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The Antimicrobial Effects of the Cream of Tartar ('KUKA') of Baobab Fruit, on Fermented Milk ('NONO')

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Abstract: The preservative activities of 'kuka', the cream of tartar of Baobab fruit, a local spice was studied, with respect to its effects on the total viable bacterial count especially the coliforms and staphylococcal organisms in 'nono' a product of fermented milk. Increasing the concentration of 'kuka' from 1% to 50% resulted in an inhibition of the bacteria present in 'nono'. The findings are also discussed in terms of the nutritional value of 'nono'.

Key words: Baobab Fruit, Adansonian Digitata Linn, Cream of Tartar, 'KUKA', Fermented Milk, 'NONO'

Introduction

Adansonia digitata L. (Baobab tree), occurs throughout the drier parts of tropical Africa (Ghani and Agbejule, 1986). It is a tree up to 24m high, with a very stout bole attaining 12m or more in girth. (Keay, 1989). Baobab tree has large flowers and fruits hanging from long stalks. The plants is preserved in these semi arid areas for its edible leaves and fruits which are widely used as articles of food and sources of medicine (Dalziel, 1937). The leaves are sometimes cooked but most often dried and added to soups which are used to soften or dilute corn or millet porridge (Addy, 1978). In Ghana, a soup prepared from the leaves is used as weaning food (Woolfe *et al.*, 1977). The pulp of the fruit has a pleasant acid taste. Juices prepared from the fresh or dried pulp are commonly used alone or in combination with other substances and are highly nourishing and refreshing (Ghani and Agbejule, 1986) Traditionally, different parts of the plant are also used for medicinal purposes. A dilute suspension of the fruit pulp is given as a cooling drink in cases of fever and as a remedy for dysentery. The pulp is also used as a remedy for chicken pox, measles and amenorrhoea. The leaves are used as anti-perspirant, in healing circumcision wounds, and in male and female infertility. The bark is used in treating malaria fever (Ghani and Agbejule, 1986). In the northern parts of Nigeria, 'kuka' (cream of tartar of baobab fruit) is often added to 'nono' to thicken 'nono' for sale and as a spice to enhance its taste. 'Nono' is a product derived traditionally from naturally fermented milk and has a considerable economic importance in the nothern part of Nigeria as it is the main fermentaion product of fresh milk appreciated by indigenes. Other products of fresh milk fermentation include butter and cheese.

The origin of 'nono' is difficult to trace. Fulani herdmen, after milking the cows and drinking the fresh milk, probably forgot the covered up left over for some time only to discover another product, whose, homogeneous fluid ('nono') was drinkable. Biochemically, 'nono' has been found to meet the protein requirement of adults and children (Okoh, 1973).

Staphylococcal group of organisms (Olson *et al,* 1970; Minor and Marth, 1972; Sheikh and Luedecke ,1974 and Sylvester ,1974) and *Escherichia coli* and other coliforms (Martins ,1969) have been found in milk and milk products and their eradication from dairy products is of great importance since they are sources of food poisoning (Minor and Marth 1974; Nalin *et al.*, 1975 and Klipstein *et al.,* 1977). Unlike in the Western countries where as from the end of the nineteenth century' increasing importance has been attached to the hygienic collection, preparation and control of microbial activity in milk and milk products (Cox, 1979; Muir, 1984) to obtain consistent quality of fermented dairy products, traditional processes of collecting and fermenting milk and milk products have changed very little in Africa and Asia.

The antimicrobial properties of some spices have been demonstrated (AL- delaimy and Ali 1970; Applecton and Tansey, 1975; Beuchaat, 1976; Zaika and Kinsinger, 1981). Some work has also been done and reported, biochemically, on 'nono' and 'kuka'(Okoh, 1973; Bassir and Maduagwu, 1978) but little is known of the microbiology of 'kuka'in 'nono'. This investigation was undertaken to ascertain the bacteriological effects of 'kuka' in 'nono'. It is expected that the result of this investigation would enhance knowledge on the effectiveness of this food additive as an anti-microbial agent.

Materials and Method

The Preparation of the 'Kuka' (Cream of Tartar of Baobab Fruit: The fruit used for this investigation was bought from a Nigerian local market in an exposed form as it is traditionally used. The pod form was also bought and used as control. The exposed fruit was pounded slightly using sterile mortal and pestle, to remove the white (cream of tartar). This powder was sieved, using sieve pore number 80 to get it in homogenous form. This sieved powder was stored in a sterile container. The pod was broken and the fruit was also treated as above to obtain the cream

was stored in a sterile container. The pod was broken and the fruit was also treated as above to obtain the cream of tartar, which was also sieved and stored.

