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Journal of Agroalimentary Processes and Technologies 2009, *15*(2), 267-272

Journal of Agroalimentary Processes and Technologies

A study on sensory characteristics of a kefir type produced using starter cultures and brewer's yeast

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Abstract

The purpose of this work was to evaluate the sensory characteristics of a kefir type produced using starter cultures and brewer's yeast. Skim milk with 1.8% fat was inoculated with mesophilic starter cultures, a single strain yeast Debaryomyces hansenii and brewer's yeast, Saccharomyces cerevisiae, and was incubated at 30ºC and stored at 4ºC. Sensory analyse aims' were to evaluate and improve the product quality and to test consumers' preferences during storage. Kefir type product had a high acceptability and didn't evidence major quality defects.

Keywords: kefir, sensory characteristics, brewer's yeast, starter culture

1. Introduction

Kefir is an acid-alcoholic fermented milk, surrounded by mystery, history and tradition. It is believed by some that kefir originates from Russia, other claim that it originates from Turkey.

The most known legend has it that in the Caucasus Mountains the prophet Mohammed gave kefir grains to the orthodox. Kefir is a product manufactured by a starter culture prepared from kefir grains. The industrial manufacture of kefir using grains as the starter culture is very difficult due to the complexity of their microbiological composition, which varies widely depending on the origin of the grains and conditions of storage and handling [1,2]. At the same time, it is difficult to maintain the stability of the microbiological composition of the kefir grains over time, during the production of successive batches. The most reasonable approach for obtaining a quality product with consistent characteristics is to use defined strain starter cultures [3], which give the desired characteristics.

Throughout the world there is a huge variety of fermented milks made by mesophilic fermentation. Kefir and kefir products are such type of fermented product. The starter cultures consist of lactic acid bacteria and lactose fermenting and non-lactose fermenting yeasts growing in a strong relationship [4].

The characteristic flavor of kefir products is a result of a complex interaction between the milk matrix and compounds formed during the metabolic activity of the applied bacteria culture and especially the yeast culture. Kefir typically contains both ethanol and CO2. The content of CO2 and ethanol give kefir products a refreshing and sparkling sensation. The typical flavor of kefir is developed by the yeast strains in particular.

Mesophilic cultures are composed of several species of lactic acid bacteria of which each has a specific role in the formation of the final taste, texture and flavor [5]. The microorganisms in a mesophilic aromatic culture can be divided in two groups, acidifiers and aroma producers, based on their metabolic activity

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in the milk. The strains belonging to Lactococcus lactis subsp.lactis and L. lactis subsp. cremoris ferment lactose mainly into lactic acid, thus acidifying the milk.

These cultures are the dominating components of the starter cultures. In addition to the ability to acidify the milk certain strains of Lactococcus lactis subsp. cremoris produce exopolysaccharides (EPS-kefiran) that greatly affect the viscosity/texture of fermented milk products. Strains that belong to Lactococcus lactis subsp. Lactis biovar. diacetylactis (D) and Leuconostoc sp. (L) metabolise both lactose and citrate producing acetate, diacetyl, acetaldehyde, ethanol and carbon dioxide, contributing to the odor and flavour of the product [6].

Diacetyl is recognized as a compound contributing to the specific “buttery” flavor. In fresh products fermented by a mixed culture, diacetyl is present in low concentration, not more than 1-3 mg/l. Generally, this concentration gives a good flavor in fermented dairy products. Diacetyl is an unstable compound that is subjected to degradation to compounds with no aromatic properties [7]. Thus, the stability of diacetyl is one of the main causes of variability of fresh fermented products in terms of quality and shelf life.

Acetaldehyde is a flavour component desirable in yoghurt types, and gives "green-apple" or "fruity" flavour. In order to get a balanced flavour in mesophilic products where this flavour is normally not wanted, strains belonging to Leuconostoc species are commonly used as a component of the mixed mesophilic cultures.

The largest amount of ethanol is produced during the alcoholic fermentation of the yeast. Ethanol gives the characteristic alcoholic and sharp flavor of a kefir product.

Carbon dioxide formed during fermentation of milk originates in kefir products mainly from the alcoholic fermentation of the yeast, where sugar is degraded. By itself, CO2 is tasteless but it has an influence on taste and contributes to perceived freshness. Furthermore, it causes a sparkling/tingling effect, which is characteristic for the kefir products [8,9]. The formation of CO2 is desirable to a certain extent. Lack of CO2 causes a so-called flat flavor, but a surplus of CO2 or post-fermentative development of CO2 is undesirable, as it can cause packages to blow.

