Full length research article

PRODUCTION OF LOCAL DADAWA SEASONING AND CONDIMENT FROM *ACACIA NILOTICA* (LINN) SEEDS.

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ABSTRACT

Dadawa was produced in the laboratory by fermenting *Acacia nilotica* LINN Rico 1994 seeds with *Bacillus subtilis*(Ehrenberg 1835) Cohn 1872 and analysed for proximate content, temperature and pH. There was 5 % increase in ash and moisture content and a corresponding reduction in crude fibre. The crude protein and carbohydrates increased by 3.81 % and 14.81 % respectively while the pH rose from 5.09 at the beginning of the fermentation to 8.43 at the end. With the increase in the time of fermentation, the microbial growth was rapid, increasing from 10.05-56.87 $\log_{10}$ c.f.u.g^{-1} resulting in a rise in the fermentation temperature from 27.5 ^{o}C-31.7^{o}C after 48 hours which dropped thereafter to 27.3 ^{o}C at the end of the process. The total soluble sugar decreased from 27.21-14.45 mg.g^{-1}while the reducing sugar increased from 2.18-10.23 mg.g^{-1} after 48 hours before reducing to 8.07 mg^{-1} on the 3rd day. There was no significant difference ($P<0.05$) in the organoleptic attributes scored between the dadawa produced by fermenting *Acacia nilotica* seeds with *Bacillus subtilis* and that produced from locust beans

Key words. "Dadawa", *Acacia nilotica,* Fermentation, *Bacillus subtilis*

INTRODUCTION

The preparation of foods by fermentation has good advantages such as the destruction of undesirable flavours and odours, production of a good flavour, increased digestibility, synthesis of desirable constituents and changes in physical state, longer shelve life and destruction of inhibitors (Odunfa 1985). Fermentation is one of the oldest methods of food preservation known to man. In Africa, the art of fermentation is widespread including the processing of fruits and other carbohydrate sources to yield alcoholic and non-alcoholic beverages (Adewusi *et al*. 1991). Oil seeds, such as African locust bean, melon seed, castor oil seed, mesquite bean and soybean are also fermented to give condiments (Omafuvbe *et al*. 2004).

The production of condiments is largely done on a traditional small-scale household basis under highly variable conditions (Odunfa 1985). The fermentation is usually carried out in a moist solid state, involving contact with appropriate inocula of assorted microorganisms aided by the temperatures of the tropics. The desired state of the fermentation of the condiments is indicated by the formation of mucilage and overtones of ammonia produced as a result of the breakdown of amino acids during the fermentation process (Omafuvbe *et al*. 2000). The characteristic ammoniacal odour and flavour of condiments enhance the taste of food in which they are used especially the various soups used as accompaniment to the starchy root and tuber diets (Simmons 1976).

The ultimate aim of eating food is to derive adequate nutrients, which the body needs for its normal functioning. In Nigeria, the prevalence of malnutrition demands that particular attention be paid to the nutritive value of food.

Significant contributions have been made in microbiology and biochemistry in fermentation process of legumes and oils seeds leading to the production of fermented condiments such as iru, from African locust bean (Eka 1984; Odunfa 1986), Ogiri from melon seed (Barber & Achinewhu 1992), Soumbala from African locust bean seed, (Ouoba *et al*. (2003) and dadawa from soybean (Omafuvbe *et al*. 2000) but so far, little research has been conducted on the production of dadawa from *Acacia* seeds.

MATERIALS AND METHODS

Acacia nilotica seeds

These were collected at the farmlands of Usmanu Danfodiyo University, Sokoto, Nigeria.

Fermentation

1.5 kg of the seeds were boiled for 12 hr and allowed to cool overnight. These were dehulled by pounding with wooden pestle and mortar and washed with water to remove the seed coats. They were boiled again for 6 hr, drain, allowed to cool and divided into three parts of 500 g and packed in baskets lined and covered with aluminium foil. 10.05 $\log_{10}$ cfu.g^{-1} cell mass of *Bacillus subtilis* were inoculated onto the cooked seeds. These were then kept in the dark for 3 days to ferment.

Determination of Ash

10 g of the raw seeds and the fermenting dadawa were weighed and transferred into a crucible of known weight. This was then ash-burned in a muffle furnace at 500 ^{O}C for 1 hr. The difference in weight was calculated according to the methods of Udo & Ogunwale (1986).

