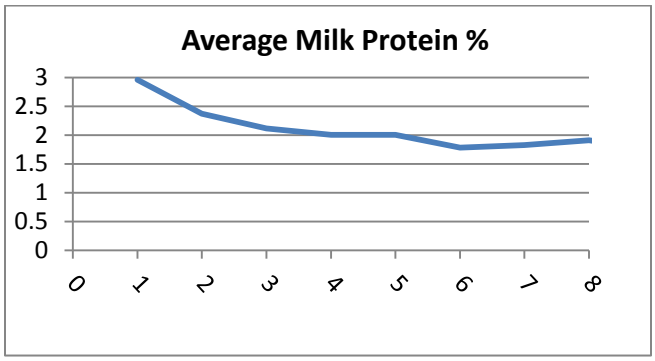

Figure 2. Average % protein over 8 weeks for 15 mares.

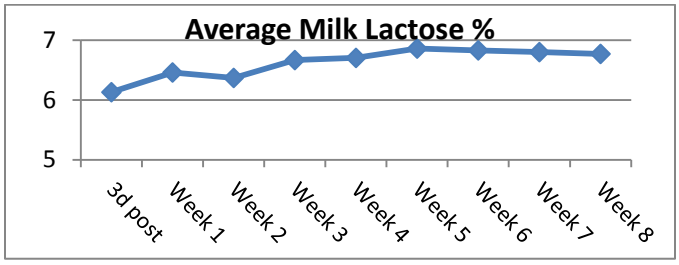

Figure 3. Average % lactose over 8 weeks for 15 mares.

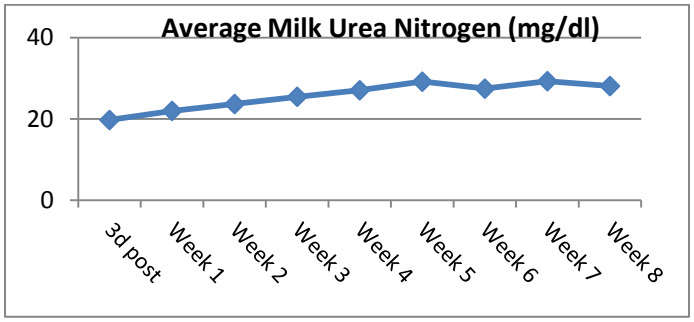

Figure 4. Avg. MUN (mg/dl) over 8 weeks for 15 mares.

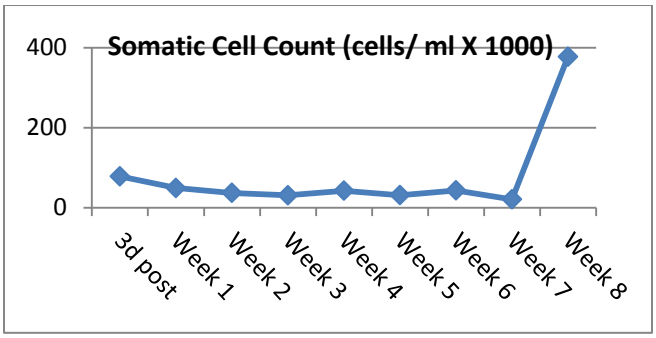

Figure 5. Avg. SCC(cells/ml X 1000) over 8 wks/15 mares

Conclusions

Fat and protein %, and somatic cell counts decreased as a whole throughout lactation, while lactose and milk urea nitrogen increased. Averages for fat, protein, lactose, MUN, and SCC were 1.73%, 2.08%, 6.62%, 25.77mg/dl, and 79,000 cells/ml (39,000 cells/ml without 1 outlier sample), respectively. These were similar to our 2011 study with 14 mares over 12 weeks (1.70% fat, 1.94% protein, 6.65% lactose, 26.37% milk urea nitrogen, and 34,000 SCC/ ml). The overall lack of infection suggested by no cultures, low somatic cell counts, and no CMT reactions, throughout this testing period also suggests that perhaps the mare's udder location, teat size, and tendencies to avoid laying down may be playing a major role in limiting pathogen exposure as well. There were notable MUN concentration differences from week to week and day to day detected in this trial. It is suspected that, but not limited to, variation in time of collection, mare diet, and competition between animals, may play a role in altering these values. This inconsistency suggests that the MUN concentrations and the factors affecting them in the mare need further investigation.