TRENDS IN AGRICULTURE SCIENCE
Popular Article
Vol.2 Issue 9 September 2023, Page: 764-767

Factors Affecting Milk Composition/ Quality

Lokendra

Assistant Professor, Department of Veterinary and Animal Husbandry Extension at Sriganganagar Veterinary College, Tantia University, Sriganganagar (Raj.)-335001

https://doi.org/10.5281/zenodo.8387555

Introduction

Milk is a vital source of nutrition for humans and is consumed in various forms worldwide. The quality and composition of milk are of utmost importance, as they directly impact its nutritional value and suitability for various dairy products. The variation of milk composition is a regular phenomenon in any dairy animal. The factors that affect milk composition are broadly classified as 2 types: -

A. Physiological factors governed by genetic makeup

B. Environmental factor which are governed by non-genetic factors.

The factors which affect milk composition are as follows: -

1. Species
2. Breed
3. Individuality
4. Stage of lactation
5. Day to day variation
6. Variation in milking
7. Estrous/ Heat
8. Pregnancy
9. Age of the animal/ Parity
10. Interval between milkings
11. Excitement
12. Season or Environmental temperature
13. Exercise
14. Disease
15. Feed and feeding
16. Dry period and body condition

Official Website: trendsinagriculturescience.com
Email Address: trendsinagriculturescience@gmail.com
Published: 25 Sep 2023

Species: Buffaloes are known to yield higher levels of milk fat, SNF (Solids-Not-Fat), lactose, ash, and total solids compared to cows.

Breed: The composition of milk can significantly vary among different breeds of dairy cattle. For instance, Jersey and Guernsey breeds tend to produce milk with higher fat and protein content compared to Friesians. Generally, when the production volume is higher, the fat percentage tends to be lower. There is an inverse or negative relationship between the fat and protein content of milk and its overall yield. Notably, Indian zebu cattle produce more milk fat than their European counterparts.

Milk composition in different breeds

BREED	TOTAL SOLIDS (%)	FAT (%)	PROTEIN (%)
Holstein Friesian	12.4	3.7	3.1
Brown Swiss	13.3	4.0	3.6
Ayrshire	13.1	4.1	3.6
Guernsey	14.4	5.0	3.8
Jersey	14.6	5.1	3.9
Sindhi	13.6	4.9	3.4
Gir	13.3	4.7	3.3
Tharparkar	13.2	4.5	3.3
Sahiwal	13.3	4.5	3.3

Individual Variation: There is a significant variance in milk fat and solids not fat (SNF) among individuals, which is a hereditary trait. The genetic makeup of an individual cow determines the potential fat content, as well as protein and lactose levels in its milk. Consequently, selective breeding can be employed to enhance milk quality.

Lactation Stages: The most noticeable variations in milk composition occur immediately after parturition, typically within the first five days. Colostrum, the initial secretion, contains higher levels of vitamin A, vitamin D, iron, calcium, magnesium, chlorides, and phosphorus compared to regular milk. However, it has lower lactose and potassium content. Colostrum undergoes transformation into standard milk over approximately ten days. From that point onward, its composition remains relatively consistent until around the 90th day of lactation. Beyond this period, the percentage of protein gradually increases until the end of the lactation cycle. Lactose remains nearly constant throughout the lactation period, except during the colostral phase. During advanced lactation, milk may develop bitterness after standing for a shorter duration. This bitterness results from the presence of an enzyme called lipase, which breaks down fat into glycerol and fatty acids. These free fatty acids, known for their rancid taste, react with milk cations to form soap, contributing to the bitter flavor.

Official Website: trendsinagriculturescience.com
Email Address: trendsinagriculturescience@gmail.com
Published: 25 Sep 2023

Daily Fluctuations: The composition of milk exhibits significant day-to-day variations. Among the various milk components, fat content exhibits the greatest variability, ranging from 0.1% to 2.0%. Protein content follows in terms of variability, while lactose remains the least variable. These fluctuations can be attributed to factors such as excitement, estrus, incomplete milking, and underfeeding.

