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MICROORGANISMS ASSOCIATED WITH THE TRADITIONAL FERMENTATION OF AFRICAN LOCUST BEANS FOR THE PRODUCTION TASTY FOOD CONDIMENT (DAWADAWA)

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ABSTRACT: *Microorganisms associated with the traditional fermentation of African locust beans for the production Tasty Food Condiment (Dawadawa) was carried out. The organisms involved in the fermentation of the seeds were determined by standard microbiological and biochemical methods. The organisms identified are from genera Bacillus, Kurthia, Staphylococcus, Listeria and Micrococcus. Hazard and critical control point (HACCP) at each stage during fermentation was determined, washed seeds and water used for washing was found to have high number of microorganisms. Microbial fermentation increased the bioavailability of nutrients in the condiments produced from the seeds of P.biglobosa. African locust bean is a good source of protein and can be used as a Tasty Food Condiment (Dawadawa).*

KEYWORDS: Microorganisms, African Locust Beans, Dawadawa, Traditional Fermentation

INTRODUCTION

Production of fermented African locust bean has remained a traditional family art in homes with rudimentary utensils (Audu *et al,* 2004). Adewumi and Olalusi (1995) reported that women mainly do processing of locust bean locally. Methods used vary from one locality to another depending on the culture of the people, their beliefs, taste and practice of the fore-parents who were involved in the same vocation. These variations in processing techniques in turn bring about variations in the quality of iru (Sadiku, 2010).

Fermentation is one of the oldest methods of food preservation known to man. In Africa, the art of fermentation is wide spread including the processing of fruit and other carbohydrate source to yield alcoholic and non-alcoholic beverages, the production of sour tasting Ogi - the fermented cereal product which provide instant energy in breakfast and convalescent diets (Adewusi *et al.,* 1991; 1992) oil seed such as African locust bean, melon seed, castor oil seed mesquite bean and soybean are also fermented to give condiment. Fermentations are enzyme-induced chemical alterations in food or substrate. The enzyme involved may be produced by microorganisms or they may be indigenous to the food or substrate (Ihekoronye and Ngoddy, 1985). Generally, fermentation results in the breakdown of complex organic substances into smaller ones through the action of catalysis.

A substantial literature documents the successful fermentation of vegetable proteins for condiment production. Both microbial and biochemical changes involved therein have

received much attention. A further understanding about the interactions of the microorganisms and plant materials is necessary to improve the quality of fermented condiments. Such understanding will aid in further development and control of the fermentation process (Dakwa *et al*, 2005). This paper aimed at isolation and identification of microorganisms associated with the traditional fermentation of African locust beans used for the production of tasty food condiment (Daddawa).

MATERIALS AND METHODS

Sample collection

Dried sample of African locust bean *(Parkia biglobosa)* were obtained from Sokoto central market located in Sokoto metropolis. All the materials used in dawadawa production (Basket, Calabash, Sieve, pawpaw /banana leaves, Wood ash/Potash, jute bags, plastic buckets) were purchased from Sokoto central market. The samples were taken to laboratory for analyses.

Traditional fermentation of dawadawa from African locust beans

For the production of dawadawa, method of Waters-Bayer, (1988) was followed. Locust beans were boiled for at least 24 hours with water being added frequently. Cooked beans was mixed with wood ash and pounded, then washed several times to remove the seed coats. The beans were being boiled for another 3-4 hours until they become softer, and was spread in a large flat basket covered with leaves and was allowed to ferment for two days. On the third day, the locust bean mass was transferred to a deep bowl and allowed to ferment for another 24 hours. The locust bean was spread out again in a large flat basket and partially in sun for several hours. The bean was pounded with mortar and pestle into a paste and formed by hand into balls or wafers. The flow chart of the fermentation process of making Food tasty condiment known as Dawadawa from African Locust Beans is presented in Figure 1 below.

