

APR -32

Assessment of Physicochemical, Microbial and Sensory Characteristics of Fresh White and Red Sorghum Extract Preserved West African Soft Cheese Retailed in Ogbomoso, South-Western Nigeria

G.O. Tona¹, G.A. Ibhaze², A.O. Ajala¹, A.O. Babatunde¹ and T. Adedokun¹

¹Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria; ²Department of Animal Production and Health, Federal University of Technology, Akure, Ondo State, Nigeria

Corresponding author: G.O. Tona; E-mail: gotona@lautech.edu.ng

Abstract

The physicochemical, microbiological and sensory properties of fresh white and fresh red sorghum extract preserved West African soft cheese were investigated. It was found that the fresh red sorghum extract preserved soft cheese had higher ($p < 0.05$) nutrient contents (17.23% protein, 14.10% fat and 1.67% ash) than the fresh white soft cheese, which had 16.57% protein, 13.57% fat and 1.57% ash. The fresh white soft cheese had higher total viable bacterial counts (7.7×10^4 cfu/ml) and higher total fungal counts (4.2×10^4 cfu/ml). While the fresh red sorghum extract preserved soft cheese had lower values of 3.1×10^4 cfu/ml (total bacterial counts) and 9.6×10^2 cfu/ml (total fungal counts). The microorganisms isolated were *Bacillus species*, *Pseudomonas species*, *Aspergillus species* and *Penicillium species*. The microbial load in the two types of soft cheese isolated fall within the acceptable recommendation of the European Commission standards (2004/24/EC and 852/2004/EC) for retailed cheese (between 10^2 to $< 10^5$ cfu/g). Mean scores recorded for the sensory attributes were all very high and ranged between 6.42 and 8.67 on a nine point hedonic scale. It can be concluded that the fresh red sorghum extract preserved soft cheese had higher nutrient contents, lower microbial counts but lesser sensory quality levels than the fresh white soft cheese.

Keywords: Wara, physicochemical, microbiological, organoleptic, qualities

Introduction

The West African soft cheese is an unripened cheese consumed in several West African countries such as Nigeria. It is mostly prepared from indigenous cow milk by the process of enzymatic or acidic coagulation of the milk. The two major types of soft cheese produced in South-Western Nigeria are the white West African soft cheese and the red sorghum extract preserved West African soft cheese. These are usually retailed in the cooked or fried form and have been reported to be rich in nutrients such as protein, fat, lactose and minerals (Tona *et al.*, 2013). Islam *et al.* (2009) stated that milk and milk products are highly susceptible to a variety of micro-organisms due to their high nutritive value. Other researchers (Adetunji *et al.*, 2003) also mentioned that milk and milk products are also good medium for the growth and transmission of several micro-organisms to humans. The lack of household refrigeration facilities and irregular electricity supply in several urban and rural areas in Nigeria and other West African countries call for the need to increase the shelf life of the West African soft cheese. Organoleptic evaluation of West African soft cheese produced with different preservatives was carried out by Oladipo and Jadesimi (2013).

This study was carried out to compare the physicochemical, microbial and sensory characteristics of retailed fresh white and red sorghum extract preserved West African soft cheese.

Materials and Methods

The experiment was conducted at the Department of Animal Production and Health laboratory of Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Oyo State, Nigeria. Six fresh samples each of white and red sorghum preserved West African soft cheese were purchased on the same day they were prepared from retailers in Sabo market, Ogbomoso. The samples were kept in sterilized containers and preserved in a refrigerator pending laboratory analysis. Physicochemical analysis (titrable acidity, density, moisture content, protein, fat and ash) were carried out in the laboratory by the standard methods of AOAC (2005). Microbiological analysis and sensory evaluation were conducted according procedures outlined in the research article of Tona (2016). Microbial counts (cfu/ml) and identification of micro-organisms present were carried out.

The sensory evaluation session took place in a classroom in the Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. The two types of cheese samples were offered to a 12-member panel of judges, who were students, and were familiar with the consumption of soft

cheese. Each judge was made to sit separately, in order to avoid biased assessment. The samples were then assessed based on the following sensory perceptions: colour, taste, aroma, texture and general acceptance. The soft cheese attributes were quantified using a continuous nine point hedonic scale, as follows: disliked extremely = 1; disliked very much = 2; disliked moderately = 3; disliked slightly = 4; neither disliked nor liked = 5; liked slightly = 6; liked moderately = 7; liked very much = 8; liked extremely = 9. The relative intensity of each attribute was expressed as the mean of the scores obtained from the 12 judges and these mean scores were then tabulated.

The standard deviations between treatment means were calculated using the students't test (SAS, 2002). Significant means were separated using the Duncan's multiple range test of the same software. Mean differences were considered significant at $p < 0.05$.