Nitrogen

20 ml of concentrated sulphuric acid was introduced into the micro-kjeldahl flask containing 2 g of ground sample. Two kjeldahl catalyst tablets were added and digested for 4 hr, cool overnight in a fume cupboard and the contents diluted with water to 250 cm^3. A distillation unit was then used and the percentage nitrogen determined according to the Kjeldahl techniques of the AOAC (1990)

Moisture content

6 g of the ground sample were dried in the air oven at 105 ^{O}C for 24 hr. The sample was then cooled in desiccators. Further drying was done until constant weight was obtained. The moisture content was calculated as percentage moisture according to the methods of Owoso & Ogunmoyela (2001).

Ether extract

2 g of the sample were wrapped in a defatted filter paper in the extraction thimble and transferred to the soxhlet extraction unit

containing 200 ml of petroleum ether. The extraction was done for 6 hr after which the solvent was evaporated and cooled in the desiccator and weighed. The percentage of the ether extract was calculated by multiplying the increase in weight of the extraction flask by 100 (Owoso *et al.* 2000).

Crude fibre
2 g of the sample were ground and diluted in 100 ml distilled water in a conical flask. 20 ml of 10 % sulphuric acid were added and boiled gently for 30 min. The sample was then cooled and filtered. The filtrate was subjected to treatment using 10 % sodium hydroxide. The residue was passed through 20 ml of ethanol and petroleum ether and then dried at 105 ^{O}C. The sample was weighed and ashed at 600 ^{O}C for 90 min, cooled and reweighed and the percentage of crude fibre calculated (Owoso *et al.* 2000).

Temperature and pH
Temperature was monitored using a thermometer every eight hours for 72 hr while pH was measured by dissolving 2 g of the sample in 10 ml distilled water.

The microbial growth
This was monitored by dissolving 2 g of the sample and serially diluting it and inoculating it into nutrient agar plates. The number of colonies formed were counted and expressed as colony forming units per gram (c.f.u.g^{-1}) of the sample (Fawole & Oso 2001).

Determination of sugars
At different hours of the fermentation, 2 g of the samples were collected and dried in the oven at 70 ^{O}C, ground and defatted. The soluble sugars were extracted with 80 % ethanol (v/v) following the methods of Omafuvbe *et al.* (2004). The total soluble sugar was determined by the anthrone reagent method of Morris (1948) and reducing sugar was determined by the calorimetric method (Somogyi 1945) using standard curve of glucose.

Sensory evaluation
Cooked okro soup of *Acacia nilotica* seeds (dadawa) produced with the fermentation of *Bacillus subtilis* was organoleptically evaluated by a panel of 20 tasters of 10 males and ten females within the ages of 20 and 30 yr, comparing it to locust bean dadawa prepared soup using a score line of 1(dislike extremely) to 5 (like extremely) according to the methods of Njoku *et al.* (1991) and Wokoma & Aziagba (2002). Four attributes were assessed, namely colour, aroma, taste and acceptability.

Statistical analysis
The data obtained in this study was subjected to analysis of variance. Statistical significance was accepted at P value equal to or less than 0.05 confidence level.

RESULTS
The biochemical analysis showed that after the fermentation there was an increase in the ash (5-10 %), moisture (5-10 %), crude protein (24.39-28.20 %), while there was a decrease in the crude fibre (25-20 %) and carbohydrate from 45.61-30.80 % (Fig. 1). The microbial growth rose from 10.05 $\log_{10}$ cfu.g^{-1} at the beginning of the fermentation to 60.98 $\log_{10}$ cfu.g^{-1} at the 48th hr and then began to decrease (Fig. 2A), while the pH gradually increased from 5.09-8.43 (Fig 2B). The temperature increased gradually during the fermentation process from 27.5 ^{O}C-31.7 ^{O}C after 32 hr and dropped down to 27.3 ^{O}C at the 72nd hr (Fig. 3).

There was a decline in total sugar from 27.2 mg.g^{-1} to 14.45 mg.g^{-1}, while the reducing sugar increased from 2.18 mg.g^{-1} to 10.23 mg.g^{-1} after 48 hr of fermentation. By the 3rd day, the concentration of the reducing sugar had declined to 8.07 mg.g^{-1} (Fig. 4). There was no significant difference ($P<0.05$) in the organoleptic attributes scored between the dadawa produced by fermenting *Acacia nilotica* seeds with *Bacillus subtilis* and that produced from locust beans (Fig. 5).

