Journal of Food Technology 8 (3): 99-101, 2010
ISSN: 1684-8462

Influence of Hydrothermal Treatments on Proximate Compositions of Fermented Locust Bean (Dawadawa)

Ogbonnaya Chukwu, B.A. Orhevba and Babatunde Ibrahim Mahmood
Department of Agricultural and Bioresources Engineering,
Federal University of Technology, P.M.B. 65, Minna, Niger State, Nigeria

Abstract: Seeds of locust bean (*Parkia biglobosa*) were boiled for 12 h and soaked for 8 h and re-boiled for 1 h with the addition of potash as a softening agent and subjected to fermentation for 48 h. The unfermented and fermented (dawadawa) beans were then analyzed for proximate compositions. The results of the chemical analyses indicate that fermentation resulted in protein and lipid enrichment and a reduction in total carbohydrate. It was concluded that processing locust bean into dawadawa increases the key nutritional constituent, protein. This explains why dawadawa is commonly included in stews and soups as a substitute to animal protein among the low income earners in less developed and developing countries.

Key words: Dawadawa, fermentation, hydrothermal treatments, locust bean, proximate compositions, animal protein

INTRODUCTION

The high cost of animal protein has directed interest towards several leguminous seeds. Among the plant species, legumes are considered as the major sources of dietary protein. They are consumed worldwide especially in developing and under-developed countries where consumption of animal protein is limited as a result of economic, social and cultural factors (Esenwah and Ikenebomeh, 2008). Seeds of legumes may account for 80% of dietary protein and may be the only source of protein for some groups. They are eaten as meals in cooked form and are commonly used in fermented form as condiments to enhance the flavour of food (Odunfa, 2007; Aidoo, 1986; Achi, 2005). With high contents of protein, legume condiments can serve as a tasty complement to sauces and soups and can substitute for fish or meat.

Locust bean seed (*Parkia biglobosa*) is a grain legume found growing in savannah areas in Africa. It is fermented and added to soups and stews as condiment to enhance their flavour and nutritional values. Odunfa (1981) stated that the fermented locust bean seed is commonly consumed in Ghana, Nigeria, Sierra-Leone and Togo. In Nigeria it is called iru in Yoruba, dawadawa in Hausa and ogiri-igala in Igbo. It is also referred to as kinda in Sierra-Leone and kpalugu in Ghana. Fermented food spices have remained popular among Africans especially now that the industrially-processed food seasonings such as curry and thyme are costly and beyond the reach of many people. Soups and stews prepared with dawadawa are preferred in some regions in Africa because they produce better taste and aroma. They are also important protein supplement (Ogunbunmi and Bashir, 1980).

The objective of this research is to study the effect of hydrothermal treatments and subsequent fermentation on the proximate compositions of locust bean. Given the importance of dawadawa as a food condiment among traditional rural populations and given the fact that the product's quality is variable and its shelf life unreliable, it becomes necessary that the influence of hydrothermal treatments on its proximate compositions be studied. Because of its high protein content and realizing that protein is essentially thermo labile, knowledge of the effect of hydrothermal treatments on proximate composition and subsequent fermentation process is needed by processors and consumers to ensure food quality and stability to increase the economic value and enhance organoleptic properties of dawadawa. The response of the nutritional compositions to hydrothermal processes is also needed in the design of processing and heating equipment in an attempt to mechanize some of the unit operations involved in the conversion of raw locust bean into dawadawa. This will complement efforts geared towards food security now and in the future.

MATERIALS AND METHODS

The sample of locust beans used in this study was purchased from a market in Nigeria. The cleaned sample was divided into two; one half (500 g) was processed into dawadawa (Fig. 1) while the other half (500 g) (raw)

Corresponding Author: Ogbonnaya Chukwu, Department of Agricultural and Bioresources Engineering, Federal University of Technology, P.M.B. 65, Minna, Niger State, Nigeria