Results and Discussion

The physicochemical properties of fresh white and red sorghum extract preserved West African soft cheese samples are shown in Table 1. The values observed were higher ($p < 0.05$) for the fresh red sorghum preserved soft cheese in titrable acidity (0.66% lactic acid), protein (17.23%), fat (14.10%) and ash (1.67%). Whereas the fresh white soft cheese had higher ($p < 0.05$) density (1.18 g/ml) and moisture content (70.57%). The soft cheese moisture contents of 68.10% and 70.57% observed in this study are comparable to the moisture contents of 65.42%, 70.03% and 72.51% reported by Yinusa and Adedibu (2013) for cheese obtained from milk of Red Bororo, Muturu and White Fulani cattle breeds. The higher value of titrable acidity (0.66% lactic acid) in the fresh red sorghum extract preserved soft cheese showed that probably they developed higher lactic acid content than in the fresh white soft cheese (0.61% lactic acid). The titrable acidity values of 0.61% and 0.66% observed in this study are comparable to the 0.67% lactic acid of cow milk cheese observed in the research of Nazim *et al.* (2013). Again, in this research, the higher nutrient contents (protein, fat and ash) observed in the fresh red sorghum preserved soft cheese than in the fresh white soft cheese could probably be due to the differences in moisture contents. The ranges of 16.57 to 17.23 % protein, 13.57 to 14.10% fat and 1.57 to 1.67% ash observed in the current study are higher than the 12.53 to 12.56% protein and slightly lower than the 14.33 to 14.43% fat in *Cymbopogon citratus* and *Calotropis procera* processed West African soft cheese reported by Adetunji and Babalobi (2011). Also, the values observed in this study were within the range of 14.74 and 20.13% protein and 12.68 and 15.30% fat observed in unsalted and salted soft cheese reported by Ojedapo *et al.* (2014). Nazim *et al.* (2013) also recorded higher values of 20.19% protein, 16.63% fat and 4.21% ash in cow milk cheese.

Table 1: Physicochemical properties of fresh white and red sorghum extract preserved West African soft cheese samples		
Parameters	Fresh white soft cheese	Fresh red sorghum extract preserved soft cheese
Titrable acidity (% lactic acid)	0.61 ± 0.01 ^b	0.66 ± 0.01 ^a
Density (g/ml)	1.18 ± 0.01 ^a	1.13 ± 0.01 ^b
Moisture content (%)	70.57 ± 0.14 ^a	68.10 ± 0.18 ^b
Protein (%)	16.57 ± 0.14 ^b	17.23 ± 0.05 ^a
Fat (%)	13.57 ± 0.14 ^b	14.10 ± 0.09 ^a
Ash (%)	1.57 ± 0.05 ^b	1.67 ± 0.05 ^a
Data are mean values ± standard deviation; ^{a,b} Means in the same row with different superscript are significantly different ($n < 0.05$)		

The microbial counts and micro-organism isolates of fresh white and red sorghum extract preserved West African soft cheese samples are presented in Tables 2 and 3. There were higher ($p < 0.05$) total viable bacterial counts of 7.7×10^4 cfu/ml in the fresh white soft cheese samples than in the fresh red sorghum extract preserved soft cheese (3.1×10^4 cfu/ml). Total coliform count was nil in both soft cheese samples. The total fungal counts were also higher ($p < 0.05$) in the fresh white soft cheese samples (4.2×10^3 cfu/ml) than in the fresh red sorghum extract preserved soft cheese samples (9.6×10^2 cfu/ml). The lower micro-organism counts in the fresh red sorghum extract preserved soft cheese than in the fresh white soft cheese could imply that the red sorghum extract coating of the cheese served not only as colorant but could have given the soft cheese better preservative property against the growth and multiplication of micro-organisms. Oladipo and Jadesimi (2013) reported that preservation using ginger and garlic resulted in reduction in cheese samples' microbial load as

compared to the control treatment samples. The absence of coliform bacteria in the two types of fresh soft cheese samples examined could serve as evidence of satisfactory cheese production hygiene. Hegazy and

Table 2: Microbial counts (cfu/ml) of fresh white and red sorghum extract preserved West African soft cheese samples

Parameters	Fresh white soft cheese	Fresh red sorghum extract preserved soft cheese
Total viable bacterial Count	7.7×10^4	3.1×10^4
Total coliform count	Nil	Nil
Total fungal count	4.2×10^3	9.6×10^2

Table 3: Micro-organism isolates of fresh white and red sorghum extract preserved West African soft cheese samples

Micro-organism	Fresh white soft cheese	Fresh red sorghum extract preserved soft cheese
<i>Bacillus species</i>	+	+
<i>Pseudomonas species</i>	+	-
<i>Aspergillus species</i>	+	+
<i>Penicillium species</i>	+	-

+ = Present - = Absent

Mahgoub (2013) similarly reported the absence of coliform bacteria in some of the cheese samples that they investigated. In another research, Oladipo and Jadesimi (2013) isolated *Pseudomonas species* and *Bacillus species* in West African soft cheese samples. Hegazy and Mahgoub (2013) reported based on the recommendation of the European Commission (2004/24/EC and 852/2004/EC) standards that microbial load in retailed cheese should range between 10^2 to $<10^5$ in order to be classified as average to satisfactory level. Thus it is observed that the cheese samples investigated in the current research with microbial counts range between 9.6×10^2 cfu/ml and 7.7×10^4 cfu/ml were of satisfactory to average hygiene quality.

