

Short Communication

Effect of fermentation on the chemical composition of mango (*Mangifera indica* R) peels

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Ripe mango peels (*Mangifera indica* R) was naturally fermented for 96 h at room temperature (30°C). The quality of the fermented mango peels were accessed by determining the microbiological quality, proximate composition as well as the anti-nutritional content. Mixed flora of fungi and bacteria were isolated from the fermenting mango peels. Three species of fungi (*Saccharomyces cerevisiae*, *Aspergillus flavus* and *Rhizopus oryzae*) and five bacteria (*Aerobacter clocae*, *Leuconostoc Micrococcus luteus*, *Streptococcus mutans* and *staphylococcus aureus*) were identified. The result of the proximate analysis revealed that there was an increase in the protein content of the ripe mango peels fermented. There was no considerable difference in the fat and carbohydrate content while there was a decrease in fibre content. Antinutrients such as tannin and phytate decreased in the fermented sample. A decrease in pH was also recorded.

Key words: Mango, *Mangifera indica*, antinutrient, fermentation.

INTRODUCTION

The mango tree is erect roughly 10 – 30 m high, with a broad rounded canopy which may with age attain 30 – 38 m in width or a more upright, oval, relatively slender crown. In deep soil, the taproot descends to a depth of 6 inches, the profuse wide-spreading feeder root system also sends down many anchor roots which penetrate for several metres. The tree is long-lived, some specimen being known to be 300 years old and still fruiting (Henry, 1988). Ripe mango flesh contains carbohydrate and fiber. Carotene, thiamine, riboflavin, niacin, ascorbic acid, tryptophan, lysine and minerals are also present in the fruit (Goldsmith, 1976). Mango peel fibre is a good source of dietary fibre and its chemical composition may be compared to that of citrus fibre. The peel fibre also shows higher values of antioxidant activity, glucose retardation and its aroma and flavour are pleasant (Reyes and Vega, 1988).

There are a number of roles that microorganisms can play in food processing, either positive or negative. The positive effects are generally regarded as part of the fermentation processing namely product preservation, flavour development and reduction of antinutrient. Furthermore, fermentation enhances the nutrient, vitamins, essential amino acids and protein, by improving

protein and fibre digestibility. The negative effects include spoilage of food products and contamination by pathogenic microorganisms. Therefore this paper seeks to evaluate the effect of fermentation on the chemical composition of ripe mango peels.

MATERIALS AND METHODS

Fresh ripe mango fruits were obtained from Oja – Oba market Akure, Nigeria. The fruits were washed in sterile distilled water. A 300 g of the peels were placed into a clean bowl containing 2 litres of distilled water and then allowed to ferment for 3 days at room temperature $30 \pm 2^\circ\text{C}$.

Microbial analysis

The method of Sumbo and Adedeji (1992) was used based on plate dilution technique. Oxoid nutrient agar (NA) and Potato Dextrose agar (PDA) used for the isolation of bacteria and fungi were prepared according to the manufacturer's instructions. Aliquots of the samples and nutrient were mixed and poured aseptically into sterile Petri dishes for incubation at 37°C for 24 h for bacteria while those for fungi were incubated at 30°C for 48 h. The number of colonies growing in each plate was counted. Isolates were streaked on fresh nutrient media and subcultured until pure colonies were

obtained. After isolation of pure colonies, all bacteria and fungal cultures were maintained on slants (in screw cap Mac cartney bottles) and stored in the refrigerator at 4°C. Characterization and identification was based essentially on cultural morphological and biochemical reactions (Cowan and Steel, 1993; Buchanan and Gibbons, 1994). The changes in pH of the fermenting mango peels were determined.

Compositional analysis

The nutritional composition (ash, fat, crude fibre, and carbohydrate) of the fermented peels were evaluated using the standard AOAC (1990) method. The protein was determined using the microkjeldahl method (N X 6.25). The antinutrient contents of both the fermented and unfermented peels were estimated. Phytate was determined by the method of Wheeler and Ferrel (1971). The tannin content was determined using the Makkar et al. (1993) method.

Statistical analysis

The data were analyzed using mean \pm S.D and analysis of variance (Zar, 1984).

