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Research Application Summary

Determination of milk components lost in whey during the manufacture of three cheese types

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Abstract

A small-scale farm in Harare processes soft goat cheese from goat milk and feta and gouda cheese from jersy cow milk. Milk constituents were measured in milk and as residual components in whey after processing cheese. Residual phosphorus and fat were significantly lower in soft goat cheese whey than gouda and feta ($P<0.05$) in that order while nitrogen was significantly higher in soft goat cheese whey than gouda and feta cheese ($P<0.05$) in that order. Whey from gouda cheese contains a balance of nutrients for beverage and livestock feed manufacture. Pre-treatment is required for all three whey types before discharge to the environment.

Key words: Cow milk, feta cheese, goat milk, gouda cheese, nutrients, soft goat cheese

Résumé

Une ferme de petite taille dans la ville d'Harare transforme le fromage mou de chèvre à partir du lait de chèvre et le fromage au lait de vache et le fromage friable à partir du lait de vache. Des constituants de lait ont été mesurés en lait et en tant que composants résiduels en lactosérum après avoir transformé le fromage. Le phosphore et la graisse résiduels étaient sensiblement inférieurs en lactosérum mou de fromage de chèvre que le fromage au lait de vache et le fromage friable ($P<0.05$) dans cet ordre tandis que l'azote était sensiblement plus haut dans le lactosérum mou de fromage de chèvre que le fromage au lait de vache et le fromage friable ($P<0.05$) dans cet ordre. Le lactosérum du fromage au lait de vache contient un équilibre des aliments pour la fabrication de nouriture de bétail et la boisson. Le traitement préparatoire est exigé pour tous les trois types de lactosérum avant la décharge dans l'environnement.

Mots clés: Lait de vache, fromage friable, lait de chèvre, fromage au lait de vache, aliments, fromage de chèvre mou

Background

The presence of milk and its components in dairy waste water is a sign of losses from the plant. Whey from cheese manufacture has potential for making various dairy products. Milk constituents contribute to the high organic load in the cheese whey which causes a threat to the environment and pose water treatment problems. This means that industry needs to be proactive and design cost effective methods of dealing with effluent generated from their operations. The objective of this study was to determine proportions of milk constituents lost in whey during the manufacture of soft goat cheese, gouda cheese and feta cheese in Harare, Zimbabwe.

Literature Summary

When milk is subjected to different cheese making processing conditions, different milk constituents react differently resulting in differences in their final compositions in the whey. The amount of these constituents is directly related to the composition of the milk that was used and is an indication of cheese yield (Emmons *et al.*, 1990). The method of processing can also result in differences in constituents lost (Mullan, 2006).

Cow and goat milk show different processing properties and this can be used to make products with variable properties and compositions. Attempts to use whey as a raw material for livestock feed and beverage manufacture is based on the nutritional composition of whey (Formigoni *et al.*, 2006; Goyal, 2009; Outinen, 2010).

Study Description

Milk from a small scale farm in Harare was measured before pasteurisation in a batch pasteuriser. Saanen goat milk was used to process soft goat cheese while jersey cow milk was used to make gouda and feta cheeses. Samples of milk and whey produced after each processing method were collected for analysis within 24 hours (APHA, 2005). Whey production data for individual operations cheese processing from the plant were obtained by hand sampling and was limited to one day per week for nine weeks.

Analyses were made for total suspended solids, total solids, fats oil and grease, lactose, total kjedhal nitrogen and total phosphorus (APHA, 2005). The pH was determined by a Crison GLP21 pH meter calibrated at pH 4.00 and 7.00 at 25^{o}C. Lactose analysis was done by spectrophotometry. Data were analysed using SAS version 9.1 (2004) using analysis of variance and lsmeans at 5% significance level.

Research Application

There were highly significant differences (P<0.001) for retained phosphorus, nitrogen, fats oils and grease, and significant differences for total suspended solids (P<0.01) while total solids and lactose did not show any significant difference among the three cheese types (data not shown). The pH for gouda and feta were the same but significantly lower for soft goat cheese (P<0.01) at 4.64.

Soft goat cheese whey contained the least amount of phosphorus being 26% less than gouda cheese whey and 36% less than feta cheese whey. The amount of nitrogen retained in whey was least in gouda cheese which was 14% less than feta cheese whey and 45% less in soft goat cheese. Fats oils and grease was high in feta cheese whey, being 4% higher than gouda cheese whey and 36% higher than soft goat cheese. The highest number of total solids was observed in soft goat cheese whey which was 1.85% higher than gouda cheese whey and 5.7% higher than feta cheese whey. Total suspended solids were high in gouda cheese whey being 48% higher than soft goat and feta cheese wheys.

Recommendation

Whey from feta and gouda cheese manufacture can be used for the manufacture of fermented beverages, buttermilk production and whey powders because of its high nutrient content. Goat milk whey contains less fat, total solids and phosphorus but more lactose, nitrogen and low pH, thus limiting its potential for beverage production. All the three types of whey require pre-treatment before they can be discharged to the environment.

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References

APHA, AWWA, WPCF, 2005. Standard methods for the examination of water and wastewater, 17th ed. Washington, DC.

Emmons, D.B., Ernstrom, C.A., Lacroix, C. and Verret, P. 1990. Predictive formulas for yield of cheese from compostion of Milk: A review. *Journal of Dairy Science* 73:1365-1394.

Formigoni A., Piva, A. and Pezzi, P. 2006. The influence of feeding fresh liquid whey on some blood metabolites, insulin and cecal fermentations of growing pigs. *Animal Feed Science and Technology* 131:52- 65.

Goyal, N. and Gandhi, D.N. 2009. Comparative analysis of Indian paneer and cheese whey for electrolyte whey drink. *World Journal of Dairy & Food Sciences* 4 (1):70-72

Mullan, W.M.A. 2006. Determination of theoretical yield and process efficiency for Cottage Cheese. Available from:http://www.dairyscience.info/cheese-yield/140-cottage-cheese.html . Accessed: 26 April, 2010.

Outinen, M. 2010. Effect of pre-treatment of cheese milk on the composition and characteristics of whey and whey products. PhD Thesis, Aalto University.