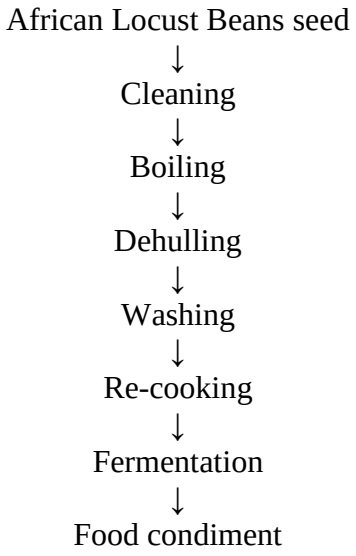

Fig. 1: Flow Chart for Traditional Processing of African Locust Bean to Tasty Food Condiment (Akande *e t al.*, 2010)

Isolation of the Fermenting Microorganisms

One gram [1g] of the fermented locust beans were taken and diluted serially. One mil (1ml) from different dilutions was streaked onto nutrient agar. Isolates from plate count agar (PCA) was picked and sub-cultured in nutrient agar and *Bacillus* species was characterized using morphological examination and biochemical test comprising of colony and cell morphology. The biochemical tests that were carried out are: anaerobic growth, acid production from D-glucose, hydrolysis of casein and starch, growth at pH 5.7, in 6.5% (w/v) NaCl and 10% (W/V) NaCl, at 37°C and 65°C (Claus and Berkeley, 1986).

Characterization of fermenting isolates from fermented Locust and Soya bean

Anaerobic Growth

The organism was isolated using method described by Claus and Berkerly (1986) using standard isolation medium. 0.1ml of the test organism was spread out on the solid standard medium plates. The plates were incubated in anaerobic jar for 2 days at 35^0C.

Acid production from D-Glucose

Isolates were inoculated into nutrient broth sugars and examine daily for seven days for acid and gas production (Barrow and Feltham, 1993)

Hydrolysis of Casein

Plates of Casein agar were inoculated at intervals and examined for up to 14days for clearing of the medium around the bacterial growth (Barrow and Feltham, 1993)

Starch Hydrolysis

Isolates were inoculated onto nutrient agar plates containing 0.2% soluble starch and incubated at 30^0C for 5 days. Plates were flooded with lugols iodine solution, the medium turned blue for negative hydrolysis. A clear colourless zone indicates hydrolysis (Barrow and Feltham, 1993).

Growth in Media with Increased NaCl Concentration

Required amount of sodium chloride 6.5% (wv) and 10% (wv) was added to broth and inoculated with organism to be tested. The tubes were incubated at 37^0C for 24hrs (Barrow and Feltham, 1993

Determination of Hazard Analysis Critical Control Point during the production of condiments

At each different stage of Daddawa production, sample was collected from raw seeds, fermented seeds, washed seeds, floor swab, mortar and pestle to determine critical control point, according to the method of the Food and Agricultural Organization (FAO, 1979).

RESULTS

The microbiological analysis of the viable bacteria count during the fermentation of African locust beans was evaluated and the result is presented in **Figure 2.** The highest count was observed in washed African locust beans seeds with a count of 7.2×10^5 CFU/g and the fermenting seeds had a count of 6.2×10^5 CFU/g.

