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Full Length Research Paper

Effect of biological and chemical preservatives on the shelf life of West African soft cheese

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The effect of biological extracts on the storage qualities of West African soft cheese was evaluated in a completely randomized design model within a 15-day period. The control and the treated cheeses were stored under ambient temperature and assessed for the pH, titrable acidity, moisture content and crude protein. The pH and titrable acidity rose (P<0.05) with ginger extract preservant. The crude protein and moisture content were increased (P<0.05) by preservation. The ginger extract was found to be the most effective method of reducing microbial load, followed closely by the garlic extract. The ginger extract treatment extended the shelf life of cheese for 15 days. Treatment of West African soft cheese with ginger extract may not markedly alter the nutritional quality but appeared promising as it has a preservative property.

Key words: West African soft cheese, biological and chemical extracts, storage qualities.

INTRODUCTION

In herding families, only the children, pregnant women and the elderly drink milk regularly while others get milk only on rare occasions due to transportation problem or/and poor keeping quality of milk if not processed. In Nigeria, the Fulani pastoralists process surplus fresh milk into various stable products like West African soft cheese *(Warankasi*), *Nono* (fermented skimmed milk) and *Mai- shanu*. The West African soft cheese which is the typical type of cheese found in Nigeria has a shelf life of 2-3 days when immersed in the whey. Various preservation methods are well documented in literature (Aworth and Egounlety, 1985; Anon, 1995; Joseph and Akinyosoye, 1997). The use of 0.8% proponic acid and 0.8% sodium benzoate in the preservation of cheese for 8 days have been reported by Joseph and Akinyosoye (1997). These authors also used colourant (Red Sorghum extract) to preserve the West African soft cheese. The thrust of this study was to evaluate the potential of ginger as a preservative and compare its efficacy with other extracts and chemical preservative on the storage quality of West African soft cheese.

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MATERIALS AND METHODS

Cheese Preparation and Sampling

The West African soft cheese was prepared by coagulating fresh milk by using vegetable rennet extract of the Sodom apple *(Calotropis procera*) which is found abundantly in the tropics and sub-tropics. The mudar plant contains the enzyme, Calotropin which curdles the milk (Belewu and Aina, 2000). The extract was obtained by crushing the leaves and stems of *C. procera* plant which was later rinsed in a calabash with the milk. The mixture of milk and the juice of *C. procera* was strained into warm milk with constant stirring and heating. Coagulation starts within 15-20 min after the addition of the coagulant. The curd was boiled for 20 min to inactive the plant enzyme and facilitates whey expulsion. The curd was then strained through a sieve (a small conical raffia basket which facilitate whey drainage and give a characteristic shape and size to the cheese). The cheese has similar consistency as Mozzarella. About 5 litre of milk was used to produce 1 kg of cheese (Kees, 1995) and the whole process took one to two hours.

Based on the results of Joseph and Akinyosoye (1997) proponic acid and sodium benzoate (with a keeping quality of 8 days) were used as the chemical preservative, while untreated cheese kept in the whey was the control group. Boiled cheese alone, and those treated with sorghum extract, garlic extract and ginger extract were

Table 1. Proximate analysis of West African soft cheese treated with chemical and biological preservatives.

Parameters (%)	Control	Boiled cheese alone	Sorghum extract	Garlic extract	Ginger extract	Proponic acid	Sodium benzoate	SEM
Moisture	62.30	60.25	61.40	62.15	60.27	62.49	64.23	3.60NS
Crude Protein	8.30	12.00	14.25	20.14	20.15	15.11	15.01	2.23*
PH	6.50	6.30	6.20	6.20	6.10	5.50	5.20	1.15NS
Titrable acidity	0.20	0.25	0.26	0.26	0.27	0.28	0.29	0.32NS

*Significant at (P<0.05).
NS, not significant (P>0.05).

evaluated. The treated and untreated samples were stored in beaker at ambient temperature while relative humidity was determined daily at 8.00, 11.00 16.00 and 18.00 hours.

The chemical composition in the cheese was determined every three days while the pH was measured with one part of the cheese and nine part of distilled water (w/v) and the titrable acidity was determined with 0.1 M NaOH using phenolphthalein as an indicator (Pearson, 1970) and expressed as percentage lactic acid.

