

PHYSICO-CHEMICAL AND SENSORY ASSESSMENTS OF 'WARA' PRECIPITATED USING TWO PLANT EXTRACTS

* G.A. IBHAZE, A.O. OSASONA, O.A. ADEBAYO, C. JOACHIM AND
A. N. FAJEMISIN

Department of Animal Production and Health, Federal University of Technology, Akure

*Correspondence: gaibhaze@futa.edu.ng; 08055865289

ABSTRACT

In order to find alternative plant rennet to the traditional *Calotropis procera* (CLE) used in cheese production in Nigeria, the physico-chemical and sensory qualities of unripe *Carica papaya* pulp extract (UCE) and its combination with CLE was investigated. The extracts which formed the treatments were in the following concentrations; 20% CLE alone, 20% UPE alone, 20% CLE + 80% UPE, 15% CLE + 85% UPE, 10% CLE + 90% UPE, 5% CLE + 95% UPE. The physico-chemical quality showed significant variations in the fat, moisture and protein contents. The fat content (60.77%) of cheese made from 15% CLE + 85% UPE was significantly ($P < 0.05$) higher. There were no significant ($P > 0.05$) difference in the ash content. The protein (24.98%) of cheese precipitated from 20% CLE + 80% UPE was significantly ($P < 0.05$) higher. Free fatty acid values was not significantly ($P > 0.05$) different. The peroxide and acid values, % cheese yield differed significantly ($P < 0.05$). The coagulation time (CT) of the cheese were significantly ($P < 0.05$) different with 20% UPE having the highest value (40mins). The cheese pH did not differ ($P > 0.05$) significantly. The sensory evaluation result was not significantly different ($P > 0.05$). These results show that unripe *C. papaya* extract can serve as suitable alternative and can be combined with *C. procera* as coagulants in cheese production.

Keywords: plant extracts, wara, physico-chemical, sensory

INTRODUCTION

Milk is a concentration of nutrients needed for growth and maintenance of good health in young and growing humans. However, the major constraint to the consumption of fresh milk is its short shelf -life. However, cheese provides an opportunity to extend the shelf life of milk and preserve its valuable nutrients in a concentrated form (Law and Tamime, 2010). Cheese is popularly called "Wara" in Nigeria. It is made from unpasteurized, unfermented whole milk by coagulation of the milk with Sodom apple leaf, pod or stem extract (Ashaye *et al.*, 2006). In recent times, focus has been on the use of other plants as alternative coagulants. Adeniji *et al.* (2007) and Belewu *et al.* (2005) investigated the use of lemon and pawpaw leaf in replacement of sodom apple leaf respectively. Adetunji and Salawu (2008) utilized *Carica papaya* and *Calotropis procera* leaf extracts for soft cheese production. Olorunnisomo and Ibhaze (2010) also used pawpaw leaf extracts as coagulant in Cheese production. However, there is paucity of information on the use of unripe *Carica papaya* pulp as alternative coagulant as well as its combination with *Calotropis procera*. Hence, the thrust of this study is to investigate the suitability

of unripe *Carica papaya* pulp extract and its combination with *Calotropis procera* leaf in the production of wara in Nigeria.

MATERIALS AND METHODS

The study was carried out at the Nutrition laboratory of the Department of Animal Production and Health, Federal University of Technology Akure, Ondo State, Nigeria.

Experimental materials and Preparation of extracts

Fresh whole cow milk was obtained by hand milking from lactating White Fulani cows at Ipinsa cattle ranch in Akure, Ondo State, Nigeria. The raw milk was clarified using a cheese cloth and the pH of the milk was determined using a pH meter. Sodom apple (*Calotropis procera*) leaf and pawpaw (*Carica papaya*) fruits were obtained from a backyard farm. Fresh *Calotropis procera* leaves (100g) were weighed and crushed using a mortar and pestle. The crushed leaves were soaked with distilled water at ratio 1:1 (w/v). After five minutes, the mixture was sieved to collect the extract into a labelled bottle. Washed medium size unripe *Carica papaya* were peeled to obtain 100g of the pulp which were mixed with distilled

water at ratio 1:1(w/v), blended with a juice blender and the juice extract was obtained using a muslin cloth. The extracts which formed the treatments were in the following proportions; 20% CLE alone, 20% UCE alone, 20% CLE + 80% UCE, 15% CLE+ 85% UCE, 10% CLE+ 90% UCE, and 5% CLE+95% UCE