RESULTS AND DISCUSSION

A total of eight microorganisms were identified from the fermenting peels. The bacteria isolates were *Aerobacter cloacae*, *Leuconostoc* sp., *Micrococcus luteus*, *Streptococcus mutans* and *Staphylococcus pyogenes*. The fungi isolates were *Saccharomyces cerevisiae*, *Aspergillus flavus* and *Rhizopus oryzae*. The changes in pH in fermenting mango peels are shown in Table 1. There was decrease in pH throughout the fermentation. Raimbault and Tewe (2001) indicated that the pH of a culture may change in response to metabolic activities. The most obvious reason being the secretion of organic acids as citric, acetic or lactic this causes pH to decrease. The proximate composition of the fermented and unfermented mango peels in Table 2 reveals that fermentation of the peels increases the protein content of the fermented sample ($8.64 \pm 0.91\%$) compared to the unfermented sample ($6.15 \pm 0.08\%$). The increase in protein of the fermented mango peels sample may be due to the fact that the microorganisms identified which degrades the sample readily may have secreted extracellular enzymes in the peels which subsequently increases the protein content of the fermented sample as well as microbial biomass (Odetokun, 2000). There was no considerable difference in the fat, while there was a decrease in fibre content of the fermented sample. This affected the carbohydrate content (calculated by difference) in which there was no considerable difference. Aykroyd and Doughy (1982), Bough and Azam-Ali (1992) and Odetokun (2000) reported that increase in carbohydrate content during fermentation may be due to a reduction in the fibre content and increase in both reducing sugars and total soluble sugars. This may also be attributed to the fact that during fermentation carbohydrate including cellulose, pectin, lignocellulose and starch are broken down by

Table 1. Changes in pH during fermentation of mango peels.

Fermentation time (h)	pH
0	4.06 \pm 0.1
24	3.80 \pm 0.0
48	3.41 \pm 0.1
72	3.23 \pm 0.0
96	3.07 \pm 0.0

Table 2. Proximate composition of fermented and unfermented mango peels.

Parameter	Fermented	Unfermented
Moisture (%)	7.34 \pm 0.2	6.56 \pm 0.1
Protein (%)	8.64 \pm 0.9	6.16 \pm 0.0
Fat (%)	9.78 \pm 0.6	8.22 \pm 0.0
Carbohydrate (%)	30.4 \pm 0.1	32.6 \pm 0.4
Ash (%)	32.30 \pm 0.0	29.9 \pm 0.3
Crude fibre (%)	11.7 \pm 0.1	16.4 \pm 0.0

Table 3. Levels of some antinutrients of fermented and unfermented mango peels.

Antinutrient	Fermented	Unfermented
Tannin (%)	0.05	0.08 \pm 0.0
Phytate (mg/100g)	2425.67	2442.59 \pm 0.9

fermenting microorganisms thereby reducing the fibre content of such food (Raimbault and Tewe, 2001).

The levels of tannin and phytate which the plant probably uses for defense (Aletor, 1993) were also determined in the samples (Table 3). Tannin affects the nutritive value of food products by forming complex with protein (both substrate and enzyme) thereby inhibiting digestion and absorption (Osuntogun et al., 1987). They also bind Fe making it unavailable (Aletor and Adeogun, 1995) and other evidence suggests that condensed tannins may cleave DNA in the presence of copper ions (Shirata et al., 1998). There was a reduction of the tannin content of the fermented mango peels (0.05%) compared to the unfermented sample (0.08%). The decrease in tannin may be as a result of the processing that the sample was subjected to coupled with the activities of microbial enzymes involved in the fermentation. Phytate (which is capable of chelating divalent cationic mineral like Ca, Fe, Mg and Zn, thereby reducing dietary deficiency) content of the fermented mango peels were lower 2425.67 mg/100 g than those of the unfermented sample 2442.59 mg/100 g. The decrease in phytate content could be attributed to possible secretion of the hydrolytic enzyme (phytase) by microorganisms. This enzyme is capable of hydrolyzing phytate content in the fermented mango peels (Ojokoh et al., 2005). The present study, therefore, reveals that fer-

mentation can greatly influence the nutritional composition of mango peels.

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