The Preparation of 'NONO' (Fermented Milk) : Fresh milk used for the study was collected directly from the cow asceptically. 100-mls.of previously made NONO was added as starter culture to 12 litres of this fresh milk in a calabash and covered with woven mat (faifai) and left at room temperature for 24 hours to allow fermentation to take place.
At the end of 24 hours, the faifai was removed. A calabash spoon was dipped into the fermented to break a thick cream covering the milk.The cream and the milk were transferred into a gourd ('gora') corked with a maize cob and shaken several times to separate the cream (butter). The content in the 'gora' was once more poured into the calabash and mixed with a wooden spoon ('marburgi'). The butter was scooped off into small balls ('curi) with a calabash spoon, leaving a homogenous liquid called 'NONO'. 'KUKA' was dissolved in water and added to 'NONO' to thicken it.
Samples were collected into sterile universal containers for microbiological analysis at the following stages of preparation:

Fresh milk obtained from the cow;
Fresh milk from cow pooled together into storage cans;
Fresh milk allowed to undergo 24 hours fermentation ('NONO' + 'curi');
24- hours fermnted milk from which the 'curi' (butter) had been removed ('NONO');
'KUKA' solution (10 grams 'KUKA' + 100mls sterile distilled water) ;
'NONO' to which varying amounts of 'KUKA' solution had been added;
(g)'NONO' made out of 48 hours fermented milk.

Microbiological Analysis
Determination of pH: The pH of each sample was taken using pH meter (model 292 MK2).

The Most Probable Number (MPN): Coliforms were presumptively enumerated by the five-tube Most Probable Number (M.P.N.), procedure of the American Public Health Association (1967).
One milliliter aliquots of the homogenates representing 10^{-2} through 10^{-4} dilutions of milk were seeded into quinplicate tubes of Brilliant Green Bile broth (BGBb). The BGBb tubes were incubated at 37°C for 48 hours. Gas-positive BGBb tubes were recorded and the pattern of positive and negative tubes yielded the MPN of coliforms in the milk.

Viable Bacterial Count: Stock dilutions (0.1 ml) of to 10^{-1} to 10^{-10} were plated in duplicates on Nutriens Agar (Difco) for general bacterial count, with Tellurite Glycine Agar (Difco) used for staphylococcal count and Desoxycholate Lactose Agar (Difco) for coliform count using the spread plate method. The inoculated plates were then incubated at 37°C for 24 hours except for Tellurite Glycine Agar plates which were incubated for 48hours. The number of colonies formed on each plate were counted using the Quebec Colony counter after incubation and recorded.
All microbiological analysis were carried out in duplicates while the experiment itself was repeated ten times.

Results

The pH and the bacterial population of 'NONO' at the different stages of preparation. The pH of fresh milk collected directly from cow into sterile bottle had a pH of 6.6 with no coliform and *Staphylococus sp* counts and a total aerobic bacterial count of 6.00×10^3-6.5×10^3/ml while pooled milk from storage can had a pH of 6.1 and showed the presence of coliforms and *Staphylococcus sp* with total aerobic bacterial count of 1.31×10^5-1.50×10^5/ml. At 24 hours of fermentation, the pH of the milk decreased to 4.1 while the bacterial population increased but at 24 hours of fermentation, the pH (3.2) and the bacterial count deceased further with a zero *Staphylococcus. sp.* counts.
Effect of different concentration of KUKA on the bacterial load of the fermented milk ('NONO'). The pH of 'NONO' was 4.1 while that of 'KUKA' was 3.2. The pH of 'NONO decreased to pH 3.3 with increasing concentration of 'KUKA' while the bacterial count also decreased.

Discussion

In a study of the preparation of 'NONO', it was observed that milk obtained directly from cow into sterile bottle had low bacterial count. (6.0×10^3 – 6.50×10^3) with no coliform and *Stapylococcus sp*. However, samples collected from storage cans had high total aerobic bacterial count (3.5×10^5) while coliform count was 5.0×10^2 and Staphylococcos sp. count was 2.51×10^3. Allowing this milk to undergo fermentation for 24hr increased the

total bacterial and coliform counts while Staphylococcus count and pH decreased. After 48 hours fermentation, which is seldom allowed, a zero count was recorded for *Staphylococcus species*. The pH, the total bacterial and the coliform populations also decreased. This preparation was carried out during the end of raining season when the temperature was fairly high. This might have accounted for the high bacterial count compared to counts obtained during the harmattan.

'KUKA' obtained directly from its pod was observed to be acidic (pH 3.2), and harboured no bacterial at all while 'KUKA' which had been exposed (as sold in the market) although still had a pH of 3.2, had a low total count of 160 aerobic bacterial / ml. Organisms identified were mainly gram positive rods with spores at both ends. Neither Staphylococcus nor coliforms were indentified in the exposed 'KUKA'.

The pH of 'NONO' was also observed to be acidic (pH 4.1). When the exposed 'KUKA' solution was mixed with 'NONO' in varying proportions, the pH of 'NONO' decreased. The low bacterial count of 'KUKA' might be due to its dry powdery nature, hence, low water activity, its low pH in solution and its chemical composition. Addy (1978) claimed 'KUKA' contains 5% tannins and therefore these tannins are thought to have played a role in reducing the bacterial population of 'NONO' since they are polphenolic compounds which form insoluble complexes with proteins (Swain, 1965). An increase in the 'KUKA' content of 'NONO' led to a concomitant decrease in the pH, total bacteria, coliform and Staphylococcal population of 'NONO'.

