



Descriptive sensory profile of cow and buffalo milk Cheddar cheese prepared using indigenous cultures

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ABSTRACT

The objective of the study was to compare the sensory profile of Cheddar cheese prepared from cow and buffalo milk using indigenous and commercial cultures. Commercially available and locally isolated, indigenous starter cultures were used to prepare cow and buffalo milk Cheddar cheese. The cheese was ripened at 4 and 12°C and analyzed for descriptive sensory profile by a panel of 10 assessors after 60 and 120 d of ripening. On evaluation, the mean scores for odor, flavor, and texture attributes obtained for buffalo milk cheese were significantly higher than those obtained for cow milk cheese. For most of the traits, cheese samples prepared from indigenous cultures and ripened at higher temperature received higher descriptive scores compared with those of commercial cultures and ripened at lower degrees. Milk sources highly significantly affected the “creamy” and “sour” traits of odor; the “creamy,” “smoky,” and “soapy” flavors; and all the texture attributes except “maturity.” Starter cultures considerably influenced the production of “acidic,” “bitter,” “sweet,” and “sour” characteristics. The use of elevated ripening temperature showed noticeable effect on all the characteristics except the “creamy” odor and flavor. Principal component analysis and hierarchical cluster analysis also showed that milk sources, starter cultures, and ripening temperatures significantly influenced the sensory characteristics.

Key words: Cheddar cheese, cow milk, buffalo milk, sensory evaluation

INTRODUCTION

Starter cultures and milk composition are key factors affecting Cheddar cheese quality (Varnam and Sutherland, 1994). The starter cultures are used to promote acid development during curd manufacturing and also to confer distinct textural and flavor properties (Mc-

Sweeney and Sousa, 2000). Milk composition is influenced by species, breed, individuality, nutritional status, health, and stage of lactation of producing animals (Fox et al., 2000). Buffalo milk is rich in fat, lactose, caseins, calcium, magnesium, and phosphate compared with cow milk (Fundora et al., 2001; Ahmad et al., 2008) and, because of its chemical composition, it offers excellent opportunities for the development of different dairy products (Murtaza et al., 2008). Worldwide, Cheddar cheese is produced from cow milk, but buffalo milk ranks at the top in Pakistan’s milk production and is more suitable for cheese manufacturing (Murtaza et al., 2012).

Cheddar is a hard cheese that undergoes a complex series of chemical, bacterial, and enzymatic reactions during ripening (Singh et al., 2003; Farkye, 2004), which are responsible for the development of sensory characteristics that are typical of ripened cheese (Pollard et al., 2003; Smit et al., 2005; Azarnia et al., 2006).

Ripening of cheese is an expensive and time-consuming process (Law, 2001; Murtaza et al., 2012), influenced by altered ripening times (Fox, 1989), use of enzymes (Wilkinson, 1993), use of various starter cultures in different combinations (Lee et al., 1990), and various ripening temperatures (Rehman et al., 2000). Attempts to shorten the ripening time using a range of ripening systems have had varying degrees of success (Wilkinson, 1993; Law, 2001). The use of elevated ripening temperatures is technically the simplest strategy to accelerate cheese ripening but, in spite of being recognized as beneficial for many years, it is still not widely used commercially (Law, 2001; Hannon et al., 2005; Murtaza et al., 2012).

Assessment of the degree of ripening and various sensory characteristics is an important part of cheese quality evaluation and currently involves the use of trained sensory panelists or individuals (Downey et al., 2005). Grading and judging are used extensively for sensory evaluation of dairy products (Bodyfelt et al., 1988); a product is evaluated based on the presence or absence of specific attributes and on overall quality score. These quality scores are usually based on the opinions of one individual, and the quality score is subjective rather

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than specifically defined (Drake et al., 2005; Caspia et al., 2006).

The traditional approach to sensory analysis reveals little or no information on the complex flavor attributes of the cheese or what factors affect those attributes and does not enable direct comparisons between the results obtained from different studies. However, modern sensory techniques allow the key attributes of the cheese to be objectively determined and described (Hannon et al., 2005).

Descriptive evaluation by a panel of trained assessors is a modern technique for determining the sensory profile of a cheese and evaluating the influence of processing changes on individual sensory characteristics (Fox et al., 2000). It is a sophisticated sensory test method that creates a total sensory description of a product (Stone and Sidel, 1985). This methodology can be used to determine the effect of individual components on scores of descriptors of a complex product. Descriptive analysis has been used to study a variety of products, including cheese (Heisserer and Chambers, 1993). Omission testing removes one component at a time from a product, creating a series of samples, to estimate the effect of components on the attributes of the product (House and Acree, 2002).

Principal component analysis (PCA) and hierarchical cluster analysis (HCA) are forms of multivariate statistical analysis useful for studying correlation in a set of measurements of a given number of variables for a determined number of assessors. Multivariate methodology can be applied to reduce a large number of variables to a smaller subset. The techniques retain variables that contribute significantly to important components and discard those variables that contribute mainly to unimportant components (Hannon et al., 2005).

The study was designed with the objectives (1) to compare the sensory quality of cow and buffalo milk Cheddar cheese and (2) to assess the influence of commercially available and locally isolated starter cultures and elevated ripening temperature on descriptive sensory profile.

MATERIALS AND METHODS

Milk and Starter Cultures

Cow and buffalo milk samples were procured from a farmhouse (research herd), Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Pakistan. Milk samples were standardized at 4.0% fat level and analyzed for composition following the standard procedures of AOAC (1990). Commercially available (Chr. Hansen Ireland Ltd., Little Island,

Co. Cork, Ireland) and indigenous (locally isolated in Biotechnology Laboratory, National Institute of Food Science and Technology, University of Agriculture, Faisalabad, Pakistan) cultures of *Lactococcus lactis* ssp. *cremoris* and *Lactococcus lactis* ssp. *lactis* were used in combination at a ratio of 95:5.

Cheese Manufacturing and Ripening

Cheddar cheese was manufactured from cow and buffalo milks (3 samples from each, 50 L/sample) using commercially available and locally isolated starter cultures following the standard method described by Scott (1981). The cheese samples were ripened at 4 and 12°C for a total period of 120 d.

Descriptive Sensory Evaluation

Descriptive sensory evaluation was done for cheese samples after 60 and 120 d of ripening by a panel of 10 assessors drawn from faculty members and postgraduate students of National Institute of Food Science and Technology, University of Agriculture, Faisalabad, Pakistan, following the method detailed by Muir and Hunter (1992). The assessors were first trained (in 5 sessions) on different commercially available cheese samples and a descriptive sensory language was developed for different parameters (odor, flavor, and texture) of cheese. The cheese samples under study were then presented, in the form of cubes and slices, to be evaluated by the panelists at room temperature in a properly ventilated and well-lit sensory evaluation laboratory with individual cabins. Each panelist evaluated each sample 3 times and descriptive scores were awarded for different characteristics of each parameter within a total of 100. This evaluation scale was prepared by the assessors, after training sessions and discussions, and ranged from 1 to 100 for each parameter (odor, flavor and texture).

Statistical Analysis

Results obtained were statistically analyzed using ANOVA and the descriptive sensory scores were further subjected to PCA and HCA as described by Steel et al. (1997) to evaluate the influence of milk sources (cow and buffalo), starter cultures, and ripening temperatures on sensory quality of Cheddar cheese.

RESULTS AND DISCUSSION

Composition of Milk Samples

Milk samples from cow and buffalo standardized at 4.0% fat levels were analyzed for composition. The

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