https://doi.org/10.33805/2641-7383.124
Volume 4 Issue 1 | PDF 124 | Pages 4

EDELWEISS PUBLICATIONS
OPEN ACCESS

Edelweiss Chemical Science Journal

Research Article ISSN: 2641-7383

Proximate Analysis and Mineral Content Determination of Traditionally Processed Locust Bean (*Parkia biglobosa*) Fruit Pulp for Possible Industrial Application

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Citation: Olalude CB, Adegboyega AM, Bamigboye AY, Abiona DL, Anifowose OA, et al. Proximate analysis and mineral content determination of traditionally processed locust bean (*Parkia biglobosa*) fruit pulp for possible industrial application (2021) Edelweiss Chem Sci J 4: 10-13.

Received: Jan 08, 2021
Accepted: Mar 17, 2021
Published: Mar 22, 2021

Abstract

This study examined the nutritional properties and industrial application of African locust bean properly known as Iru in southwest Nigeria. Locust bean was processed into food condiment which is used as a spice that gives an African meal a pleasant flavor. The production process of locust bean includes boiling for 12 hours, soaking the seeds in water, de-hulling, boiling for another 6 hours and ferment for 4 days. Proximate analysis and mineral content of the African locust bean (*Parkia biglobosa*) fruit pulp was determined using standard methods Association of Analytical Communities (AOAC) (1995). The results showed that African locust bean contain 42.8% Moisture, 37.34% Protein, 24.21% Fiber, 0.9% Fat, 3.55% Ash, and 17.0% Carbohydrate using proximate Analysis. The Mineral elements present are Calcium 9.01 mg/100 g, Potassium 20.5 mg/100 g, Magnesium 35.00 mg/100 g, Iron 3.31 mg/100 g, Phosphorus 73.00 mg/100 g with the use of Atomic Absorption Spectrophotometer Analysis technique. With the values gotten for the nutritional and mineral analysis of African locust bean, it should therefore be substituted for Monosodium Glutamate (MSG) used industrially for the production of various magi and flavorings which are not nutritive but are carcinogenic chemicals while locust bean has no health side effect. The food industry should package the locust bean in a way which would make the condiment much more attractive to its consumer and non-consumers because is faced with packaging problem.

Keywords: Nutritional, Locust bean, Proximate, Mineral, Industry

Introduction

The African locust bean (*Parkia biglobosa*) is a multipurpose tree legume that belongs to the family *Mimosoidea* of the Leguminosae. It is found in many African countries it is green and dark brown when mature, it grows in long slender pods when premature, it is often called Iru by the Yoruba's, Dawa-Dawa" by the Hausa, and "Ogiri" by the Igbos of Nigeria [1].

It is a medium-sized tree that reaches 20-30 m high. It has a dense, widely spreading umbrella-shaped crown and a cylindrical trunk that can reach 130 cm in diameter, it exudes an amber gum when cut. The leaves are alternate, flower head is broad and it has a strong pungent smell. The flowers are bisexual, sterile or nectar-bearing. The fruit is a linear, glabrous and smooth and has indehiscent pod that becomes brown at maturity, embedded in a yellowish mealy pulp. The seeds are globosely-ovoid, smooth and glossy dark in colour and are hard coated and can remain viable up to 8 years [2].

The seeds that are used later to prepare the African locust beans after been cooked and fermented before you can consume it or used in our daily soups and stews. African locust bean is a black strong smelling seasoning which is rich in fiber, protein, and carbohydrates. The seeds, the fruit pulp and the leaves are used to prepare numerous foods and drinks, and to feed livestock and poultry, hence, it is a very popular ingredient in traditional African cuisines [3]. The beans help in boosting your immune system, relieve diseases like diarrhea, diabetes and reduce the chance of heart attack. It is also used as a remedy to counteract the effects of poison like snake bites and scorpion stings. The bark of the African locust bean tree is also used as a vapor inhalant to relieve toothache and ear issues. It is also used as a remedy for leprosy, bronchitis, skin disorders, sores, ulcers, malaria, hypertension, and many sicknesses [4].

Locust can be used to treat the following health issues; stroke, high cholesterol, diarrhea hypertension, blood Sugar level, indigestion, weight, Fever, Vision problems [5]. The seeds, pods, fruit pulp and leaves are edible and used as cooking or drinking ingredients. The tree is particularly valued for its ferment escible seeds. They are fermented to prepare a condiment that is called "soumbala", "dawadawa",

"netetu" or "afinti" that is a strongly pungent as French cheese. This condiment used for sauce and soup seasoning is one of the most important commercial products traded in western Africa. Ground with moringa leaves, the seeds are ingredients for sauces and doughnuts. They can be roasted to make a coffee substitute known as "Sudan coffee".