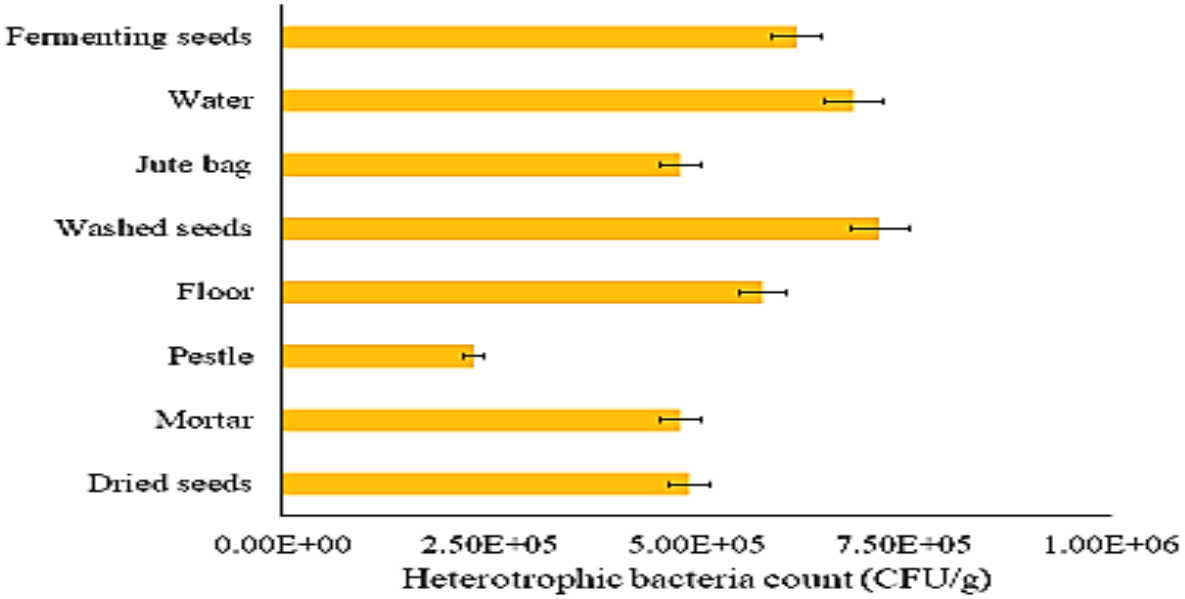

Figure 2: Viable colony count from African locust beans at each stage of production

Phenotypic identification of bacteria isolated during the production of food tasty condiment (dawadawa) by fermenting the seeds of African locust beans was evaluated and the result of the frequency of occurrence of the isolates is presented in **Figure 3.** From the figure, the organisms responsible for the fermentation of African locust beans for food tasty condiment are *Bacillus, Kurthia, Staphylococcus, Listeria and Micrococcus.* It was observed based on the frequency data of occurrence; shows that *Bacillus* spp. constitute the bulk of organism involved the fermentations of the seeds for the production of food tasty condiment (Dawadawa).