DICUSSIONS
The results from this study suggest that the *Acacia nilotica* seeds subjected to the action of microorganisms and/or enzymes gave desirable biochemical changes and led to the modification of quality of the condiment. Part of this was expressed by the increase in the pH during the fermentation process, which was probably due to the production of ammonia through the activities of protease and deaminase enzymes. The liberation of ammonia during fermentation is a common phenomenon of protein on food as observed by Odunfa (1985) during the production of iru. The rise in temperature observed was due to the growth and development of the microorganisms due to heat liberation. Most of the starches were converted to simple sugars which were used up by the microorganisms to increase the microbial mass. The microorganisms grew very rapidly and produced a high percentage yield of protein (Fig. 1). Ibrahim & Antai (2005) reinforced this observation when they work on the production of dadawa from African locust-bean seeds and observed a marked decrease in the total sugar content and increase in crude and true protein levels. Pelczer *et al.* (1993) and Omafuvbe *et al*. (2006) also made similar observation on the growth of *Lactobacillus bulgaricus* in the fermentation of Bulgarian milk and fermentation of soybean for the production of dadawa respectively.

The results further shows that soluble sugar decreased significantly while the reducing sugar increased within 48 hr and decreased in the last 12 hr (Fig. 3). The consumption of the soluble sugars by the growing microorganism (Fig. 2a) may have been responsible for the drop in the soluble sugars and reducing sugar levels. This observation was supported by earlier reports (Sanni & Ogbonna 1991; Omafuvbe *et al*. 2004). The *Bacillus subtilis* bacterium used in the fermentation is a common saprophile that has the ability to produce exoenzyme which can hydrolyse starch and casein leading to the rapid growth of the microorganism and also the reduction in the concentration of sugars. Earlier studies on the fermentation of ocust bean and soybeans (Ariahu, *et al*. 1999; Ouoba, *et al*. 2003; Omafuvbe 2006) have identified *Bacillus* sp as the main microorganisms responsible for the fermentation of dadawa.

