

Chronophysiology of Dairy Production: A Postmodern Multidisciplinary Approach for the Industry

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Philosophy and Discussion

Chronophysiology of dairy production is an emerging bioscience that has important implications for the global ruminant industry [1-4]. The objective of this forum article was to describe and delineate science and farm applications of dairy chronophysiology. Perspectives and guidelines were developed and expanded from a postmodern viewpoint. The modern dairy science and industry have advanced tremendously over the last few decades; however, the industry has been suffering from different aspects of over-modernization in nutritional physiology and health management. Therefore, the postmodern dairy farming is to utilize novel approaches that minimize risks and maximize profits.

The importance of chronological insights into human metabolism has received increasing attention [5,6]. Studying chronophysiological mechanism of diabetes development, liver and kidney abnormalities, sleep disorders, and cancer etiology are among notable examples. Practical lessons must be learned from human physiology towards optimizing food-producing animals management and health. Dairy chronophysiological management, as such, is an interdisciplinary science that bridges animal agriculture to public health. Recent studies suggest that dairy cows possess certain circadian and diurnal rhythms of feeding behavior, rumen fermentation, and visceral and splanchno-peripheral metabolism that need to be properly matched with the external environment [1-4,7]. The external factors include feeding timing and photoperiod and their interactions with different feeding strategies and systems. Synchronizing the internal dairy cow physiology with the external cues offers opportunities to improve milk production and nutrient efficiency. In addition, risks of metabolic complications and health disorders may be reduced. Altering time of feeding is a feasible on-farm strategy that helps to optimize rumen metabolism while improving milk and fat yield, especially under thermoneutral conditions. The same diets may have different metabolic and production fates if fed at different times of the circadian period.

Research data suggest that feeding lactating dairy cows high-concentrate rations at certain times of the 24-h period (e.g., evening vs. morning) alters post-feeding rhythms of feed intake, increases nutrient intake and rumen fermentation, and improves milk production without compromising rumen health and systemic metabolism [8,9]. Future research should be designed to uncover possible interactions of feeding time with other feeding strategies and feeding systems in dairy cows and other dairy ruminants. Another field of study would be to monitor and quantify metabolic and health indices of metabolic disorders (e.g., subacute rumen acidosis, fatty liver, ketosis, and depressed immunity) in response to feeding time alterations.

In conclusion, dairy chronophysiology, as an interdisciplinary postmodern science, provides opportunities to improve production and optimize health and economics of the modern dairy cow.

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