'KUKA' is often used to thicken 'NONO'; being a white powder that can be made into a liquid, resembling 'NONO'. Okoh (1973), found that 'KUKA' has a high Calcium level (2.7% dry weight) while Carr (1955) and Nicol (1957), recorded a good ascorbic level of 317 mg percent and 373 mg percent (wet weight) respectively for it. Thus 'KUKA', apart from being effective in reducing bacterial population in 'NONO', may also enhance the nutritive value. Although, 'KUKA', is used to adulterate and increase the volume of 'NONO' for sale, it is actually useful in improving the bacteriological quality of 'NONO'. However, the fact that it has been suggested that its tannin content could complex protein of bacteria gives cause for concern since it may also complex the protein of milk and render it unavailable for absorption. More data are required to enable a scientific recommendation to be made about its usefulness.

References

Addy, E. O. H., 1978. Studies on the nutritive value of leaves and fruits of the Baobab tree (Adansonia digitata). M.Sc. Thesis. Ahmadu Bello University, Zaria, Nigeria

American public health association, 1967. Standard Methods for the examination of water and Waste water including bottom sediments and sludges. Pp.567 – 609. American Public Health Association. New York.

Al-Delaimy, R. S. and S. H. Ali, 1970. Antibacterial action of Vegetable extract on the growth of pathogenic bacteria. J. Sci. Fd, Agric., 21:110

Appleton, J. A. and M. R. Tansey, 1975. Inhibition of growth of zoopathogenic fungi by garlic extract Myclogia, 67:882.

Bassir, O. and E. N. Maduagwu, 1978. Occurrence of Nitrate, Nitrite, Dimethylamine and Dimethylnitrosamine in some fermented Nigerian Beverages. J. Agric. Food Chem., 26:200 - 203

Beuchat, L. R., 1976. Sensitivity to *Vibrio parahaemolyticus* to spices and organic acid J. Food Sci., 41:899 – 902.

Carr, W. R., 1955. Ascorbic acid content of Baobab fruit. *Nature 176*:1273.

Cox, W. A., 1979. Food group syposium fermented foods - Fermented dairy products. J.Sci Food Agric. 30:839 – 842

Dalziel, J. M., 1937. Useful Plants of West Tropical Africa. Crown Agents for Oversea Governments and Administrations, London. 2nd Reprint (1955).P. 112

Ghani, A. and A. O. Agbejule, 1986. A pharmacognostic study of the fruits of Adansonia digitata L. In: The state of Medicinal Plants research in Nigeria. Sofowora, A. (Ed.) Faculty of Pharmacy, University of Ife, Ile – Ife, Nigeria. PP:181 – 185.

Keay, R. W. J., 1989. Trees of Nigeria. Clarendon Press, Oxford P. 476.

Klipstein, F. A., R. F. Engert and H. B. Short 1977. Relative Enterotoxigenicity of coliform bacteria. The J. Infect. Disease, 136: 205 – 215.

Martins, C. R. S., 1969. Practical Food Inspection 7th edition H.K. Lewis and Co. Ltd. London.

Minor, T. E. and E. H. Marth, 1972. *Staphylococcus aureus* and Staphylococcal food intoxication. A review III staphylococci in dairy foods. J. Milk Food Technol., 32: 77 – 82

Muir, D. D., 1984. Reviews of progress of Dairy Science: Frozen concentrated milk. J. Dairy Res., 51: 649 – 664.

Nalin, D. R, M. Rahaman, J. C. Claughlin, M. Yunus and G. Curlin, 1975. Enterotoxigenic *Escherichia coli* and indio pathic diarrhea in Bangladesh. Lancet 2: 1116 – 1119.

Nicol, B. M., 1957. Ascorbic acid content of Baobab fruit. *Nature 80:* 287.

Okoh, P. N., 1973. Biochemical Studies of traditionally prepared foods of Northern Nigeria. M. Sc. Thesis. Ahmadu Bello University, Zaria Nigeria

Olson, J. C., E. P. Casman, E. F. Baer and J. E. Stone, 1970. Enterotoxigenicity of *Staphylococcus aureus* cultures isoalted from acute cases of bovine mastitis Appl. Microbiol., 20: 605 – 607.

Swain, T., 1965. Plant Biochemistry-Edited by J. Bonner and J.E. Varner. pp: 552. Academic press, New York, N.Y.

Sheikh, M. I. and L. O. Luedecke, 1974. *Staphylococcus aureus* in commercial processed fluid and non dairy products. J. Milk Food Technol., 37: 329 – 332.

Sylvester, K., 1974. Occurrence of *Staphylococcus aureus* in Milk of mastits cows. Food Sci. Technol Abst., 6:4 P472.

Woolfe, M. L., M. F. Chaplain and G. Otchere, 1977. J. Sci. Food Agric., 28 : 519.

Zaika, L. L. and J. C. Kissinger, 1981. Inhibitory and stimulatory effects of Oregano on *Lactobacillus plantarum* and *Pediococcus cerevisiase*. J. Food. Sc. 46: 1205 – 1210.