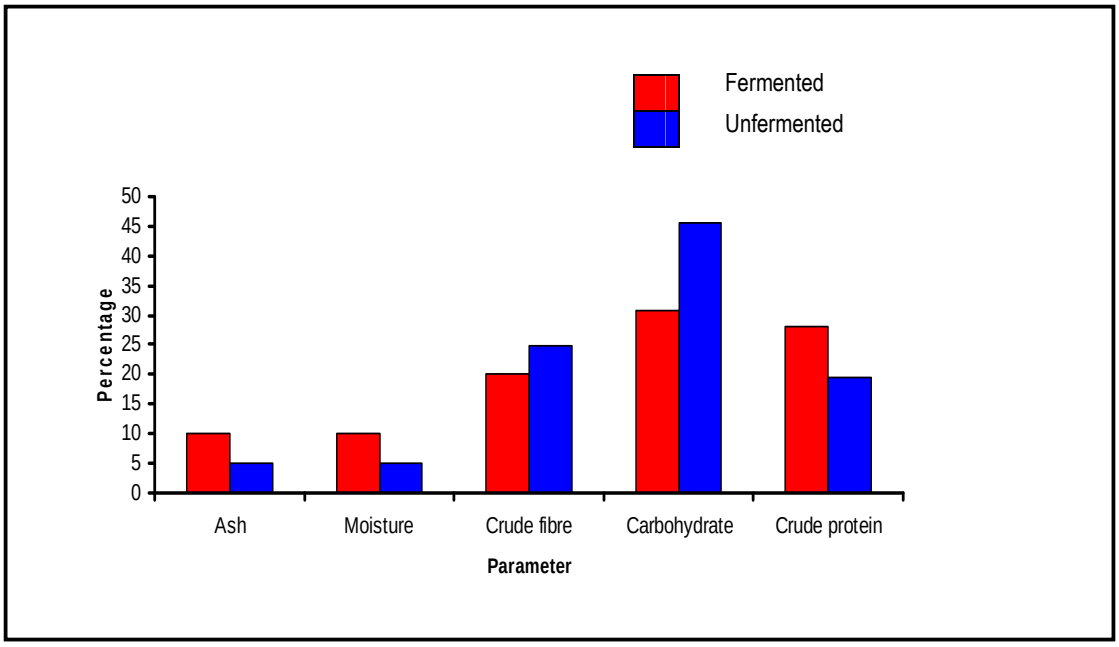

FIG 1: PROXIMATE ANALYSIS OF FERMENTED AND UNFERMENTED SEEDS OF *ACACIA NOLITICA.*

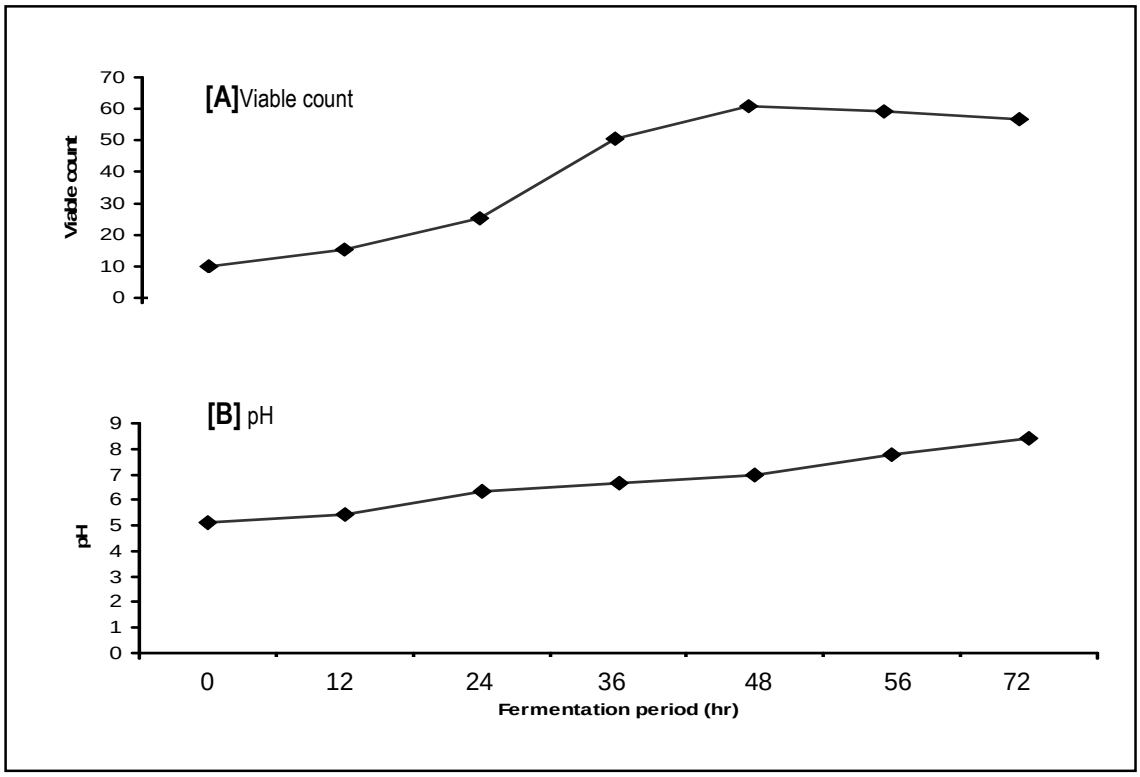

FIG. 2. CHANGES IN THE VIABLE COLONY COUNTS IN C.F.U.G^{-1} AND pH DURING THE FERMENTATION OF *A. NILOTICA* SEEDS WITH *B. SUBTILIS*