The objective of the research reported in this paper was to study the sensory characteristics of a kefir type product produced using starter cultures and brewer’s yeast.

2. Materials and Method

2. 1. Manufacturing kefir products

For this study three batches were manufactured in a pilot plant. Skimmed milk with 1.8% fat content was heated at 85-90°C for 30 min in a flash pasteurizer (plates heat exchanger), than was cooled to inoculation temperature 30°C and freeze-dried commercial starter cultures were added. The DVS starter culture contained the following microbial species in unknown proportions: *Lactococcus lactis* subsp. *lactis, Lactococcus lactis* subsp. *cremoris, Lactococcus lactis* subsp. *lactis,*biovar *diacetylactis, Leuconostoc mesenteroides* subsp.*cremoris*. The second starter culture contained a single yeast strain of *Debaryomyces hansenii.* The yeast culture may be used to provide a balanced flavour and medium to high levels of CO_2 formation in kefir type products. In two batches was added brewer’s yeast, *Saccharomyces cerevisiae*, which was drawn from beer’s second fermentation process and the yeast’s sludge was filtrated and centrifuged. The yeast’s inoculation level was 0.05-0.1% up to the milk quantity. After this cultures were added, the milk was agitated for 15 min and then distributed in packaging plastic glasses, each of which was sealed with a metal screw lid and then incubated in a thermostatically controlled chamber at 29-30°C for 12 hours. The acidification and coagulation process took place in the packaging cups and then these cups were cooled. Cooling is used to control the metabolic activity of the starter cultures. Cooling of the kefir commences directly the primary objective of the initial cooling step where the product is cooled as quickly as possible from incubation to below 25°C_is to control the final acidity of the product. Finally the product is cooled slowly in the refrigerated storage room at 4~6°C.

Following this technological steps there were prepared three different kefir type products by adding:

1. Mesophilic culture and brewer's yeast
2. Mesophilic culture and kefir's yeast
3. Mesophilic culture, kefir's yeast and brewer's yeast

2.2. Sensory analysis

All samples were evaluated by 10 assessors, untrained panellists between the ages of 20-55 from the faculty, staff and students in the Food Science and Technology Department, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine from Cluj-Napoca. Attributes recognized by the sensory panel as describing the sensory properties of the kefir products were: color, taste, odor, flavour, aspect and texture [10]. It was applyed four tests: triangle test, hedonic test, score test and sensory profiling test. The aims of these tests were:

- triangle test- to identify the differences between samples;
- hedonic test – to evaluate the acceptability and identify the favourite product;
- score test – to evaluate sensory characteristics;
- sensory profiling test- to describe the product's flavour.

The subjects received a tray with a score sheet, a napkin, a pencil, a cup of room temperature water, an empty cup to expectorate into, and three cold 15 mL samples (5-8°C) served in 220 ml plastic cups. Each subject received two sets of three coded and randomised samples, and were asked to follow the sheet's instructions. The hedonic test, the score test and the sensory profiling test were applied during the shelf life of products. From each batch of kefir type product, samples were taken at 24h, 7 days and 14 days of storage period.

3. Results and discusion

The test demonstrated that there are significant differences between samples, which contained brewer's yeast in composition, and the control. The control was the sample obtained by adding only mesophilic culture and kefir's yeast (Debaryomyces hansenii). From the ten panelists, seven respective eight have indicated that the different samples were those with brewer's yeast.

The hedonic test demonstrated that in the first period of storage, kefir type products with brewer's yeast had a high acceptability and didn't evidence major quality defects. But the product's acceptability decreases to the end of the period. (Figure 1)

The hedonic scale has 9 levels: the first four levels (1-4) show the positive sensations and the last four (6-9) show the negative sensations.