In locust bean mature pod, seeds are surrounded by a quantitatively important mucilaginous pulp which is separated from the seeds when they are collected. This mealy pulp is traditionally consumed as fresh food by local African populations. It makes valuable baby food and is used to make a refreshing drink. The leaves can be boiled, mixed with cereal flour and eaten as vegetable. Flower buds are edible and added to salads [2,6].

Fruit pulp, foliage and seeds of the African locust bean can be used to feed livestock and poultry. The fruit pulp and the seeds, once processed to remove anti-nutritional factors, can be included in livestock feed. The leaves provide useful though not very palatable fodder. Their usefulness is increased by the fact that they can be harvested during the dry season when feed is scarce. However, it should be mixed with other feed because their mineral content is too low. The flowers are attractive to bees and a good source of nectar. The African locust bean trees are suitable for beehives [2].

The wood is used in light constructions, poles, mortars, and many kinds of furniture and utensils. It is valuable firewood and provides pulp to make paper. The bark has many traditional uses in ethno-medicine. A root decoction is reported to treat coccidiosis in poultry. Green pods are used as fish poison to catch fish in rivers. African locust bean trees are used as ornamental. They are useful soil improvers and their leaves provide green manure [6]. African is a blessed continent to have such a tree of great importance because of the food and herbal benefits that is associated with the African locust bean tree and by-product. It is a good source of income for rural dwellers in Africa as everything within the African locust bean tree is of great importance [7].

African locust beans have been used as a seasoning and adding flavor in cooking soups and stews. It is boiled and fermented through a process that requires continues boiling until is ready for fermentation (see flow chat of locust bean production below). It has been put on research and tested on rats to find the impacts and it is shown that it can control blood pressure because it helps in reducing arterial blood pressure when you eat the right quantity. It is also a good substitute to spicy or seasoning cubes and contains enough mineral substances found in many plants.

Justification

In the developing country like Nigeria, many people may not be able to afford animal products which are rich sources of protein because they are either too expensive or simply unavailable. Staple diets consist mainly of cereal grains or starchy roots and tuber crops thus leading to various health problems associated with protein and vitamin or mineral deficiencies. In the search for plant protein and vitamin substitutes, the African locust bean (*Parkia biglobosa*) has found very popular especially in the fermented 'iru' form, which is a product of the seeds, however; the yellow dry powdery fruit pulp has not attracted much attention.

Objectives

The main objectives of this study are

- To determine the nutritional properties.
- Possible industrial use of African locust bean.

Material and Method

Sample collection

The raw African locust bean seeds were purchased from Bodija, a local market in Ibadan, Oyo state, South West Nigeria. All the reagents used were of analytical grade.

Sample preparation

The seeds were sorted out, soaked in water, boiled for 12 hours and further soaked the beans in boiling water for another 12 hours overnight, excess water was drained off and the seeds were de-hulled by marching the seeds by feet in a mortar and removal of the seed coat was done by rubbing the cotyledon between the palms of the hand and washing with water. The cotyledons were again cooked for another 6 hours, the boiled water was drained off and the cotyledons were then spread into trays, covered and wrapped with sacks and fermented for 4 days to produce locust bean.

Analysis and equipment used

- The physico-chemical analysis was done using standard methods described by (AOAC 1995) to determine the following parameters, moisture content, crude fiber, protein, fat, moisture content, ash content, carbohydrate [8].
- Atomic Absorption Spectrophotometer was used to determine the mineral contents of the sample (locust bean) (**Figure 1 and Figure 2**).

Figure 1: Ready to eat packaged locust bean.

Results

The Proximate analysis of the African locust bean that was analyzed is: Moisture content, Ash content, Carbohydrate, Crude fat, Crude protein and Crude fiber. Potassium, calcium, magnesium, iron and phosphorus were analyzed using Atomic Absorption spectrophotometer equipment.