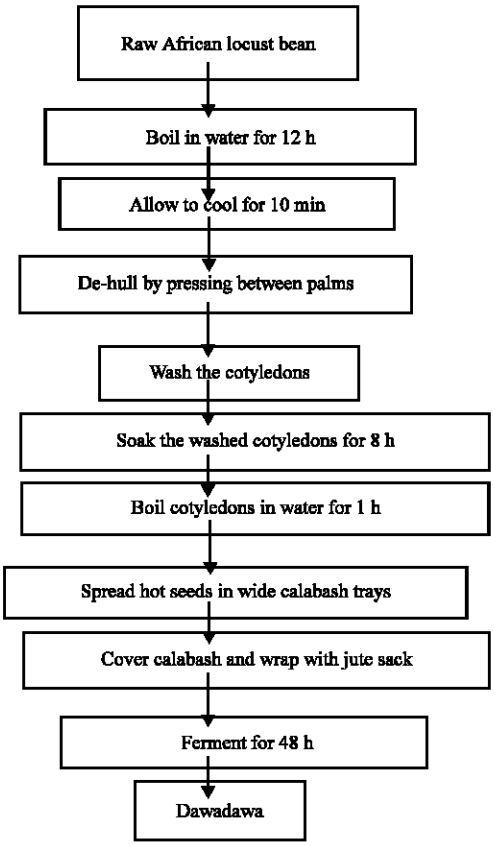

Fig. 1: Flow chart for processing locust beans into Dawadawa

served as the control. Both the processed and raw beans were analyzed for proximate compositions in four replicate determinations. AOAC (1980) and Ibitoye (2005) guidelines for determining nutritional parameters were followed. The experimental results were subjected to Analysis of Variance (ANOVA) for single factor experiments to determine significant differences and the software package Microsoft Excel for Windows XP was used.

RESULTS AND DISCUSSION

Table 1 shows the proximate compositions of unfermented (raw) and fermented (dawadawa) locust beans. Experimental results are means of four replicate determinations.

Statistical analysis of the experimental results showed that there was a significant difference in proximate compositions of raw locust beans and dawadawa ($p \leq 0.05$). This could be attributed to processing activities and subsequent fermentation of locust beans used to produce dawadawa. The proximate compositions indicate

Table 1: Proximate compositions of raw locust bean and dawadawa

Nutritional parameter	Raw locust bean	Dawadawa
Moisture content (%)	7.01±0.01^{a}	37.10±0.20^{b}
Crude fibre (%)	4.70±0.20^{c}	2.00±0.10^{d}
Lipids (%)	9.57±0.03^{e}	21.17±0.03^{f}
Crude protein (%)	28.00±2.00^{g}	38.50±1.50^{h}
Ash (%)	2.00±0.20^{i}	1.80±0.20^{i}
Carbohydrate (%)	55.73±0.73^{j}	36.53±0.53^{k}

Values are means of four replicate determinations (Mean±SD), SD = Standard Deviation, *Different letters in the same row indicate significant differences, **The same letter in same row indicates no significant differences

that the moisture contents of raw locust bean and dawadawa were 7.01 and 37.10%, respectively. The increase in moisture content for dawadawa may be probably due to boiling and subsequent soaking in water. It may also be as a result of metabolic activities of microorganisms during the fermentation period which gave out moisture as one of their end products (Omafubve *et al*., 2004). Since processed high moisture foods do not keep long in storage at room temperature, dawadawa will be prone to deteriorative agents such as moulds.

The crude fibre contents were 4.70 and 2.00% for the raw beans and dawadawa, respectively. Boiling and de-hulling of the locust bean during processing could be responsible for the reduction in crude fibre. Lipid contents of raw locust bean and dawadawa were 9.57 and 21.17%, respectively.

These values agree with the reports of Ikenebomeh (1986), Addy *et al.* (1995) and Omafuvbe *et al.* (2004). The increased lipid content may be due to some organic constituents of the locust bean becoming soluble due to heat treatment involved in the processing of dawadawa. Therefore, dawadawa is a ready source of energy in diets.

Crude protein values are 28.0 and 38.5% for raw beans and dawadawa, respectively. The increased protein content in dawadawa may be due to the reduction in the carbohydrate, ash and crude fibre contents. The high protein content for dawadawa obtained in this study agrees with other reports on African locust bean seeds (Ikenebomeh, 1986; Omafuvbe *et al*., 2004). They reported that the microorganisms (*Bacillus substilis*) involved in the fermentation of the locust bean showed proteolytic activity and may contribute to high protein content in dawadawa. Odunfa (1981) reported that *Bacillus substilis* have been known to cause hydrolysis of protein to amino-acids and peptides. In the process ammonia is released which increases the protein content of the fermented product. The current result also agrees with Odunfa (1986) who reported a high percentage of protein in dawadawa.