Preparation of cheese

Raw milk (1000ml) was heated to a temperature of 50°C inside a metal pot placed on a low - intensity burner. The mixture of extracts was added at the stipulated concentrations and heating of the milk continued with intermittent stirring until boiling and coagulation were achieved. The curds formed were poured into a sieve of 0.2mm to drain the whey.

Chemical analysis, cheese yield and pH

Chemical analyses of samples were carried out using the AOAC (2005) method. The pH of the extracts and cheese were determined using a pH meter. Coagulation time (CT) was determined by checking the time interval from the addition of coagulant until coagulation was achieved. Yield percentage was then calculated using the formula described by Akinloye and Adewumi (2014).

Sensory Evaluation

The organoleptic properties of cheese produced were determined by semi-trained panels drawn from students and staff of the Department of Animal Production and Health, Federal University of Technology, Akure using a five-point hedonic scale ranging from 5 (highest score) to 1 (lowest score).

Experimental design and statistical analysis

The experimental design used was completely randomized design. Data generated were subjected to analysis of variance (ANOVA), using SAS 2008 (version 9.2 model) and significant means were separated by Duncan's multiple range tests of the same statistical package.

RESULTS

Proximate composition of cheese (%) precipitated with varied concentrations of *Calotropis procera* leaf and Unripe *Carica papaya* pulp extracts is presented in Table 1: Results showed significant variations in the fat, moisture and protein contents. Fat content (60.77%) of cheese made from 15% CLE+85%UCE was significantly ($P<0.05$) higher than those obtained from other varied

concentrations. There were no significant ($P>0.05$) difference in the ash content. Moisture contents of the cheese made from 5%CLE +95%UCE (57.48%) was higher. The protein (24.98%) of cheese precipitated from 20%CLE+80%UCE was significantly ($P<0.05$) higher. Table 2 shows the physico-chemical quality. Results showed significant ($P<0.05$) variations in the parameters considered except free fatty acid values. The peroxide value of cheese made from 20%CLE (8.52mg/g) was significantly ($P<0.05$) higher. The coagulation time (CT) was significantly ($P<0.05$) different with 20%UCE having the highest value (40mins). The cheese pH did not differ ($P>0.05$) significantly. The cheese yield showed significant ($P<0.05$) variations among the treatments. Table 3 shows the sensory evaluation of the cheese precipitated from varied concentrations. The taste of cheese precipitated with 20% UCE and the highest concentration of UCE (95%) had the highest values (4.00). However, in the overall opinion, no significant difference ($P>0.05$) was observed.

DISCUSSION

The moisture content of varied cheese agree with the reports of Adetunji and Salawu (2008), who reported a higher moisture content of *Carica papaya* processed cheese than *Calotropis procera* cheese. However, the moisture content of *Calotropis procera* cheese reported by these authors (61.70%) and the results obtained in this study (31.58%) were different. Olorunnisomo and Ibhaze (2010) reported a moisture content of 47.50% for cheese coagulated with Sodom apple. The differences could be due to variation in the quantity of coagulants used. High moisture content is not desirable because it could favour the growth and proliferation of microorganism, thus reduces the shelf - life of cheese (Adegoke, 1992). Ash is an indicative of mineral present in food. The ash content of cheese precipitated from 20% CLE+80UCE (3.09%) was highest followed by 20% CLE (2.75%). The result is similar to the value (2.72%) obtained by Oladapo and Jadesiimi (2013). The protein content of cheese made with 20% CLE+ 80% UCE had the highest value (24.98%) and this is higher than 4.45% reported by Fasakin and Unokiwedi (1992) but similar to the finding of Olorunnisomo and Ibhaze (2010) who reported

(27.60%). The results suggest that *C. procera* leaf extract has greater ability to precipitate casein from milk. The peroxide value decreased with increased concentration of UCE while cheese with 20CLE had the highest value indicating that UCE is rich in antioxidants that could suppress oxidation. The yield was highest at 15%CLE+ 85%UCE followed by 20% UCE and this can be attributed to the coagulation time because it was longer.

