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Short Communication

West African soft cheese ‘wara’ processed with *Calotropis procera* and *Carica papaya*: A comparative assessment of nutritional values

V. O. Adetunji[1] and O. T. Salawu[2]

[1]Department of Veterinary Public Health and Preventive Veterinary Medicine, University of Ibadan, Ibadan, Nigeria.
[2]Department of Zoology, University of Ibadan, Nigeria.

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The nutritional contents of *Carica papaya* and *Calotropis procera* processed cheeses were evaluated. The following nutrients and elements were assayed; fat, protein, moisture, sugar, Zn, Mn, Fe, and Cu and their values were 22.3 and 31.45%, 31.60 and 33.84%, 62.5 and 61.70%, 2.05 and 8.10%, 1.19 and 4.14%, 2.80 and 2.35%, 4.8 and 4.7%, 4.6 and 7.3% for *C. papaya* and *C. procera* processed cheeses, respectively. The values obtained for fat, protein, sugar, Zn, and Cu were higher in *C. procera* processed cheese while Fe and Mn were higher in *C. papaya* processed cheese. This work therefore showed that even though *C. procera* have higher nutrient compositions, *C. papaya* processed cheese could be a good supplement for Fe and Mn in food deficient of the minerals.

Key words: ‘Wara’, *Carica papaya, Calotropis procera,* nutrient compositions.

INTRODUCTION

The use of vegetable extracts as milk coagulants in soft cheese processing has been known since antiquity. Milk coagulants of plant origin have over-ridden the use of animal rennet. Animal rennet may be limited for religious reasons (e.g. Judaism and Islam), diet (vegetarianism), or being genetically engineer food (e.g. in Germany and the Netherlands forbid the use of recombinant calf rennet) (Roseiro et al., 2003). The first reference to the substitution of animal rennet by vegetable coagulants dates from experiments in 1935 (Christen and Virasoro, 1935a, 1935b) and later, in 1961 (Veringa, 1961), 1992 (Guinee and Wilkinson, 1992), and 1994 (Garg and Johri, 1994).

Calotropis procera (Sodom apple) extract has been used for traditional cheese making in West African countries, such as Nigeria and the republic of Benin (Aworth and Muller, 1987). The use of *Carica papaya* as vegetable coagulant has also been known for long (Veringa, 1961). However, investigations have revealed that vegetable coagulants have some inherent drawbacks that limit their use. Plant proteases are considered too proteolytic, leading to generation of excessive acid, bitter flavors and also texture defect in cheese (Roseiro et al., 2003). For example, the mealy texture white cheeses made with extract from *C. papaya* leaves showed flavor defect, such as bitterness (Veringa, 1961). Nevertheless, despite these drawbacks, experiments have shown production of better cheese with vegetable coagulant. One of such is the early maturation of Camembert cheese made with *Cynara* sp (cardoon) extract compare with animal rennet (Christen and Virasoro, 1935a, 1935b).

However, despite the high venturing into the use of indigenous plant extract in cheese making and their socio-economical contribution to the dairy sector at local and regional areas of each country, there are no registered commercially available coagulant of vegetable origin. Gambelli et al. (1999) have reported the technological treatment of cheese product to be one of the factors that determines the levels of essential minerals and trace element in cow milk. The traditional technologies involving the use of plant extract as milk coagulant and particularly during cheese ripening may make some of the mineral salt migrate from the central part towards the external layer of the cheese block or vice versa under pH grade effect, forcing change in the concentration of elements in the final product. Therefore, in the quest for

*Corresponding author. E-mail: vadetunji@gmail.com.

Table 1. Nutritional evaluations of the two varieties of cheese (%).

Cheese type	Fat	Protein	Moisture	Lactose	Zn	Mn	Fe	Cu
C. papaya cheese	22.33a	31.60a	62.50a	2.05a	1.19a	2.80a	4.84a	4.60a
C. procera cheese	31.45b	33.84b	61.70b	8.10b	4.14a	2.35b	4.77a	7.33a

Same lower case letters in the same column are not significantly different (P > 0.05)