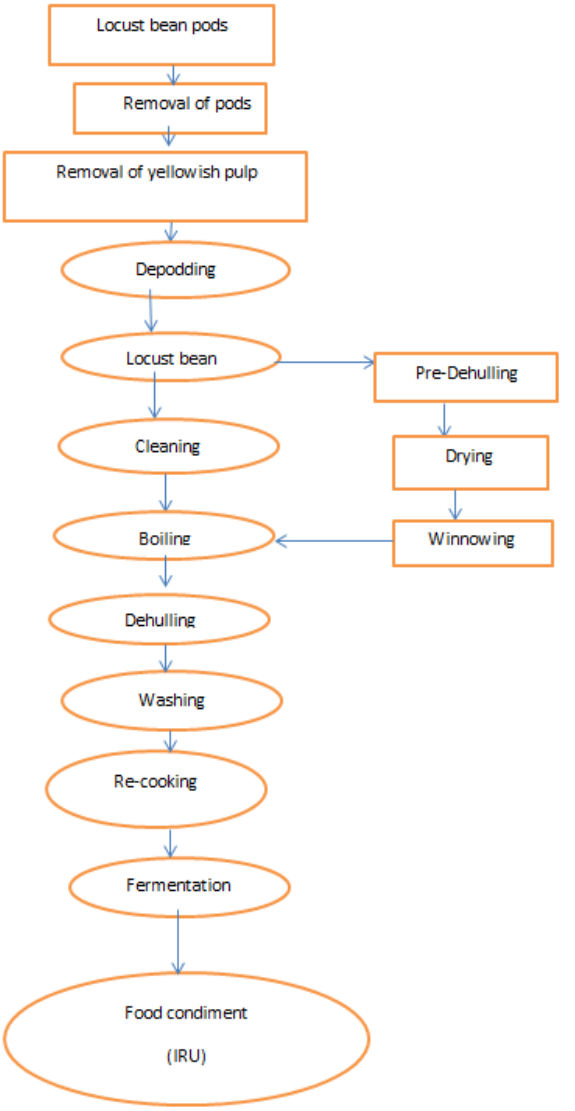

Figure 2: Flow chart for traditional processing of locust bean to food condiment.

Discussion

Table 1: The African locust bean had high value of Protein (37.34%), protein helps to build the body for proper body growth and is in agreement with the finding of Uwaegbute (2006) [9]. The level of crude fiber was high 24.21% which is considered advantageous since high fiber contents are desirable in meal, as they aid digestion easily, and known to be most effective in maintaining human health such as reduction in body weight, reduction in stroke incidence and good heart health, it is also a source of dietary fiber which is essential for good bowel movement and helps in preventing obesity, diabetes, cancer of the colon and other ailments of the gastro-intestinal tract of man. The value is much higher than most food legumes, which range from 2.10% in groundnuts to 7.60% in kidney beans [10]. This makes the African locust bean is a good source of dietary fiber.

Carbohydrate content was found to be 17.0% it is in agreement with the value of Olalude et al [10] with this content of carbohydrate, the African locust bean is a potential good source of energy, Though proteins and fats also provide necessary energy, carbohydrates are much cheaper and more easily digested and absorbed. The ash content present indicates that it is a good source of macro and micro elements. The content of 3.55% is within the range for most legumes of 2.00% in pea to 5.00% in soya bean; this is an indication that the African locust bean is a potential good source of minerals required by the body.

Crude fat was found to be 5.30%, this is in conformity with most legumes, which apart from groundnuts (45.30%), soybeans (17.70%) and winged bean (17.00%), and all have less than 3.00% fat with lentils having as low as 0.60% [11]. It is also reported a fat content of 0.50% for Mediterranean locust bean (*Ceratonia siliqua*) fruit pulp. This low fat content is an indication that locust bean can be stored for long periods at the right temperature and moisture without spoilage by rancidity, which is characteristic of many legumes.

Parameters	Experimental Mean value of locust Bean (Percentage)
% Moisture content	42.80%
% Crude fat	5.30%
% Crude fiber	24.21%
% Carbohydrate	17.00%
% Ash content	3.55%
% Crude Protein	37.34%

Table 1: Proximate analysis of African locust bean.

Table 2: Mineral elements such as Potassium 20.5 mg, Sodium 35.00 mg, and Calcium 9.01 mg, Phosphorus 73.00 mg, Iron 3.31 mg and Magnesium 35.00 mg were obtained from the experimental analysis and were of appreciable amount. Calcium, Magnesium and Phosphorus are important for bone formation and its maintenance. High potassium concentration with low sodium level are intracellular and extracellular cations of importance, they perform specific functions in cellular metabolism, modulation and signaling.

Parameters	Experimental Mean value of locust Bean (/100mg)
Calcium	9.01 mg
Potassium	20.5 mg
Sodium	35.00 mg
Magnesium	35.00 mg
Iron	3.31 mg
Phosphorus	73.00 mg

Table 2: Mineral content of the African locust bean.

Conclusion

The production of locust bean offers a means of utilizing it as a food. African locust bean contain essential nutrients needed for the growth and development of the body. The liberal use of this condiment is expected to increase the intake of these essential dietary components appreciably. In addition, the presence of high level of ash and fiber content is an added advantage over seasoning salts, which can cause cancer.

Iru should be substituted to Monosodium Glutamate, because it has been found to have no side effect on the health of humans. African locust beans should be used during cooking of soups or other food instead of the varieties of magi which contain MSG.

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