Results of the sensory quality attributes of the two types of West African soft cheese investigated are presented in Table 4. The mean scores for the fresh white soft cheese samples were consistently higher ($p < 0.05$) than for the fresh red sorghum extract preserved soft cheese samples in terms of colour, taste, aroma, texture and general acceptance. In a nine point hedonic scale, the recorded scores range between 6.42 and 8.67, showed that the two cheese types had good organoleptic properties. Yinusa and Adedibu (2013) in their study similarly observed that the milk of three indigenous cattle breeds (White Fulani, Muturu and Red Bororo) in Nigeria were suitable for cheese production with good cheese yield, nutrient composition and organoleptic properties.

Table 4: Sensory evaluation of fresh white and red sorghum extract preserved West African soft cheese samples

Parameters	Fresh white soft cheese	Fresh red sorghum extract preserved soft cheese
Colour	8.67 ± 0.21^a	7.42 ± 0.53^b
Taste	7.83 ± 0.17^a	6.83 ± 0.53^b
Aroma	7.67 ± 0.56^a	6.92 ± 0.40^b
Texture	6.83 ± 0.70^a	6.42 ± 0.42^b
General acceptance	8.17 ± 0.40^a	7.08 ± 0.43^b

Data are mean values $\pm$ standard deviation; ^{a,b} Means in the same row with different superscript are significantly different ($p < 0.05$)

Conclusion

It can be concluded that the fresh red sorghum extract preserved West African soft cheese had higher nutrient (protein, fat and ash) contents, lower microbial counts but lesser sensory quality levels than the fresh white soft cheese. The microbial load in the two types of soft cheese isolated fall within the acceptable recommendation of the European Commission standards (2004/24/EC and 852/2004/EC) for retailed cheese (between 10^2 to $< 10^5$ cfu/g).

References

- Adetunji, V.O., Ikheloa, J.O., Adedeji, A.M. and Alonge, D.O. (2003). An evaluation of the bacteria in milk products sold in SouthWestern Nigeria. *Nig. Vet. J.* 24(3):92-96.
- Adetunji, V.O. and Babalobi, O.O. (2011). A comparative assessment of the nutritional contents of 'wara' a West African soft cheese using *Calotropis procera* and *Cymbopogon citratus* as coagulants. *AJFAND Online*. 11(7): 5573 – 5585.
- AOAC (2005), Official Methods of Analysis", Association of official analytical chemists, Washington DC, USA.
- Hegazy, M.I. and Mahgoub, S.A. (2013). Microbiological characterization of the Egyptian soft white cheese and identification of its dominant yeasts. *Afr. J. Microb. Res.* 7(20):2205-2212.
- Islam, M.A., Islam, M.N., Khan, M.A.S., Rashid, M.H. and S.M. Obaidullah, 2009. Effect of different hygienic condition during milking on bacterial count of cow's milk. *Bang. J. Anim. Sci.* 38 (1&2): 108-114.
- Nazim, M.U., Mitra, K., Rahman, M.M., Abdullah, A.I. and Parveen, S. (2013). Evaluation of the nutritional quality and microbiological analysis of newly developed soya cheese. *Int. Food Res. J.* 20(6): 3373-3380.
- Oladipo, I.C. and Jadesimi, P.D. (2013). Microbiological analysis and nutritional evaluation of West African soft cheese produced with different preservatives. *Am. J. Food Nutr.* 3(1): 13-21.
- Ojedapo, L.O., Tona, G.O., Amao, S.R. and J.A. Adeneye, J.A. (2014). Yield, composition and coagulation time of unsalted and salted soft cheese from milk of White Fulani cows. *Int. J. Current Microb. Appl. Sci.* 3(8) 378-383.
- Statistical Analysis Systems (SAS) (2002). Institute Inc. SAS/ STAT. User's guide version 8. 3rd Ed. Cary. North Carolina, USA. pp. 944.
- Tona, G., Oyegoke, O., Ademola, S. and Akinlade, J. (2013). Chemical and bacteriological assessment of soft cheese prepared from raw cow milk in Ogbomoso, Nigeria. *J. Pure Appl. Microbio.* 7(3): 1731-1736.
- Tona, Grace O. (2016). Preparation and quality evaluation of raw milk and yoghurt sourced from machine milked Jersey cows. *Food Sci. Qual. Mgt.* 57:48-56 (IISTE).
- Yinusa, A. J. and Adedibu, I.I. (2013). Quality attributes of cheese produced from three Nigeria cattle breeds. *Int. Res. J. Agric. Sci.* 1(1): 8-10.