Milking Variations: The last portion of milk drawn during milking contains a higher fat percentage compared to the initial portion. Subsequent milkings yield a higher fat content since they incorporate the remnants of the previous milking, which contain a higher fat concentration.

Type of milk	Yield (%)	Fat (%)
Foremilk	15%	1.9%
Middle milk	58%	2.3%
Stripping	27%	6.8%

Estrous Cycle: During the estrous period, there is an increase in milk fat percentage as milk yield decreases. Some animals may delay milk release due to excitement, resulting in milk with a lower fat percentage.

Pregnancy: Late in lactation, pregnancy is associated with an increase in solids-not-fat (SNF) and protein percentages. However, pregnancy has no significant effect on the fat content of milk.

Animal Age and Parity: As animals age or go through multiple lactation cycles (parity), the percentages of protein, fat, and SNF decline. Specifically, fat and lactose gradually decrease by approximately 0.2-0.4% over the first five lactation cycles.

Interval between Milkings: The fat content of milk can vary considerably between morning and evening milkings due to the shorter interval between them. If cows were milked at 12-hour intervals, the variation in fat content between milkings would be minimal. However, this is often not practical on most farms. Longer intervals between milkings may result in slightly lower fat content. SNF content typically remains stable even with varying intervals between milkings.

Excitement: Excitement during milking can lead to incomplete milk removal and, consequently, lower fat content in the milk. SNF content remains unaffected.

Seasonal Factors (Environmental Temperature): Milk fat content tends to increase when environmental temperatures are above 70°F (21°C) and below 30°C, while protein and SNF content decrease at higher temperatures and increase at lower temperatures.

Official Website: trendsinagriculturescience.com
Email Address: trendsinagriculturescience@gmail.com
Published: 25 Sep 2023

Exercise: Mild exercise appears to increase milk fat content by approximately 0.2 to 0.3% without affecting milk quantity. However, moderate to heavy exercise in high-producing cows can lead to reduced milk secretion but an increased fat yield. Exercise has no significant impact on milk SNF content.

Diseases: Elevated body temperature can increase milk fat content but decrease SNF content. Diseases affecting the udder, digestive system, and overall health can reduce milk quality. In cases of mastitis, milk composition changes depending on the severity of infection, with decreased lactose content, increased chloride content, decreased casein content, increased heat-sensitive protein, altered pH towards alkalinity, and, in severe cases, a drop in fat percentage to around 0.3%. Ketosis reduces milk yield but increases fat yield.

Feed and Feeding: The quality and quantity of feed directly affect milk quality. Milk fat content can be increased to some extent by adjusting the diet. Feeds that promote acetic acid production in the rumen tend to increase milk fat content, while feeds that suppress this acid may reduce milk fat content. Diets high in concentrate, low in roughage, and featuring lush pasture grass and finely ground hay may reduce fat content in milk. Feeds with a high fat content, such as cottonseed oil, linseed oil, and soybean oil, can increase milk fat content. However, high-fat diets tend to decrease the casein and protein content of milk.

Dry Period and Body Condition: The length of the dry period and the body condition of cows at calving have a significant impact on milk quality and composition. Cows should ideally be in good body condition at calving and have an optimal dry period to achieve maximum production. This dry period is crucial as it allows the cow's body to accumulate reserves for the next lactation. Cows in good body condition tend to produce 25% more milk than those in poor condition. Very fat cows at calving can produce milk with a considerably higher fat content for a significant period after calving.

References

Bauman, D. E., Mather, I. H., & Wall, R. J. (2006). Lock in of hexadecenoic acid in the fat of milk of dairy cows fed a diet supplemented with fish oil. Journal of Dairy Science, 89(9), 3528-3536.

Hogeveen, H., Huijps, K., & Lam, T. J. G. M. (2011). Economic aspects of mastitis: New developments. New Zealand Veterinary Journal. 59(1), 16-23.

Jenkins, T. C., Wallace, R. J., Moate, P. J., & Mosley, E. E. (2008). Board-invited review: Recent advances in biohydrogenation of unsaturated fatty acids within the rumen microbial ecosystem. Journal of Animal Science, 86(2), 397-412.