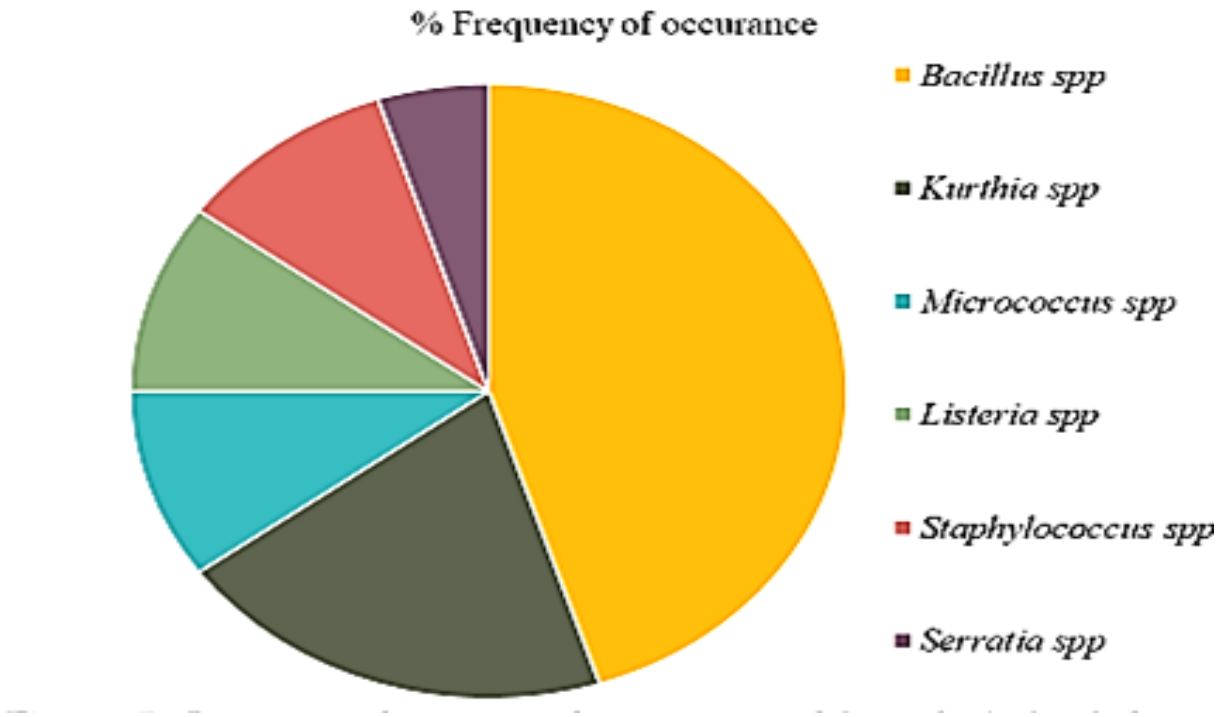

Fig. 3: Percentage Frequency of Occurrence of Bacteria Isolated from Dawadawa Production

DISCUSSION

The microorganisms identified are from *Bacillus* genera which are the dominant organisms, other microorganisms isolated are from the genera of *Staphylolococcus*, *Kurthia*, *Listeria*, *Micrococcus* and *Serratia*. Similar result was also reported by Achi (1992) who investigated the microorganisms associated with the natural fermentation of *Prosopis africana* seed. A wide array of microorganisms including *B. subtilis*, *B. megaterium*, *B. licheniformis*, *Staphylococcus* spp, *Micrococcus* spp, *Klebsiella* spp, *Enterobacter* spp and *Lactobacillus spp*. The involvement of a variety of microorganisms in spontaneous food fermentation is normal and does not render the product unsafe for human consumption, especially when none of the microorganisms is pathogenic to man (Oyeyiola, 2002). The growth of microorganisms during the fermentation of daddawa is likely to have a significant influence on the quality and flavor of the final product.

Staphylococcus species have been found to be associated with fermenting foods of plant origin particularly vegetable proteins (Omafuvbe *et al.*, 2000; Odunfa and Komolafe, 1989). Presence of *Staphylococcus* could have been caused by handling of the seeds after boiling. *Corynebacterium species* which was present between the 12 and 48h of fermentation of locust bean is known to be associated with fermentation of cassava to *gari*. It converts starch to lactic acid and formic acid thus lowering the pH (Akingbala *et al.*, 2005). Its role could be that of opportunistic contaminant. Further study in which it should be used as a starter may reveal its real contribution to fermentation of locust bean.

High content of carbohydrate (63%) could have encouraged its initial presence in fermenting Locust beans. *Corynebacterium* was absent during the fermentation of locust bean to produce *daddawa*. This might be due to the low carbohydrate content of locust bean. (Omafuvbe *et al.,* 2000) Reported low carbohydrate content in locust bean seeds (17%) when proximate composition and sensory value of fermented and unfermented soybean and locust bean were compared. The high count recorded from the washed seeds was due to the water used in washing the seeds. Edema and Fawole (2006) reported water used for washing the dehulled seeds may remove some of the contaminating microorganisms introduced during dehulling, but it may also add new ones. Another reason for not having high count in other steps during production of traditional daddawa was the daddawa was carefully done by the researcher at home taking consideration of all sources of contamination and thereby producing the condiment under hygienic conditions.

