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Biochemical Factors Affecting Taste of Milks from Machine Milking

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The objective of this research is to investigate the biochemical factors affecting taste of milks from machine milking. The data were obtained in winter and summer periods. The milk fat and acidity (sH levels) were the highest in the winter and the lowest in the summer period. However, there were no significant differences in total solids and pH levels between the periods. A decrease in milk fat percentage for summer period can directly lead to taste loss. The most striking conclusion in present study is that the fat means in winter milks from machine milking are suitable for desired taste than summer milks. On the contrary, the acidity (sH levels) in summer milks are more favourable for consumer preference.

Key Words: Biochemical factors, Milks, Machine milking.

INTRODUCTION

The major biochemical pathways which occur in milk products such as cheese are the following: the metabolism of residual lactose, lactate and citrate (sometimes, although erroneously, referred to as 'glycolysis'), liberation of free fatty acids, FFA (lipolysis), associated catabolic reactions and the degradation of the casein matrix to a range of peptides and free amino acids, FAA (proteolysis) and subsequent reactions involved in the catabolism of FAA[1]. 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 (Fig. 1) 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 use of machine milking in dairy farm conditions are limited[2,3] and not enough studies have been done on biochemical parameters affecting taste of milks of machine milked cows. The aim of this study is to investigate the biochemical factors affecting taste of milks from machine milking.

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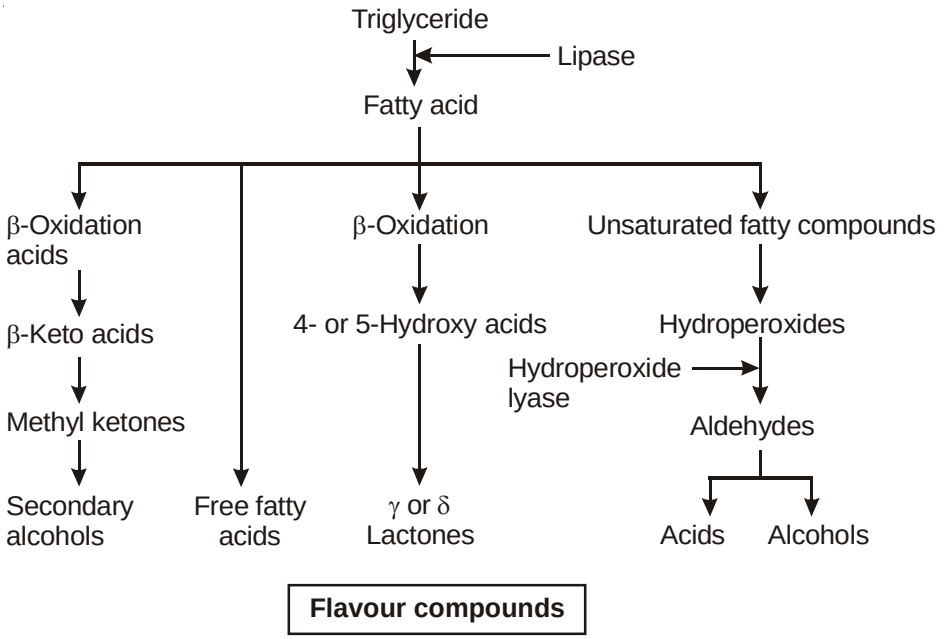

Fig. 1. General pathways for flavour compunds

EXPERIMENTAL

The data was collected from DIMES Company for winter; December, January and February (W) and summer season; June, July and August (S) in 2005. The samples were collected from 11 different regions in Turkey. Cow's milk samples were collected directly from homogenized bulk milk at determined local points and put in to the 200 mL sterile plastic container stored at 4 ºC and immediately transported in freeze to the laboratory and analyzed. The milk fat was determined by Roese-Gottlieb Method[4]. 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 °C. All the data are indicated as mean ± SEM. Independent samples t-test was performed on data using SPSS.

RESULTS AND DISCUSSION

It can be seen from Fig. 2 that milk biochemical components in this study are consistent with normal values for cows reported by Koneko and Cornelius[5]. Milk fat and sH were the highest in the winter and the lowest in the summer period.

