Animal Industry Report

Animal Industry Report

AS 658

ASL R2719

2012

Evaluation of Mare Milk Composition / Quality during Lactation

Stephanie Wells
Iowa State University

Nikki Ferwerda
Iowa State University

Leo L. Timms
Iowa State University

Evaluation of Mare Milk Composition / Quality during Lactation

A.S. Leaflet R2719

Stephanie Wells, undergraduate honors student;
Nikki Ferwerda, equine lecturer;
Leo Timms, professor, Department of Animal Science

Summary and Implications

We investigated changes in the composition and quality of mare's milk throughout lactation. Milk samples were obtained from fourteen mares immediately after foaling, and then once weekly from the first week of lactation up until the second through twelfth 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 plastic snap top vials, 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 those for lactose and milk urea nitrogen increased. However, somatic cell counts and milk urea nitrogen did not do so in a linear fashion. The averages for fat, protein, lactose, milk urea nitrogen, and somatic cell count were 1.70%, 1.94%, 6.65%, 26.37%, and 34,000 cells/ml 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 one mare lost her foal during the fifth week of lactation. This resulted in rapid milk composition changes associated with involution (decreased lactose and increased somatic cell count). 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.

Materials and Methods

A total of fourteen 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 twelve weeks (Table 1), the milk composition of the mares was 1.70% fat, 1.94% protein, 34,000 somatic cells/ ml, 6.65% lactose, and 26.37% milk urea nitrogen. 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. However, the decrease for overall somatic cell count and milk urea nitrogen did not occur in a linear fashion (For references, see Figures 1-5 on following page).

No bacterial growth or infections 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 throughout the collection period, and one foal died during a mare's fifth week of lactation. Therefore, her fifth week sample showed rapid changes associated with udder involution. These would've included decreased amounts of lactose and dramatically increased somatic cell counts.

Table 1. Milk composition averages for each week.

Weeks	% Fat	% Protein	SCC X 1000	% Lactose	% MUN
1	2.07	2.64	40.64	6.15	23.16
2	1.74	2.29	32.86	6.40	23.66
3	2.07	2.12	30.22	6.50	23.22
4	1.86	2.01	34.00	6.59	29.41
5	1.89	2.02	27.83	6.61	28.07
6	1.39	1.88	40.50	6.74	30.53
7	1.56	1.89	36.80	6.83	30.05
8	1.55	1.66	26.20	6.80	28.07
9	1.63	1.69	54.60	6.80	27.20
10	1.59	1.64	29.75	6.87	22.29
11	1.40	1.80	28.00	6.70	26.93
12	1.65	1.65	26.50	6.81	23.88

Conclusions

The lack of a linear trend for overall somatic cell count and milk urea nitrogen suggest that perhaps mare's milk composition should be discussed in stages rather than as a whole. A similar conclusion was also made in a study that was conducted in which the changes in protein content, protein fractions, and amino acid composition of mares' colostrum and milk were studied during the first 45 days of lactation. These milk samples were collected from 29 mares' each day at the beginning of lactation and then weekly from days 5 to 45 postpartum. The total protein and NPN contents were 16.41% and 0.052% for colostrum right after parturition, 4.13% and 0.043% for milk between days 2 and 5, and 2.31% and 0.031% for milk from days 8 to 45 lactation.

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.

In a study conducted with eight Murgese mares during a 25 day trial, they found that when a mare was hand milked the milk composition consisted of 1.06% fat, 7.04% lactose, 1.85% crude protein, and 3.88% SCC log10 cells/ml. In yet another study that was conducted, average composition values of 1.9% protein, 1.5% fat, and 6.8% lactose were found. Therefore, the milk composition averages of 1.70% fat, 1.94% protein, 34,000 SCC/ ml, 6.65% lactose, and 26.37% milk urea nitrogen that we found in this study closely match those of other similar studies.

This study has given a more complete and up to date understanding of the lactation cycle in the mare. This will hopefully aid producers, educators, and buyers in the agricultural industry as well as infants or other children with allergies related to cow's milk. All in all, a better understanding of mares' milk may not only improve the agriculture industry, but also change the types of milk that we drink in the future.