The ash contents of raw locust bean and dawadawa were 2 and 1.8%, respectively. The slight reduction in the

ash content of dawadawa may be due to leaching of soluble inorganic minerals in the processed sample during boiling for 12 h and subsequent soaking in water for 8 h. The carbohydrate content of dawadawa also decreased as a result of soaking and boiling from 55.73% for the raw beans to 36.53% for dawadawa. This result agrees with the reports of Addy *et al.* (1995), Omafuvbe *et al.* (2004) and Osman (2007). Loss in carbohydrate may be due to leaching of soluble carbohydrate like sugars into the cooking and soaking water while loss in carbohydrate during fermentation may be as a result of utilization of some of the sugars by fermenting organisms for growth and metabolic activities. Ibrahim and Antai (1986) reported that when selected microorganisms grow on plant or animal products that are fermented by microorganisms for human consumption, many biochemical changes that lead to formation of many kinds of products take place. These changes mostly affect the major constituents of food namely, proteins, carbohydrates and fats.

CONCLUSION

From the experimental results and statistical analysis, it was established that processing activities such as boiling and soaking and subsequent fermentation significantly led to protein and lipid enrichment in dawadawa with consequent reduction in total carbohydrate. It was also concluded that processing of locust beans to dawadawa resulted in a value-added product especially when protein and lipids are the target nutritional components.

ACKNOWLEDGEMENT

We thank the staff of the Biochemistry department, Federal University of Technology, Minna, Niger State, Nigeria where the experiments were carried out.

REFERENCES

AOAC, 1980. Official Methods of Analysis. 13th Edn., Association of Official Analytical Chemist, Washington, DC., USA., pp: 56-132.

Achi, O.K., 2005. Traditional fermented protein condiments in Nigeria. Afr. J. Biotechnol., 4: 1612-1621.

Addy, E.O., L.I. Salami, L.C. Igboeli and S.H. Remawa, 1995. Effect of processing on nutrient composition and anti-nutritive substances of African locust bean (*Parkia biglobasa*) and baobab seed (*Adansonia digitata*). Plant Foods Hum. Nutr., 48: 113-117.

Aidoo, K.E., 1986. Lesser-known fermented plant foods. Trop. Sci., 26: 249-258.

Esenwah, C.N. and M.J. Ikenebomeh, 2008. Processing effects on the nutritional and anti-nutritional contents of African locust bean (*Parkia biglobosa* benth.) seed. Pak. J. Nutr., 7: 214-217.

Ibitoye, A.A., 2005. Laboratory Manual on Basic Methods in Plant Analysis. Foladave Publishing Co., Akure, Nigeria, pp: 6-27.

Ibrahim, M.H. and S.P. Antai, 1986. Chemical changes during the fermentation of African locus-bean (*Parkia filicoidea* Welw) seeds for production of Daddawa. Qual. Plant Foods Hum. Nutr., 36: 179-184.

Ikenebomeh, M.J., 1986. African locust bean fermentation: Some physicochemical parameters. Nig. J. Applied Sci., 4: 101-108.

Odunfa, S.A., 1981. A note of microorganisms associated with the fermentation of African locust bean (*Parkia* species) during *iru* production. J. Plant Foods, 3: 245-250.

Odunfa, S.A., 1986. Dawadawa. In: Legume-Based Fermented Foods, Reddy, N.R., M.D. Pierson and D.K. Salunkhe (Eds.). CRC Press Inc., Florida, pp: 173-189.

Odunfa, S.A., 2007. Biochemical changes in fermenting African locust bean (*Parkiabiglobosa*) during *iru* fermentation. J. Food Technol., 20: 295-303.

Ogunbunmi, E.M. and O. Bashir, 1980. Protein and amino acid content of some Nigerian food condiments. Nutr. Rep. Int., 22: 497-497.

Omafuvbe, B.O., O.S. Falade, B.A. Oshuntogun and S.R.A. Adewusi, 2004. Chemical and biochemical changes in African locust bean (*Parkia biglobosa*) and melon (*Citrullus vulgaris*) seeds during fermentation to condiments. Pak. J. Nutr., 3: 140-145.

Osman, M.A., 2007. Effect of different processing methods on nutrient composition, antinutritional factors and *in vitro* protein digestibility of Dolichos lablab bean {*Lablab purpureus* (L.) sweet}. Pak. J. Nutr., 6: 299-303.