The climatic conditions and lactation periods are known as seasonal changes which have influences on the milk composition and taste. Especially, there is a negative correlation between environmental temperature and the amount of milk fat and protein. Increased feeding frequency of low fiber, high grain diets increase milk fat levels. High temperature is an additional weather-induced condition which

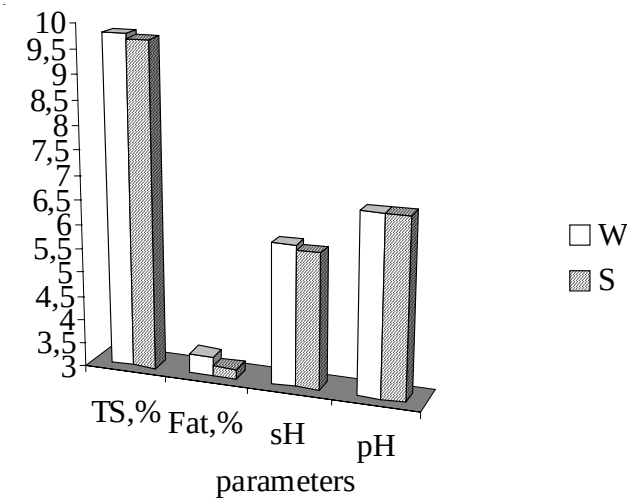

Fig. 2. Biochemical parameters for winter (W) and summer (S) periods

results in reduced feed intake and thus decreased energy availability. Again, reducing milk fat synthesis during such periods of energy insufficiency could alleviate the energy deficit and may even allow for a more efficient use of nutrients for synthesis of other milk components (*e.g.*, 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[6]. Milk fat is essential for the development of the correct flavour in milk products[1]. Milk fat contains high concentrations of short- and intermediate-chain fatty acids which, when liberated by lipolysis, contribute directly to milk flavour. In addition, 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[7], although in full-fat products, a certain proportion of bitter peptides, being hydrophobic, are less likely to be perceived as being bitter, perhaps due to their partition into the fat phase. The literature concerning bitterness in dairy products has been reviewed by Lemieux and Simard[8,9] and McSweeney *et al.*[10].

The milk acidity (sH) in winter period were tolerable for desired taste. The extra acidity value in milk is not desirable for flavour. Sourness is the undesirable taste that detects acidity.

It has been explained in The Turkish Food Regulation that the acidity of cows' milk is not more than 8 milk acidity (sH) (0.18 %). It can be seen from Fig. 2 that is higher than the normal value. However, Turkish dairy milk acidity values have changed between 4.20 milk acidity (sH) (0.09 %) and 12 milk acidity (sH) (0.27 %)[11].

A decrease in milk fat percentage for summer period can directly lead to taste loss. However the acidity (sH levels) in summer milks were more acceptable for consumer choice.

The most striking conclusion in our study was that the fat means in winter milks from machine milking were suitable for desired taste than summer milks', on the contrary the acidity (sH levels) in summer milks were more favourable for consumer preference. However, originally it was thought that milk flavour resulted from a single compound (such as either fat or milk acidity) or class of compounds[12,13] (both of fat and milk acidity).

There has been extensive research in recent decades into milk taste 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. Therefore, further research is needed to investigate on biochemical factors affecting taste of milks from machine milking.

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REFERENCES

1. P.L.H. McSweeney and M.J. Sousa, *Lait*, **80**, 293 (2000).
2. M. Cetin, M. Cimen, M. Dilmac, E. Ozgoz and M. Karaalp, *Asian J. Chem.*, **19**, 2135 (2007).
3. A.P. Chaudhary, O.S. Parmar and K.P. Singh, *Proc. 6th Wld. Cong. Genet. Appl. Livest. Prod.*, **25**, 11 (1998).
4. K.E. Hundrieser, R.M. Clark, R.G. Jensen and A.M. Ferris, *Nutr. Res.*, **4**, 21 (1984).
5. J.J. Koneko and C.E. Cornelius, Clinical Biochemistry of Domestic Animals, Academic Press, New York, edn. 3, pp. 41-376 (1980).
6. Anonymous, Australia New Zealand Food Authority, The 19th Australian Total Diet Survey, Canberra, Australian New Zealand Food Authority (2001).
7. J. Banks, D.D. Muir, E.Y. Brechany and A.J.R. Law, The Production of Low Fat Cheese, Proc. 3rd Cheese Symp., Moorepark, Fermoy, Co. Cork, Ireland, pp. 67-80 (1992).
8. L. Lemieux and R.E. Simard, *Lait*, **71**, 599 (1991).
9. L. Lemieux and R.E. Simard, *Lait*, **72**, 335 (1992).
10. P.L.H. McSweeney, H.E. Nursten and G. Urbach, in eds.: P.F. Fox, Flavours and Off-flavours in Milk and Dairy Products, Advanced Dairy Chemistry, Chapman and Hall, London, UK, edn. 2, Vol. 3, pp. 403-468 (1997).
11. A. Kurt, S. Cakmakci and A. Caglar, Guide of Inspection and Analysis Methods in Milk and Milk Products, Erzurum, p. 284 (2003).
12. A. Noomen, *Neth. Milk Dairy J.*, **37**, 229 (1983).
13. J.A. Ohren and S.L. Tuckey, *J. Dairy Sci.*, **52**, 598 (1967).

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