Microbiology evaluation

The total viable bacterial counts were determined on plate count agar consisting of peptone (Difco) 5 g, peptone (Evans) 5 g, meat extract (Oxoid Lab Lemico) 19 g, NaCl 5 g, agar (Davis) 15 g, tap water 1000 ml. Potato dextrose agar (PDA) was used for the determination of fungi isolated from the samples after 15 of storage. Pure culture of each bacterium and fungi was obtained, identified and characterized using Collins and Lyne (1970), Buchanan and Gibbon (1974), Harrigan and McCane (1976) and Alexopouos and Mims (1970) methods.

RESULTS AND DISCUSSION

Table 1 shows the effect of chemical and biological treatment on the proximate composition of West African soft cheese stored for a 15-day period indicating no significant differences among the samples. However, there was a gradual decrease in the moisture content. The pH of the biological treated samples showed an increasing trend. The titrable acidity was similar in the biological and chemically treated samples.

With the exception of the samples treated with garlic and ginger extracts, the crude protein content decreased significantly. in samples treated with chemical and some biological treated samples. The reduction in the protein content could probably be due to the breakdown of protein by proteolytic organism in the extracts (Aworth and Egounlety, 1985). While the non-reduction in the protein content of the garlic and ginger extracts treated samples may be due, probably, to the antioxidant properties of the extracts. This is supported by the observation of Kikuzaki et al. (1994) that most of the isolated compounds from ginger exhibited stronger antioxidant effect than alpha-tocopherol (vitamin E). There is also non-reduction of lipid (ether extract) content of the samples treated with garlic and ginger. (1992).Our finding is similar to the report of Reddy and Lokesh that ginger inhibits lipid oxidation and scavenges super-oxide anions (Krishnakantha and Lokesh, 1999).

Fungal and bacterial growth was observed in the control and other samples treated chemically and biologically, except those samples treated with ginger and garlic extracts Tables 2 and 3. The extended shelf life of samples treated with ginger extract could be due probably to the antioxidant property of ginger extract. Similar observations have been reported by Lee et al. (1986) when ginger extract was added to meat products. The poor growth of both Gram-negative and Gram-positive bacterial strains (*Esherichia coli, Proteus vulgaris, Salmonella typhimurium*, *Staphylococcus aureus* and *Streptococcus viridens*) may be attributed to the gingerol and shogaol components of ginger (Wilkinson, 2003). The extracts of ginger (Schulick, 1993) could have an anti-fungal, anti-histamine and anti-bacterial effect on the samples used in this study.

Similarly, the garlic extract inhibits the growth of some bacterial strains like *E. coli, S. aureus and Samonella* spp. This action may be due probably to the anti-microbial properties of garlic extract. The anti-microbial properties are caused by the presence of active ingredients (allicin and cinnamaldehyde) present in garlic extract. However, allicin which is sulphur-containing anti-microbial ingredient appears to be effective against the aforementioned microbes while lactic acid organism *(L. acidophilus*) are unaffected by the garlic extract (Mercola, 2003).

0.8% proponic acid and 0.8% sodium benzoate extended the shelf life of the samples till the 9th day of storage while control sample got spoilt on the 2nd day. Boiling alone and sorghum extracts preserved the samples till the 4th day of storage. These findings agreed with the report of Joseph and Akinyosoye (1997). Additionally, the results obtained in this study for the control cheese supports the observations of Jay (1978) that yeast, mould and bacterial strains spoil cottage cheese easily.

The cost and return analysis showed that variable cost dominated the production and storage costs, accounting for 97.79% of the total cost of production. Among the

Table 2. Fungi isolated from West African soft cheese subjected to biological and chemical treatments.

Treatments	*Aspergillus flavus*	*Aspergillus niger*	*Rhizopus* spp.	*Penicillin* spp.	*Mucor racemosus*
Cheese in whey (control)	+	+	+	+	+
Cheese boiled alone	-	+	+	+	-
Cheese boiled with sorghum extract	+	+	+	+	+
Cheese boiled with garlic extract	-	-	-	-	-
Cheese boiled with ginger extract	-	-	-	-	-
Cheese plus 0.08% proponic acid	-	+	-	-	-
Cheese plus 0.08% sodium benzoate	-	+	-	-	-

-: Inhibition
+: No inhibition

Table 3. Bacterial strains isolated from West African soft cheese subjected to biological and chemical treatments.