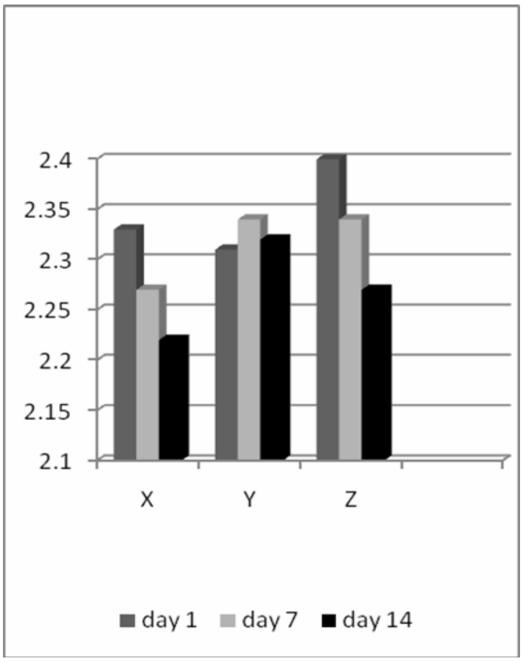

Figure 1. The product's acceptability variation in the 1th, 7th and 14th day of shelf life; X and Z are kefir type products with brewer's yeast

The total medium score was obtained by totalizing the scores for all sensory characteristics (colour, consistence, odour, taste and flavour) during the shelf life. The biggest value of total medium score belongs to the control product which was manufacturated by adding lactic culture and *Debaryomyces hansenii* yeast (47.798).

The kefir type products, with brewer's yeast, have obtained total medium scores close to the control: 47,398 and 46.598; the last value belongs to the kefir type product which contained both yeasts strains (*Debaryomyces hansenii* and *Saccharomyces cerevisiae)* (Figure 3).

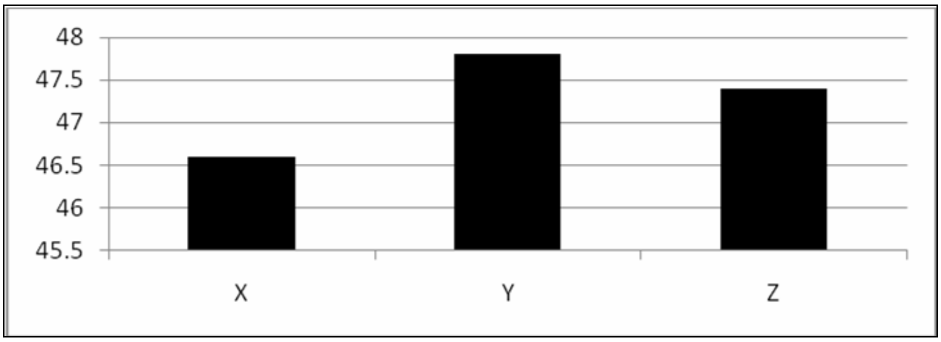

Figure 2. The total medium score for sensory characteristics during shelf-life; X and Z are kefir type products with brewer's yeast

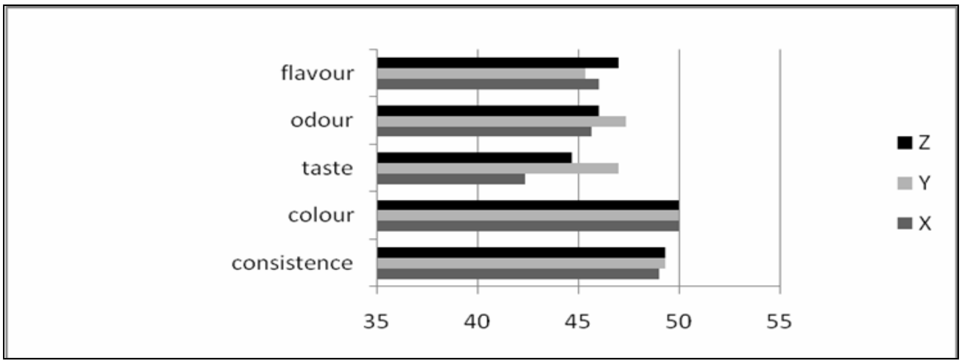

Figure 3. Corelation of sensory attributes with acceptability

Table 1. Odour, taste attribute values in kefir samples in 7th day of shelf-life

Odour	Total score			Taste	Total score		
	S1	S2	S3		S1	S2	S3
sour	10	12	11	sweet	15	0	16
fruity	3	3	3	sour	9	15	8
buttery	5	4	5	sparkling	2	2	2
yeasty	2	0	2	fruity	2	2	2
alcoholic notes	0	0	1	Buttery (milky)	5	4	5
fermented	0	0	2	Yeasty (bread-like)	5	1	5