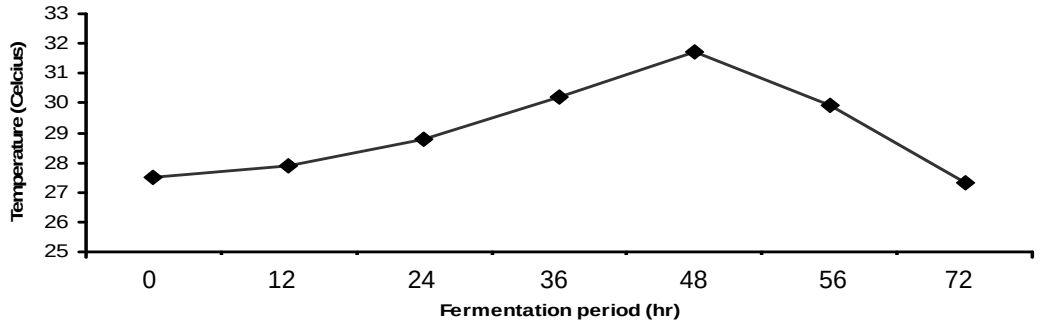

FIG. 3. CHANGES IN TEMPERATURE DURING THE FERMENTATION OF *A. NILOTICA* SEEDS WITH *B. SUBTILIS*

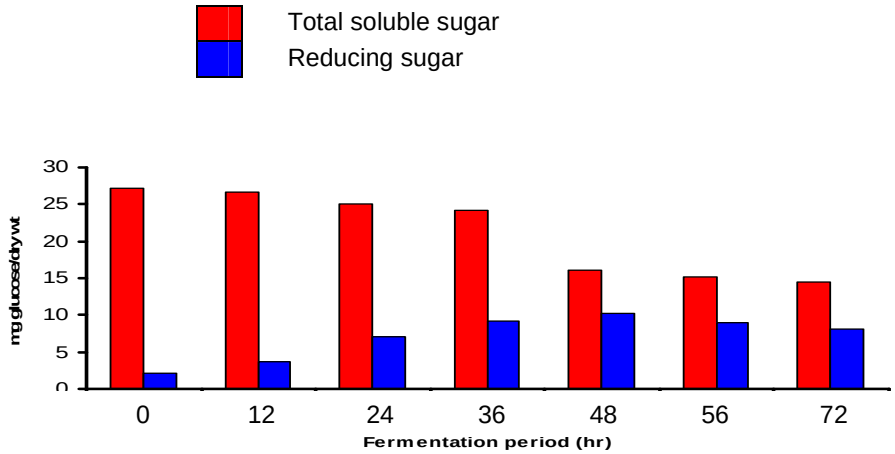

Fig 4: CHANGES IN SOLUBLE SUGAR AND REDUCING SUGAR LEVELS

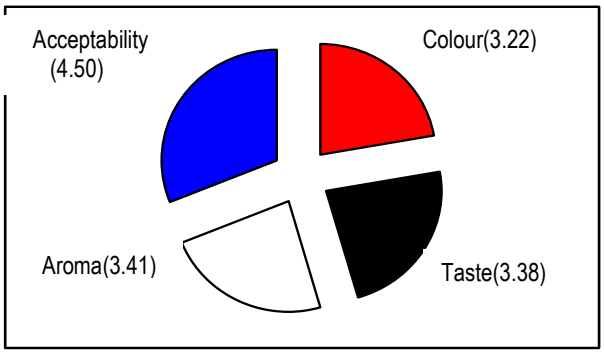

FIG. 5. ORGANOLEPTIC SCORES OF DADAWA COOKED OKRA SOUP USING SCORE LINE OF 1-5

Most bacterial fermentations produce lactic acid and therefore the dadawa produced in this study has a good taste and aroma that could make it a favorite ingredient as a seasoning and condiment. The sensory tastes carried out were found to have a characteristic aroma and good appearance that was comparable to dadawa produced from the African locust bean. Therefore the production of a fermented dadawa as a local condiment for use as maggi from *Acacia nilotica* is a further contribution towards the discovery of nutritive foods for the use of average Nigerian.

REFERENCES

Adewusi, S. R. A,; Orisadare, B. O. & Oke, O. L. 1991. Studies on Weaning Diets in Nigeria 1. Carbohydrate Sources. *Cereal Chemistry* 68:165-169.

Ariahu, C. C.; Ukpabi, U. & Mbajunwa, K. O. 1999. Production of Africanbreadfruit (*Treculia africana*) and soybean (*Glycine max*)

seed based food formulations, 1: Effects of germination and fermentation on nutritional and organoleptic quality. *Plant Foods and Human Nutrition* 54:193-206.

Association of Official Analytical Chemists (AOAC) 1990. *Official methods of analysis* 15th edition, AOAC Arlinton, United States of America

Barber, L.I. & Achinewhu, S. C. 1992. Microbiology of Ogiri production from melon seeds (*Citrullus vulgaris*). *Nigerian Food Journal* 10:129-135

Eka, O. U. 1984. Review of studies on changes in nutrient composition during fermentation of foods. *Nigerian Journal of Nutritional Science* 5(1):9-13.

