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Biochemical Flavour Parameters of Milk in Early Lactation

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This research was aimed to investigate the biochemical flavour parameters of milk by machine milking in early lactation period. In the experiment, milk samples from 50 Holstein cows were used. Cows were fed high-energy concentrate diet (140 g crude protein and 10.3 metabolizable energy MJ/d). The data was collected from DIMES Company during July month. The milk fat rates were lower ($p < 0.05$) for cows in first and second weeks than last week. Cows were shown to be more sensitive to milk fat syndrome for first and second weeks. A decrease in milk fat percentage for summer period (2.3-2.6 %) can directly lead to taste loss. There were statistically no significant differences between the weeks for milk acidity (sH and pH) values during July. The milk acidity values (sH and pH) during July were tolerable for desired taste and favourable for consumer preference.

Key Words: Milk, Biochemical flavour parameters, Early lactation.

INTRODUCTION

The feeding conditions in different lactation periods are known as important factors which have influences on the milk composition and taste. Feed intake with a high proportion of concentrate can result in decreased pH in the rumen leading to decrease of milk fat percentage[1]. Normal milk fat percentages also reflect good rumen and animal health. Grohn *et al*.[2] reported that decreased pH in the rumen mostly occurs specially in early lactation period because of high energy intake. Although the exact mechanism is not known, one of the proposed theories is that milk fat synthesis is inhibited because of metabolic changes in the rumen[3]. Although much is known about casual relationships between composition of the diet and low milk fat level. Less is known about differences in milk fat depression between genotypes. There has been extensive research in recent decades into milk flavour and the agents responsible for the production of sapid compounds. However, only limited information is available on the flavour chemistry of many varieties and it is impossible to accurately reproduce the flavour of any milk products by a mixture of pure compounds. The studies on the milk taste parameters in dairy farm conditions are limited[2-4]. This research was aimed to investigate the biochemical flavour parameters of milk in early lactation period.

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EXPERIMENTAL

In the experiment, milk samples from 50 Holstein cows were used. The data was collected from DIMES Company during July month. Cows were fed high-energy concentrate diet (140 g crude protein and 10.3 metabolizable energy MJ/d). To determine milk composition, samples were obtained by hand milking on last 3 days each week for July month. The samples were composites of milk collected at consecutive morning and afternoon and were collected into plastic vials preserved with microtabs, stored 4 ºC until analyzed for determination of parameters. The milk fat was determined by Roese-Gottlieb Method[5]. Milk acidity was determined using a Xerolyt electrode (model HA 405, Ingold Electrode, Wilmington, MA). Total solids were determined by drying a known mass of milk at 102 ± 1 ºC. All the data are indicated as mean ± SEM. Independent samples t-test was performed on data using SPSS. All of the data are indicated as mean ± SEM. Comparisons were done by using independent samples t-test with help of the SPSS [6].

RESULTS AND DISCUSSION

In this research, milk fat rates of Holstein cows during July month were lower as expected from previous knowledge on intake of high energy. It can be seen from Fig. 1 that milk fat rates in this study are lower normal values (3-4 %) for cows reported by Koneko and Cornelius[7]. A non-dairy breed characterized by small cistern volume and a low cistern milk fraction shows the normal reduction (but not excessively) in milk fat levels. However dairy breeds such as Holstein cows show lower reduction in milk fat rates[4]. The severity of milk fat syndrome is due to breed of animal.

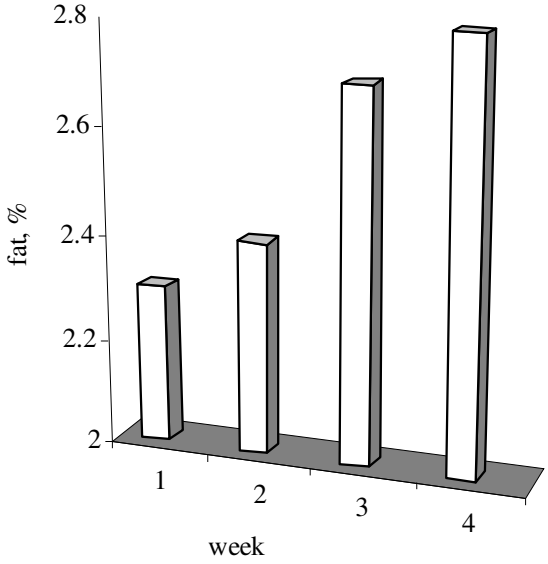

Fig. 1. Milk fat rates during July month

The milk fat rates were lower ($p < 0.05$) for cows in first and second weeks than last week. There was a main effect of high energy intake for animals at these weeks. The reason of decreasing in milk fat was high energy of diet. Samuelsson[8] mentioned that feeding cows with high energy concentrate generally have a reduced fat content in the milk whereas cows with low energy intake have an increased fat content. Feeding diets with a high proportion of concentrate to animals can result in decreased pH in the rumen[9,10]. Properly feeding concentrates primarily involves maintaining proper forage to concentrate ratios and non-fiber carbohydrate levels. Non-fiber carbohydrates include starch, sugars and pectin and high levels of them in diet lead to milk fat syndrome. The cows in study had lower results ($p < 0.05$) for milk fat levels of first week (2.3 %) than results of last week (2.8 %). However, cows were shown to be more sensitive to milk fat syndrome for first and second weeks. Characteristically, dam in first weeks synthesizes and secretes more energy (in her milk) than she can consume in feed[11]. She can not eat enough to meet her energy need in early weeks postpartum, body fat reserves are necessary to allow her to mobilize energy for high production in these weeks[12]. Hence, cows may not have sufficient reserves for maximum milk and fat production in the first weeks postpartum. As a consequence, animals experience a more severe negative energy balance, which is associated with an increased risk of metabolic disorders and milk fat syndrome[13].

