Sensory Properties of traditionally-fermented buttermilk (*Omashikwa*) processed in Namibia.

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Abstract

An investigation was carried out to test the hypothesis that the main problems of traditionally-fermented milk products processed in the rural setup are based on variable sensory quality, hygiene and unattractive presentation to consumers. Sensory evaluation scores of 9 samples of traditional fermented buttermilk and control buttermilk from ten panelists for appearance, smell, taste and consistency on a 5-point hedonic scale were subjected to analysis of variance (ANOVA) to judge whether or not differences existed for various characteristics ($p<0.05$ and $p<0.01$). Those which showed differences between the means were subjected to Duncan's Multiple Range Test. The results showed that the means of control samples differed significantly from other means and scored the highest points in all characteristics. The control samples were then considered superior.

Introduction

Most rural women in Namibia and elsewhere in Africa depend on agriculture for household food security and for income generation in order to sustain their family livelihood. Apart from growing vegetables, cereals and raising livestock, fermented milk products are widely used for nutrition and household income generation. In Africa, Asia and Europe, fermented milk is known to be more stable and beneficial to people than fresh milk. Apart from its medicinal, cosmetic and other usage, sour milk has been developed mainly as a means of providing a variety of foods and of preserving it against spoilage (Van den Berg, 1985).

Omashikwa (traditional fermented buttermilk) is one of the most popular sour milk product processed in the rural areas of *(Owamboland)* northern Namibia for quenching thirst or as a condiment for use with stiff porridge *(Oshifima or Oshithima)*, or for mixing with gruel and for income generation.

Processing is based on rural household technology. This involves accumulating milk in a gourd (or other containers), allowing it to ferment naturally for 3-4 days in the presence of *Omunkunzi* roots (*Boscia albitrunca*) and agitation (2-3 h) to churn into butter. Butter is used for household cooking and for marketing in the rural open market. The sour buttermilk *(Omashikwa)* is the main product for the family and for income. The product has a composition of 3.28% crude protein, 1.6% fat, 89.8% moisture, 0.76% ash, 4.56% lactose, 10.2% total solids (TS), 8.6% solids-not-fat (SNF) with a pH of 3.25 and no whey separation (Bille *et al* 2002).

Processing of fermented milks in Africa has been described previously by Shalo and Hansen (1973), O'Mahony and Peters (1987) and Shalo, (1987). The use of smoking of the vessels used in the storage of fermented milk by various pastoral and agro-pastoral communities in the region is with very few exceptions, the commonest feature. A limited names of plant materials and roots placed directly in the milk, including grass, shrubs and hardwoods used for smoke treatment of milk utensils by various communities in the southern and eastern Africa, are known (Shalo, 1987). The general processing method for fermented milk in southern and eastern Africa is to filter the milk into a clay pot or gourd either smoked or unsmoked and transfer the vessel to a warm place, with or without plant roots, until it has soured. Fresh batches of milk may be added each day with or without previous removal of whey until the gourd or clay pot is full. The sour milk is then consumed at the household level or sold or exchanged for grains (Kervin, 1987).

The main problems in the production of spontaneous fermented milk products in the rural setup in tropical Africa are of technology, hygiene, variable sensory quality, short shelf life and unattractive presentation of products in general (Nout, 1985). The objectives of this study are therefore to investigate the problems of sensory quality; appearance, taste, smell and consistency and design methods for their improvement.

Materials and methods

Materials

Nine samples each of fermented buttermilk *(Omashikwa)* and fresh raw milk were collected from northern Namibia, *(Owamboland)* for sensory evaluation and for production of control fermented buttermilk. The samples were collected in 250 ml sterile screw-capped bottles and 5 l sterile plastic bottles and were transported in a cool box at 5–7°C to Neudamm laboratory for analyses and for production of control product, respectively.

Nine samples of *Boscia albitrunca* roots (*Omunkunzi*) were also collected from the same site and transported to Neudamm, in the Department of Food Science and Technology for use in the processing of control product for comparison purposes.

Methods

Processing of control Omashikwa

Control fermented buttermilk were processed using the rural household technology but following modern methods of unit operations and general manufacturing practices of milk by filtration, heat treatment at 65°C for 30 min, cooling to inoculation temperature (25°C) in ice- water bath, inoculation with 2% natural culture from good quality *Omashikwa* and addition of 20-25 pieces of *Omunkunzi* (each 2 cubic cm) per 20 l milk, mixed and incubated at this temperature undisturbed for 2-3 days or until coagulated. Instead of churning to remove butter, cream was scooped off and the remaining buttermilk was gently stirred to mix. Samples were taken at this stage for sensory evaluation.

Sensory evaluation

A panel of 10 judges familiar with *Omashikwa* and sensory evaluation, from the Department of Food Science and Technology, University of Namibia was constituted and used to evaluate both traditional and control *Omashikwa* samples,. The panelists were asked to score for appearance, smell, taste and for consistency of the products on a 5-point hedonic scale, ranging from 5-1, where 1 is poor quality, 3 is medium quality and 5 is top quality.

Statistical analysis

Analysis of variance (ANOVA) was performed on all data collected. Mean comparisons of both samples were carried out by Duncan's Multiple Range Test (Lea, *et al* 1997).

Results and discussions

Sensory evaluation

Table 1 shows the results of sensory evaluation of the products. Sensory evaluation scores of both products were fairly good but there were significant differences ($p<0.05$ and $p<0.01$) between the traditional *omashikwa* and Control in sensory evaluation. Independent comments given by the judges showed preference to the control *omashikwa* (CO) which was highly viscous with mild lactic acid taste and without filth, another parameter which revealed itself during the course of sensory evaluation. Rancid flavour which was also mentioned in TO by judges was most probably contributed by disruption of fat globules by churning during butter making. This was not experienced in CO samples. Both products tasted, had a bitter flavour of the roots which is peculiar and unique compared to other fermented milk products in the rural Namibia (Bille *et al,* 2002). The higher acidity flavour in TO was most probably caused by incubation temperature which was higher in TO as was incubated at the ambient temperatures ranging from 27-36°C at the time of experiment and the period of fermentation, 3-4 days.