Fawole, M. O. & Oso, B. A. 2001. Microbial growth. In: *Laboratory Manual of Microbiology.* Spectrum Books limited, Ibadan Nigeria

Ibrahim, M. H. & Antai, S. P. 2005. Chemical changes during the Fermentation of African locust bean (*Parkia filicoidea* Welw) seeds for production of 'Daddawa'. *Plant food for Human Nutrition.* 3(26):179-184.

Morris, D. L. 1948. Qualitative determination of carbohydrate with drywoods anthrone reagent. *Science* 107:245-255.

Njoku, H. O; Ofuya, C. O. & Ogbulie, J. N. 1991. Production of Tempe from the African Bean (*Sphenostylis stenocarpa* Harms). *Food Microbiology* 8:209-214.

Odunfa, S. A. 1985. Microorganisms associated with the fermentation of African Lucust beans (*Parkia filicoidea*) during "iru" preparation. *Journal of Plant Foods*. 3:245-250.

Odunfa, S. A. 1986. African Fermented foods, In: *Wood*. B. J. B. (ed*) Microbiology of Fermented Foods,* Vol 11. Amsterdam, Elsvier Applied Science Publishers

Omafuvbe, B. O; Shunukan,C.O & Abiose, S. H. 2000. Microbiogical and biochemical changes in the traditional fermentation of soybean for soy-daddawa, Nigerian food condiment. *Food Microbiology* 17:469-474

Omafuvbe, B.O; Olumuyiwa, S.F; Bolanle, A. O. & Steve, R. S. 2004. Chemical changes in African Locust Bean (*Parkia biglobosa*) and Melon (*Citrulus vulgaris*) Seeds during Fermentation to condiments. *Pakistan Journal of Nutrition* 3(3):140-145.

Omafuvbe, B. O. 2006. Effect of Salt on the fermentation of soybean (*Glycine max*) into daddawa using *Bacillus subtilis* as starter culture. *African Journal of Biotechnology* 5(10):1001-1005.

Ououba, L. I. I.; Rechinger, K. B.; Barkholt. V.; Diawara, B.; Traore, A. S.; & Jackobsen, M. 2003. Degradation of proteins during the fermentation of Africa locust bean (*Parkia biglobosa*) by strains of *Bacillus subtilis* and *Bacillus pumilus* for production of Soumbala. *African Journal of Applied Microbiology* 94:396-402.

Owoso, O.; Aluko, O. & Banjoko, O. I. 2000. Quantitative Analysis of Food. In: *Manual of Food Analysis and Quality Control*. Concept Publications, Lagos Nigeria

Owoso, O. & Ogunmoyela, O. A. 2001. Proximate Constituents of Food. In:*Chemical Analysis of Foods- an outline*. Concept Publishers Limited, Lagos Nigeria.

Pelczer, M. J.; Chan, E. C. S. & Krieg, N. R. 1993. Microorganism as Food-Single cell protein. In: *Microbiology*. Tata McGraw Hill Publishing Company. New Delhi.

Sanni, M. O. & Ogbonna, D. N. 1991.The production of "owoh"- a Nigerian fermented seasoning agent from cotton seed (*Gossypium hisutum* L). *Food Microbiology* 8:223-299

Scott, S. A. 1977. Classification In:*Taxonomy of Flowering plants*. African Publishers Ltd. Onisha Nigeria.

Simmons, E. B. 1976. Calorie and Protein intake in three villages of Zaria Province, May 1970-July 1971. Samaru Miscellaneous Paper. Institute of Agricultural Research, ABU, Zaria No. 55:151

Somogyi, M. 1945. A new reagent for the determination of sugars. *Journal of Biology and Chemistry* 160:61-68

Udo, E. J. & Ogunwale, J. A. 1986. Determination of sugars In: *Laboratory Manual for the analysis of soil, water and plant samples* (2nd Ed) Lagos, Nigeria

Wokoma, E. C. & Aziagba, G. C. 2002. Sensory evaluation of Dawa Dawa Produced by the Traditional Fermentation of African Yam Bean (*Sphenostylis stenocarpa* Harms) seeds. *Journal of Applied Sciences and Environmental Microbiology* 8:209-214