Treatments	*E. coli*	*P. vulgaris*	*S. typhimurim*	*S. aureus*	*Streptococcus* sp.	*Lactobacillus acidophillus*
Cheese in whey (control)	+	+	+	+	+	+
Cheese boiled alone	+	+	+	+	+	+
Cheese boiled with sorghum extract	+	+	+	+	+	+
Cheese boiled with garlic extract	-	-	-	+	+	+
Cheese boiled with ginger extract	-	-	-	-	+	+
Cheese boiled with 0.8% proponic acid	+	-	-	-	-	-
Cheese boiled with 0.8% sodium benzoate	+	-	-	-	-	-

Note : -inhibition
+ no inhibition

variable cost items, the most costly in this study was the chemical used for the preservation (68.44%). The availability and the cost of purchasing the chemicals are factors militating against chemical preservative of cheese (Baba et al., 2004).

It can be concluded from this study that dipping or boiling of West African soft cheese with ginger and/or garlic extract in is a quite promising preservation technique. Additionally, this new methods will enable the farmers, traders and those concern in the business to regulate supply and transport the product to markets where prices are more favourable.

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REFERENCES

Alexopoulos CJ, Mims CW (1979). Introductory Mycology. 3rd edn. John Wiley and sons, London.
Anon (1995).Provide title please Curds and Whey. Spore 55: 1-4.
Aworh OC, Egounlety M (1985). Preservation of West African soft cheese by chemical treatment. J. Dairy Res. 52: 189-195.
Baba KM, Orire AO, Suleiman, H W (2004). Profitability of cheese production and marketing among rural women in Moro local Government area of Kwara state. Proc. Of the 29th Annual Conf. Nig. Soc. Anim. Prod. Vol. 29: 374-377.
Belewu MA, Aina (2000). Microbial evaluation of indigenous milk products with special reference to the bacterial flora of public health importance in Nigeria. Afr. J. Exp. Microbial. 1 (1): 13-19.
Buchanan RE, Gibbons NE (1974). Bergey's Manual of Determin. Bacteriol. 8th edn. Williams and Wilkings Co. Baltimore, MD. pp.???
Collins CH, Lyne PM (1970).Microbiology Methods. 3rd edn. Butterworth, London.
Harrigan WF, McCane ME(1976). Laboratory Methods in Food and Dairy Microbiology, London.
Jay JM (1978). Modern Food Microbiology . 2nd edn. D. Van Nostrand Company, NY.
Joseph JK, Akinyosoye FA (1997). Comparative studies on Red Sorghum Extract and Other chemicals as preservatives for West African soft cheese. Int. Dairy J. 193-198.
Kikuzaki H, Kawasaki Y, Nakatani N (1994). Structure of antioxidative compoundsin ginger. Acs-symp-ser. Washington DC. Am. Chem Soc. (547): 237-243.
Krishnakantha TP, Lokesh BR (1993). Scavenging of superoxide anions by spice principle. Indian J. Biochem. Biophys. 30 (2): 133-134.
Lee YB, Kim YS, Ashimore CR (1986). Antioxidant property of ginger rhizome and its application to meat products. J. Food Sci. 51(1): 20-23, 22 ref.

Mascola N, Jain R, Jain SC, Capasso F (1989). Ethnopharmacologic investigation of ginger (*Zingiber officinale*). J. Ethnopharmacol. 27(1-2): 129-140. (Nov 1989).
Mercola J (2003). Raw garlic for parasites and viral infections. Archive: 2003.
Pearson D (1970). The chemical analysis of Food, 6th edn. Churchhill. Livingstone Edinburgh. pp. ???
Reddy AC, lokesh BR (1992). Studies on spice principle as antioxidant in the inhibition of lipid oxidation of rat liver microsomes. Mol. Cell. Biochem. 111(1-2): 117-124.
Schulick PI (1993). Common spice and Wonder drug? Ginger. Herbal Free Press Brattleboro, Vermont. USA.
Wilkinson JM (2003). Ginger: A Review of its Medicinal Uses. School Of Biomedical Sciences, Charles Sturt University , Wagga wagga , NSW. p. 267.