CONCLUSION

This study revealed that cheese can be precipitated with unripe *Carica papaya* pulp extract, however, cheese precipitated with 10CLE and 90UCE had the highest preference hence can be recommended in cheese production.

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Table 1: Proximate composition (%) of cheese precipitated with varied concentrations of *Calotropis procera* leaf and Unripe *Carica papaya* pulp extracts

Concentration (%)	Fat	Ash	Moisture content	Crude protein
20 CLE	47.44 ^b	2.75	31.58 ^b	19.97 ^b
20UCE	49.38 ^b	2.70	45.47 ^a	22.26 ^{ab}
20CLE + 80UCE	53.02 ^{ab}	3.09	51.33 ^a	24.98 ^a
15CLE + 85UCE	60.77 ^a	1.76	49.63 ^a	19.41 ^b
10CLE + 90UCE	35.94 ^c	1.81	54.86 ^a	19.36 ^b
5CLE + 95UCE	37.40 ^c	2.42	57.48 ^a	21.73 ^{ab}
SEM	2.91	0.28	2.47	0.60

Means with the same superscripts along the same column are not significantly different ($P>0.05$)

CLE – *Calotropis procera* leaf extract, UCE – Unripe *Carica papaya* extract, SEM – Standard error of mean

Table 2: Physico-chemical evaluation of cheese precipitated with varied concentration of *Calotropis procera* leaf and Unripe *Carica papaya* pulp extracts.

Concentration (%)	Peroxide value (mg/g)	Acid value (ME/g)	Free fatty acid(g)	Coagulation time (mins)	Cheese pH	% Cheese yield
20 CLE	8.52 ^a	12.40	0.34	31.00 ^e	6.40 ^a	5.37 ^d
20UCE	3.07 ^d	22.47	0.61	40.00 ^a	6.15 ^{ab}	8.06 ^b
20CLE + 80UCE	6.89 ^{ab}	13.08	0.36	36.00 ^b	6.40 ^a	6.28 ^c
15CLE + 85UCE	5.81 ^{bc}	21.33	0.55	32.00 ^d	6.40 ^a	10.55 ^a
10CLE + 90UCE	4.20 ^{cd}	19.99	0.53	30.00 ^f	6.20 ^b	6.27 ^c
5CLE + 95UCE	3.14 ^d	17.81	0.47	33.00 ^c	6.20 ^b	6.30 ^c
SEM	0.63	1.47	0.04	1.02	0.03	0.53

Means with the same superscripts along the same column are not significantly different ($P>0.05$)

Table 3: Sensory evaluation of cheese precipitated with varied concentration of *Calotropis procera* leaf and Unripe *Carica papaya* pulp extracts

Concentration (%)	Colour	Texture	Taste	Aroma	Overall opinion
20 CLE	1.50 ^b	3.00	3.00 ^b	4.33	3.67
20UCE	3.17 ^a	3.00	4.00 ^a	3.50	3.83
20CLE + 80UCE	1.50 ^b	3.00	2.67 ^b	4.17	3.17
15CLE + 85UCE	2.00 ^b	3.33	3.50 ^{ab}	3.67	4.00
10CLE + 90UCE	3.17 ^a	3.34	3.50 ^{ab}	4.00	4.17
5CLE + 95UCE	2.50 ^{ab}	2.33	4.00 ^a	3.67	3.83
SEM	0.17	0.13	0.14	0.15	0.14

Means with the same superscripts along the same column are not significantly different ($P>0.05$)