The main variables which were responsible for variations within the samples for each of the quality characteristics; appearance, smell, taste and consistency studied were: samples location, replicates, panelists and random error. Interactions were not considered.

Products characteristics

The sensory evaluation scores from the 10 panelists for the products sensory characteristics were subjected to analysis of variance (ANOVA) to judge whether or not differences existed in the samples for the various characteristics at $p<0.05$ and $p<0.01$. Where differences existed, the means were subjected to Duncan's Multiple Range Test (DMRT) in order to separate the differing means. The scale of assessment was then referred to. Where the differing means were greater than the average quality, the samples were then considered to be superior than those with means below the average. The summaries of the sensory evaluation results are shown in **Tables 2-5** below.

From the ANOVA it was observed and concluded that F- calculated for the samples was greater than F-tabulated at $P<0.005$ and $P<0.01$. Therefore the samples were significantly different in their appearance at both levels of significance. Thus it was necessary to perform DMRT to differenctiate the means that differ from those that do not differ, and it was found that the Control sample differed significantly from the means at both levels of significance. The control scored highest sensory values for apperance, hence the control was superior. The other samples from TO did no differ significantly amongst themselves as shown by F-values, as calculated F-values for the sample replicates and panelists were lower than F-tabulated at $p<0.05$ and $p<0.01$.

In the case of Smell **(Table 3)**, the samples differed significantly at both levels of significance because the calculated F-value was greater than the

Table 1. Summary of sensory evaluation scores for 9 batches of traditional (TO) and control (CO) Omashikwa.

Attributes	TO		EO	
	Mean	SD	Mean	SD
Appearance	2.8	0.17	4.0	0.30
Smell	2.6	0.10	3.7	0.27
Taste	2.6	0.21	4.0	0.27
Consistency	2.7	0.20	3.7	0.52

A 5-point Hedonic Scale was used: 1 - poor quality; 3 - medium quality; 5 – top quality.
SD Standard deviation from the mean.

Table 2. Analysis of variance for Appearance

Source of Variations	Degree of freedom (DF)	Sum of square (SS)	Mean Sum of Squares (MSS)	F		
				Calculated	Fp = 0.05	Fp = 0.01
1 Samples	4 – 1 = 3	35.492	11.831	21.003	3.95	2.6
2 Replicates	3 – 1 = 2	0.05	0.025	0.0444	4.79	3.0
3 Panelists	10 – 1 = 9	7.742	0.8602	1.527	2.56	1.88
4 Random Error	120 – 1 = 119	67.031	0.5633			

Table 3. Analysis of variance for Smell

Source of Variations	DF	SS	MSS	F		
				Calculated	Fp = 0.05	Fp = 0.01
1 Samples	3	26.067	8.689	14.0598	3.95	3.36
2 Replicates	2	0.35	0.175	0.283	4.79	2.80
3 Panelists	9	2.80	0.311	0.503	2.56	4.47
4 Random Error	119	23.583	0.618			

Table 4. Analysis of variance for Taste

Source of Variations	DF	SS	MSS	F		
				Calculated	Fp = 0.05	Fp = 0.01
1 Samples	3	50.092	16.697	38.3839	3.95	3.36
2 Replicates	2	0.350	0.175	0.4023	4.79	2.80
3 Panelists	9	4.075	0.444	1.0207	2.50	4.47
4 Random Error	199	51.808	0.435			

Table 5. Analysis of variance for consistency.

Source of Variations	DF	SS	MSS	F		
				Calculated	Fp = 0.05	Fp = 0.01
1 Samples	3	22.670	7.522	10.4313	3.95	3.36
2 Replicates	2	0.017	0.0085	0.0118	4.79	2.80
3 Panelists	9	4.667	0.5186	0.7192	2.56	4.4
4 Random Error	199	85.813	0.7211			

tabulated F-values. However, the panelists and the replicates did not differ significantly as their calculated F-values were smaller than the tabulated F-values at both levels of significance. In terms of scores, the control samples obtained highest points. When Duncan's Multiple Range Test (DMRT) was performed, it was found that the control differed significantly from other means at both levels of significance and the control was therefore considered superior.

Table 4 shows the results for Taste. The results with regards to taste are similar and arrived at the same conclusion as in the previous two characteristics in Tables 2 and 3 that control sample was still superior.

Table 5 indicate the results for consistency. A similar conclusion was drawn or arrived at as in the previous cases for appearance, smell and taste, although the sensory property in reference is consistency.

Conclusion

Omashikwa is a common fermented buttermilk in the rural areas of the northern Namibia as a substitute for traditional veld vegetables, beans or meat for nutrition and income generation for the rural women and children. However, this research found that it is not as popular as one would like to think due to its sensory quality fluctuations in terms of acidity, consistency, syneresis, off flavours, short shelf life and most of the times it contains a lot of extraneous filth picked up from dirty and dusty environment. This study agrees with Nout (1985), that traditional fermented milks have a lot to improve on in order to attract consumers in the rural and in the peri-urban areas. These problems arise from contamination with a variety of microflora, high and variable incubation and storage temperatures, poor hygiene, sanitation, heat treatment and the problem of handling. All these parameters require knowledge of technology, microbiology and handling including HACCP concept (Moertimore and Wallace, 1998) which should be provided by extension personnel in the field of agriculture.

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