The yeasty taste was identified in the two samples with brewer's yeast but at low levels, probably because the panel group was untrained. The fruity taste, due to acetaldehyde, was identified in all samples but only by a few of the panelists (Figure 5). The panel group identified the sparkling taste, due to carbon dioxide, at the same level, in all samples. This situation demonstrated that the alcoholic fermentation didn't exceed the proposed limit not even during the storage period. In addition, the blow up of packages didn't appear. The results for the kefir type product made by adding mesophilic culture, kefir's yeast and brewer's yeast indicated a good acceptability in the first days of storage and a flavour profile significantly different (Figure 6). The correlations of the different sensory attributes with acceptability indicated that the panel group was positively influenced by buttery taste, buttery odor, consistence and color. The results for certain sensory characteristics agreed with the results reported by, who studied the sensory profiles of various fermented dairy products, including kefir.It therefore appears that the panelists preferred kefir with pronounced buttery taste and odor and a certain viscosity level.

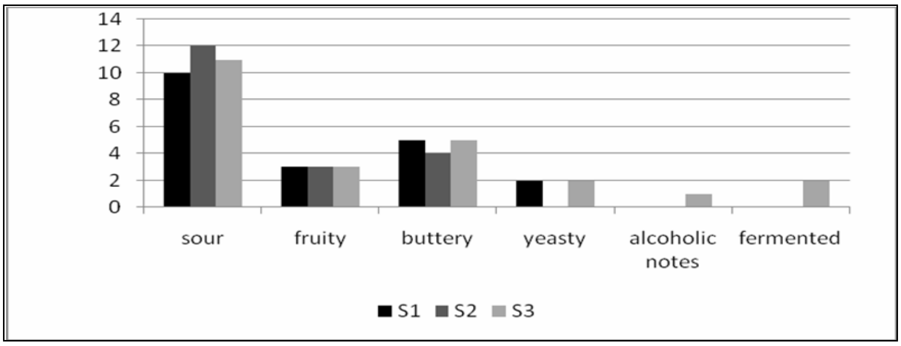

Figure 4. Comparative odour profile in samples

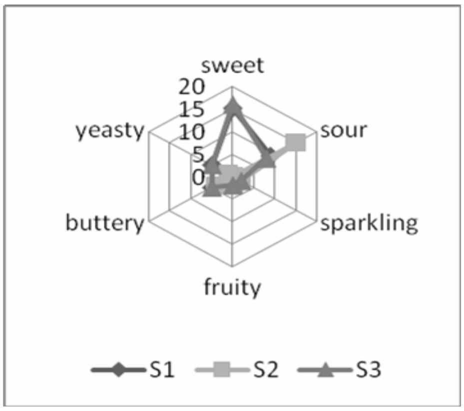

Figure 5. Comparative taste profile in samples

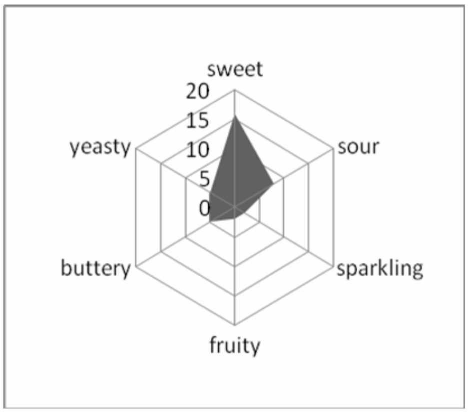

Figure 6. Flavour profile of a kefir type product with brewer's yeast in composition

4. Conclusions

Sensory analysis techniques have developed into powerful tools for understanding how appearance, flavour and consistence attributes of dairy products drive consumer preferences. Modern sensory techniques can help dairy processors to develop new products that are highly appealing to consumers. They also enable processors to optimize a product's flavour, consistence and color to attract specific target audiences as well as accurately monitor product quality. The sensory analysis of kefir type products produced using starter cultures and brewer's yeast revealed that this products could be considered different towards a traditional kefir. Product has the best acceptability level in the first days of storage. The flavour of these kefir type products was more appreciated than a traditional kefir. Nevertheless, the samples were acceptable until the ten's day of storage. The sensitive qualities of this kefir type product must be monitored and improved by correlating the chemical composition with its flavour, so with the aromatic compounds.

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