According to results from present research, the amount of concentrate diet per feeding should be limited to avoid decreased pH in the rumen. Many theories have been proposed to explain the cause of milk fat syndrome, but ultimately have been deemed incorrect. Recently it has been discovered that milk fat syndrome is the result of an altered rumen fermentation pattern, which results in synthesis of unique fatty acids that inhibit milk fat synthesis. Production of these fatty acids requires both an altered rumen environment and dietary polyunsaturated fatty acids. These fatty acids are now available for use as dietary supplements and may allow producers to manage the amount and type of milk fat produced, manipulate and improve energy balance in early lactation and during periods of heat stress, prioritize the production of other milk components and produce a low fat product. Milk has historically been priced upon fat content, thus milk fat syndrome results in reduced economic return for dairy producers. A decrease in milk fat percentage can directly lead to financial loss if the milk price depends on milk fat percentage. Proper feeding management of the lactating animal can improve the economy of production and provide for a healthier animal and optimum growth for calves. Although the amount of knowledge on lactation physiology is large for dairy breeds, the same thing can not be said for non-dairy breeds[14]. Jordan[15] reported the problems encountered in attempting to get non-dairy ewes to alter milk composition when stimulated with increases in nutrient intake during a whole lactation period. But there were not enough reports about the reason of this problem for non-dairy sheep in his studies.

This research was conducted summer period (July month). Therefore, heat stress in the summer season is a significant financial problem. The mechanism by which this occurs is mainly *via* reduced feed intake, but also includes reduced rumination, digestion and absorption of nutrients and an increase in maintenance requirements[16]. Essentially, because of reduced feed intake the dairy cow is putting herself in a negative energy balance, similar to the negative energy balance observed in early lactation. Inhibiting milk fat synthesis during periods of heat stress may alleviate the negative energy balance. As a result of the extra available energy, synthesis of other milk and milk components may increase (*i.e*., lactose and protein).

The milk fat rates in summer period were low for desired taste because, milk must contain a fat percentage at least 3.2 % for desired taste of milk[17]. Milk fat is essential for the development of the correct flavour in milk products[1].The fat is the most variable parameter among the major milk components and its synthesis is affected by many factors-especially dietary and environmental factors. Low-fat in milk products have been reported to develop bitterness[18], although in full-fat products, a certain proportion of bitter peptides, being hydrophobic, are less likely to be perceived as being bitter. The literature concerning bitterness in dairy products has been reviewed by Lemieux and Simard[19, 20] and McSweeney *et al*.[21].

There were statistically no significant differences between the weeks for milk acidity for sH (Fig. 2) and pH (Fig. 3) during July. Milk acidity of groups in this study are compatible with normal values for sheep announced by Koneko and Cornelius[7].

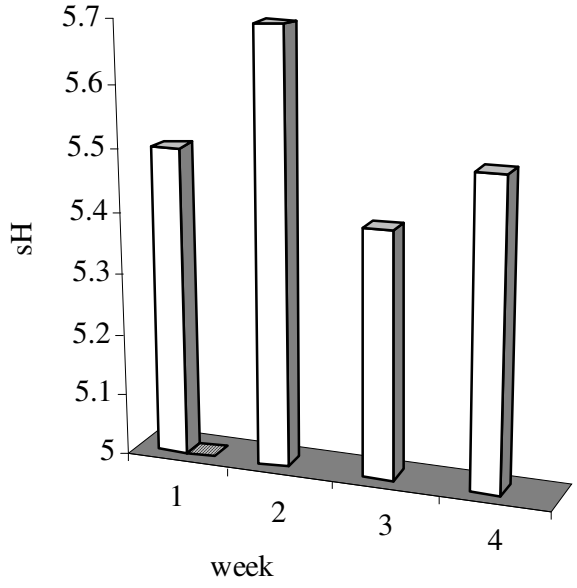

Fig. 2. Milk acidity (sH) during July month

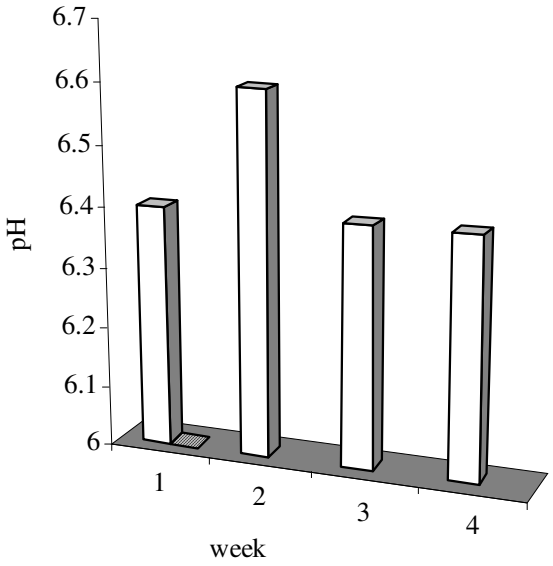

Fig. 3. Milk acidity (pH) during July month

The milk acidity (sH and pH) during July was tolerable for desired taste. The extra acidity value in milk is not desirable for flavour. Sourness is the undesirable taste that detects acidity. Turkish dairy milk acidity values have changed between 4.20 milk acidity (sH) and 12 milk acidity (sH) [22]. It has been explained in The Turkish Food Regulation that the acidity of cows' milk is not more than 8 milk acidity (sH). It can be seen from Fig. 2 that is not higher than the normal value for sH values during weeks.

As a consequence, a decrease in milk fat percentage for summer period can directly lead to taste loss. However the acidity (sH and pH levels) in July milks is favorable for consumer preference.

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