CONCLUSION

Microorganisms were isolated from traditional fermentation of African locust bean in the process of making food tasty condiment (Dawadawa) of which *Bacillus* spp has the highest occurrence. Although potential pathogens were not isolated from this study, there is need for clean environment and materials to be used during traditional fermentation, most especially the use of clean water as it contains high count of bacteria from the research.

REFERENCES

Achi, O.K. (1992). Microorganisms associated with natural fermentation of *Prosopis africana* seeds for the production of Okpiye Plant Foods. *Human Nutrition 42: 297-304.*

Adewumi, B.A. and Olalusi, A.P. (1995): Performance of a Manual operated concave-type Locust Bean Dehuller. *Journal of Agricultural. Technology 2:23:30.*

Adewusi, S.R.A, Orisadare, B.O, and Oke, O.L, (1991). Studies on wearing Diet in nigeria, 1. Carbohydrate source. *Cereal chemistry.* 165-169

Adewusi, S.R.A, Orisadare, B.O, and Oke, O.L, (1992). Studies on wearing Diet in nigeria, 2. Protein source. *Plant food for Human Nutrition.* 42: 183-192.

Akande, F. B., Adejumo, O. A., Adamade, C. A. and Badunje, J. (2010). Processing of Locust bean fruits, challenges and prospects. *African Journal of Agricultural Research.* **5**(17) 2268-2271

Akingbala J, Oyewole OB, Uzo-Peters PI, Karim RO, Baccus-Taylor GSH. (2005) Evaluating stored cassava quality in *gari* production. J Food Agric Environ. 3:75-80

Audu, I., Oloso,A. and Umar,B.(2004).Development of a concentric cylinder Locust bean dehuller. Agricultural Engineering International: The CIGR Journal of scientific research and development manuscript PM 04003.1(11)

Barrow, G.I., and Feltham, R.K.A. (1993) Cowan and steel's manual for the identification of medical bacteria. Cambridge, Cambridge university press.

Claus, D. and Berkerly, R. C. W. (1986). The genus Bacillus. In Bergey's manual of systematic Bacteriology, Vol. 2. Ed. Sneath. P. H. A, Mair, N. S, Sharpe, M. E. and Holts, J. G. 1105-1139

Dakwa, S., Sakyi-Dawson, E., Diako, C., Annan, N.T and Amoa-Awua, W.K. (2005): Effect on the fermentation of soybeans into dawadawa (Soy-dawadawa). *International journal food, microbiology*. 104:69-82.

Edema, M. O. and Fawole O. (2006). Evaluation and optimization of critical control points in the production of Iru. *Research Journal of Microbiology*, **26**; 533-541

Food and Agricultural Organisation (1979): Manuals of food Quality Control. FAO Food and Nutrition Paper, United Nations, Rome 14(4) A1-F10.

Ihekoronye, A. I. and Ngoddy, P. O. (1985). Integrated food science and technology for the tropics. Macmillan Publishers Ltd, London and Basingstroke, pp 34-87

Odunfa SA, Komolafe OB. (1989) Nutritional characteristics of *Staphylococcus* species from fermenting African locust bean (*Parkia biglobosa*). Nahrung. 33:607–615.

Omafuvbe BO, Shonukan OO, (2000) Abiose SH. Microbiological and biochemical changes in the traditional fermentation of soybean for *soy-dadawa*, Nigerian fermented condiment. *Food Microbiol*. 17:469-74

Oyeyiola G.P (2002). Fermentation of the seed of *Prosopis Africana* to produce condiment. *NISEB Journal* 2 (2):287-299

Sadiku, O.A. (2010): Processing Methods of Influence, the quality of fermented African Locust Bean (Iru/Ogiri/dadawa) *Parkia biglobosa. Journal of Applied Sciences Research* 6(11):1656-1661.

Waters-Bayer, A. (1988): Soybean Daddawa: An Innovation by Nigerian Women ILEIA Vol. 4, No. 3:8-9.