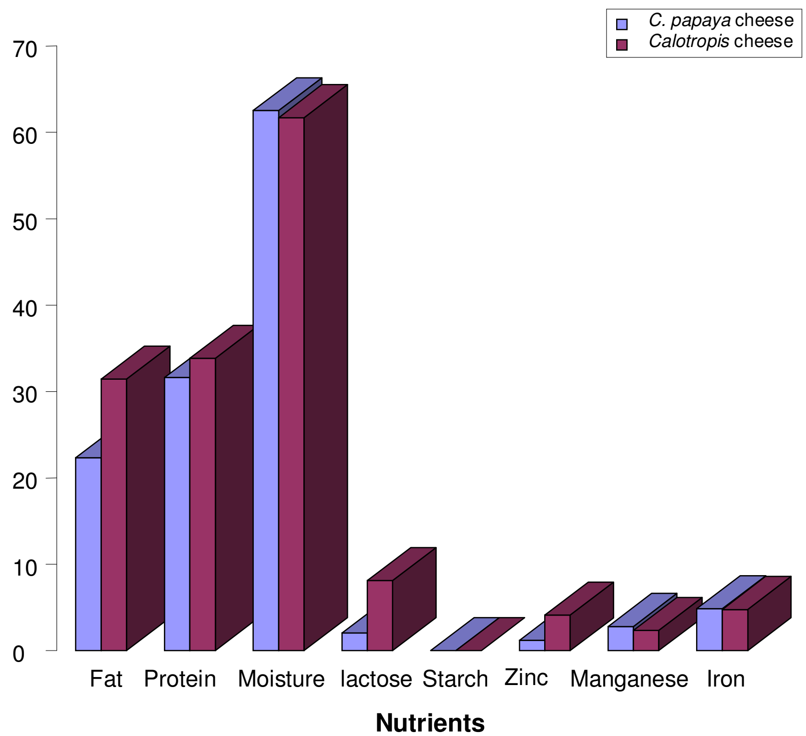

Figure 1. Nutritional evaluation of cheese (%).

vegetable milk coagulant as substitutes for animal rennet and the lactic acid bacteria, the nutritional quality of the final product should not be overlooked. The thrust of this work therefore is to compare the nutritional quality of soft cheese processed by *C. papaya* and the *C. procera* leaf extract.

MATERIALS AND METHODS

Fresh 5 liters of cow milk obtained by hand milking was gently heated in two earthenware pots (A and B) over a wood fire in the open air. The milk was heated to bring the temperature to 45 - 50°C. Three medium sized leaves of *C. procera* (Sodom apple) (8 g) was crushed and extracted in 100 ml of sterile distilled water, filtered and added to the warmed milk in pot A. Similar procedure was applied to the preparation of *C. papaya* extract for pot B. Heating continued until clotting began at about 20 - 25 min later. The heating of the curds continued to boiling point and was maintained at boiling for about 10 min to facilitate whey expulsion. The loose curds were then poured into conical shaped raffia baskets to allow the whey to drain for 20 min.

5 g of cheese were sampled at the end of processing for *C. procera* and *Carica papaya* processed cheese. All of the samples were collected aseptically in order to minimize possible external contamination. Each sample was obtained in 3 replicates. The analysis of zinc, manganese, iron and copper was done by atomic absorption spectrophotometry (Hunter et al., 1984). Protein, fat, starch, moisture and lactose were analysed using the AOAC analytical methods (1990).

RESULTS AND DISCUSSION

The mean nutrient contents (fat, protein, moisture, lactose, starch) and minerals (Zn, Mn, Fe and Cu) are presented in Table 1 and Figure 1. The result of the statistical analysis using ANOVA showed significant differences in fat, protein, moisture, sugar, and Mn contents of *C. papaya* and *C. procera* processed cheeses (P < 0.05). However, for Zn, Fe and Cu, there were no significant differences in their contents in the two cheese varieties (P > 0.05). The fat content obtained in this work was lower than the value reported by Belewu (2001), Johnson et al. (2001) and Alalade and Adeneye (2006). However, *C. procera* cheese was of higher fat content showing 25.82% increase over its *C. papaya* counterpart. The higher fat contents in *C. procera* cheese could be as a result of higher coagulation strength in the *C. procera* plant. The protein composition in this work was similar to the one obtained by Johnson et al. (2001) but lower than the value reported by Alalade and Adeneye (2006). The moisture content of *C. papaya* processed cheese was higher than that of *C. procera* processed cheese probably due also to stronger coagulating strength of the *C. procera* extract. Higher moisture content could favour the growth and proliferation of microorganisms as reported by (Adegoke et al., 1992) thus reduces the shelf-life of cheese. *C. procera* cheese had higher lactose content and was 74.69% higher than *C. papaya* processed cheese.

The Zn contents reported in two cheese varieties were higher than some of the typical Italian cheeses reported by Gambelli et al. (1999). The Zn content of *C. papaya* was lower than that in human milk but the mineral level is adequate for infant human (Jenness, 1980). The Zn content in *C. procera* cheese is almost equal to the WHO (1990) recommended daily intake level (about 81% of the recommended level).

Although, *C. procera* cheese is the preferred type in terms of organoleptic tests and many nutritional values like fat, protein, sugar, Zn, and Cu as reflected in this study, the *C. papaya* processed cheese was richer in Mn and Fe. Since the level of these elements were significantly higher in *C. papaya* cheese, it can therefore be used as food supplement in nutritional deficiency of the elements. The Fe content of *C. papaya* cheese is about 48% of the WHO (1990) recommended daily intake.

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