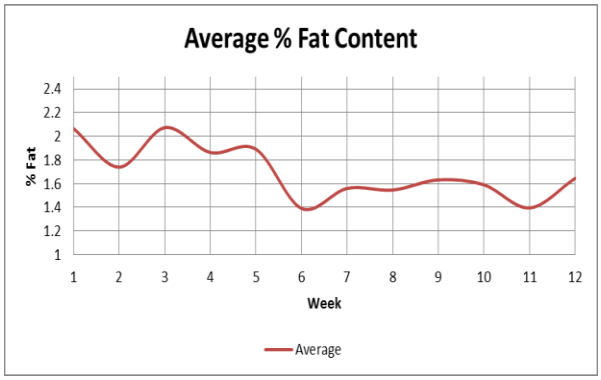

Figure 1. Average % fat content over 12 weeks for 14 mares.

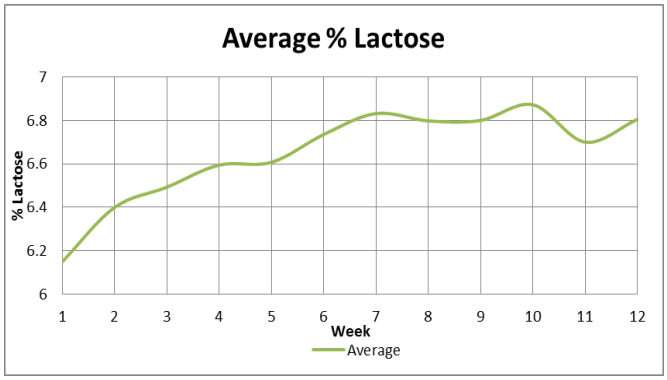

Figure 4. Average % lactose content over 12 weeks for 14 mares.

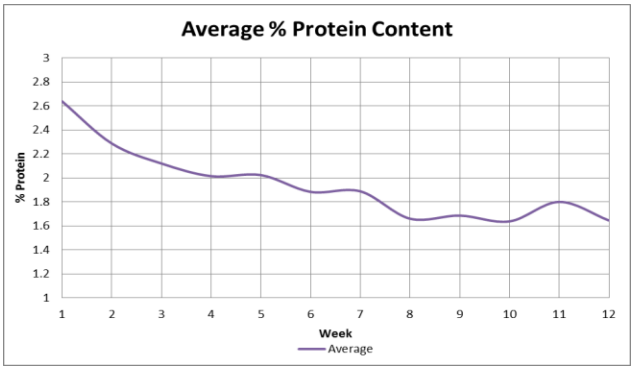

Figure 2. Average % protein content over 12 weeks for 14 mares.

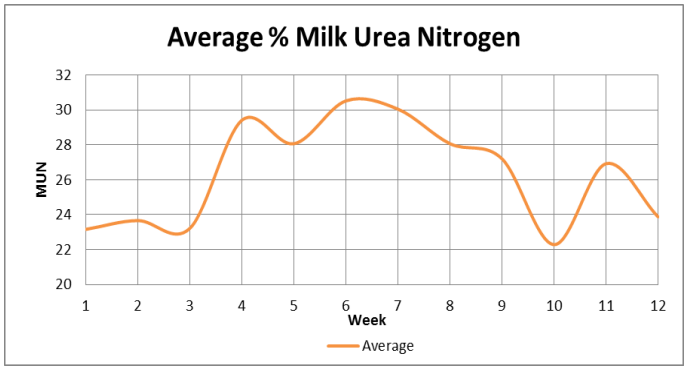

Figure 5. Average % milk urea nitrogen over 12 weeks for 14 mares.

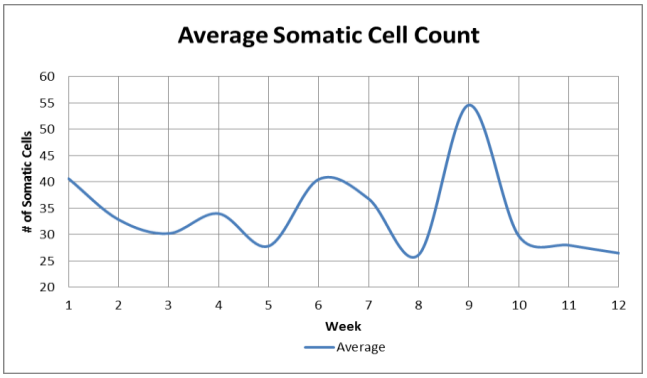

Figure 3. Average somatic cell count over 12 weeks for 14 mares.