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Chemical evaluation of the seeds of *Milletia obanensis*

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Abstract

A study was conduced to evaluate the nutritional potential of *Milletia obanensis* ''Odudu'' as a possible food or feedstuff and to assess the effect of various processing methods on its nutritional quality. Results of proximate analysis showed that the raw seeds contained 26.7% crude protein, 23.5% ether extract, 3.47% crude fibre, 4.37% ash and 42.0% nitrogen free extract. The protein was well supplied with essential and non-essential amino acids, though the values were low when compared with popular seed legumes. Minerals were in fair supply: P 3.10, Mg 92.30, K 45.25 and Fe 2.20 mg/100 g. Processing methods significantly ($p < 0.05$) affected the nutritional composition. While autoclaving, boiling and toasting (heat treatment) increased the protein content, it reduced the levels of anti-nutritional factors-phytate, tannins, oxalates, cyanogenic glycosides and (slightly) saponin. Thus, it was concluded that *M. obanensis* seeds, if properly processed, could serve as livestock feed or food for man.

Keywords: Chemical evaluation; Nutritional potential; *Milletia obanensis*; Processing methods; Antinutritional factors; Amino acids

1. Introduction

Milletia obanensis 'Odudu' is a legume plant of tropical origin. According to history, the plant was first discovered in Oban, Cross river State in the Southeast region of Nigeria. This is where it derives its specific name (obanensis). Presently, the plant is widely distributed all over the southeast region of the country.

Milletia obanensis is a small forest tree. It bears hairy green leaves with a rusty touch. In its terminal panicles, at the end of the branches, are usually borne very beautiful flowers. Its fruits are normally abundant during the early to mid-dry season (between November and early March). The seeds are usually dispersed, mainly by an explosive mechanism. The mature pod is golden brown in colour and measures about 10–20 cm in length and about 2.5 cm in width at the middle. Both the foliage and pod feel slightly velvety.

There is no documentation of the utilization of the seeds of *M. obanensis* 'Odudu' as food for man or livestock in Nigeria. However, its foliage has found a variety of usage as a traditional medicinal herb. In addition, mature branches of the plant are used for fencing in the villages because of their high sprouting and rejuvenating potential. Also, the nutritional importance of the seeds is yet to be investigated.

Studies by Ranjhan (1981) and Williamson and Payne (1978) show that the average proximate analysis of legume seed shows 30%, 18.3%, 4.5%, 3.9% and 5.1% of crude protein, ether extract, crude fibre, NFE and ash, respectively. This indicates that legume seeds are rich sources of nutrients. Indeed, most legume seeds have excellent nutritional value in terms of protein, calories, vitamins and minerals. In addition to their nutritional value, for both humans and livestock, legumes are also important in cropping systems because of their ability to fix nitrogen and so increase the overall fertility of the soil (Rachie, 1985). When, therefore, the nutritional potential of *M. obanensis* is successfully harnessed for livestock and human nutrition, attention will be turned to the possibility of its utilization in alley farming – a novel technique in agronomic practice.

It is, however, important to note that, despite their promising nutritional significance, legumes have been found to contain some inherent antinutritional factors,

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which limit their nutritive value by exerting certain deleterious effects. Such effects include lowering of the bioavailability of sulphur amino acids with respect to trypsin inhibitors (Kakade, Rachis, McGhee, & Puski, 1974), hemagglutinating effects of lectins (Liener, 1974), haemolytic effects of saponins (Nowacki, 1980); the ability of tannins to form insoluble complexes with proteins, thus interfering with the digestion process by inactivating the enzymes (Bate-Smith, 1973), release of hydrogen cyanide by cyanogenic glycoside on hydrolysis (Montgomery, 1980) and antivitamin effects of isoflavones (Liener, 1979).

Over the years, poultry and swine production have been among the most lucrative sectors of Agriculture in Nigeria. Indeed from inception, through the early 1980s, the industries have experienced tremendous expansion and growth. During the past decade, however, they have witnessed a serious set-back, due largely to inadequate feed supply, which stems from unavailability of protein concentrate and short supply of energy source. The problem has been aggravated by the high competition between man and livestock for some of the existing feed ingredients, such as maize, millet and soybeans. Furthermore, animal protein sources for compounding monogastric diets are in extremely short supply and unaffordable to farmers. It is in view of this trend that research was conducted to evaluate the nutritional potential of *M. Obanensis* and to assess the nutritional quality, with a view of harnessing it as a protein source for livestock or man.

2. Materials and methods

2.1. Collection and preparation of samples

Seeds of *M. obanensis* were harvested from the forest zone of Okoyong Usangabasi, Cross River State in southeastern Nigeria. The decorticated seeds were air dried for 48 h and stored in air tight plastic containers in a deep freezer prior to use.

About 100 g of dry *M. obanensis* seeds were autoclaved for 30 min at 126 °C under 15 psi. Another batch of the seeds was put through normal cooking for 60 min. Two other sample batches were similarly treated: one was soaked in water at room temperature for 12 h and the other toasted (popped) in a fry pan for 10 min. In addition, another sample was subjected to germination. This was achieved in 72 h, during which period emergence of the radicles only was observed. Apart from the toasted sample, other heat-treated samples, samples of soaked and germinated seeds were sun-dried for 24 h. All samples were milled to fine power using a laboratory mill (Wiley). Including a milled sample of the intact raw seeds, altogether six samples (autoclaved, boiled, toasted, germinated, soaked and raw) were prepared.

2.2. Proximate analysis

Proximate analysis was carried out on all the variously treated *M. obanensis* seeds. Moisture, ash, ether extract (EE), crude fibre (CF) and nitrogen-free extract (NFE) were determined by the methods of Association of Official Analytical Chemists (A.O.A.C, 1990). The crude protein content was then calculated by multiplying the nitrogen content by 6.25.

2.3. Amino acid determination

2.3.1. Acid hydrolysis of sample

One millilitre of 6 M HCl was added to 5 mg of raw seed sample (ground and passed through a 30 mm sieve), according to the procedure of Tkachuk and Irvine (1967), and hydrolysed at 105 °C for 16 h using Pierce-Reacti – Therm heating modules (Pierce Rockford, USA).

2.3.2. Amino acid analysis of hydrolysate

Analysis of the amino acid content of the protein hydrolysate was carried out as outlined by Spackman, Stein, and Moore (1958) using a Beckman System Gold High Performance Liquid Chromatograph (HPLC).

2.4. Mineral analysis

Total phosphorus was determined by the reaction between phosphorus and molybdovanadate to form phosphomolybdovanadate complex. The complex was measured colorimetrically at 420 nm. Other minerals were determined by, first, wet-ashing the *M. obanensis* flour (A.O.A.C, 1990). Potassium was determined by flame photometry (Corning 400). Calcium, magnesium and iron were determined by atomic absorption spectrophotometry (Perkin–Elmer 702).

2.5. Determination of some toxic compounds

2.5.1. Cyanogenic glycoside

Cyanogenic glycoside was estimated by determining the amount of HCN released on hydrolysis. *M. obanensis* seed extracts were obtained by homogenizing 30 g of seeds in 250 ml of 0.1 M orthophosphoric acid for 5 min. The homogenate was centrifuged at 2500 rpm for 20 min and clear supernatant was taken. An aliquot of the supernatant was used for estimation of hydrogen cyanide using an auto analyzer Technicon AAII, according to the method of Rao and Hahn (1984).

2.5.2. Tannic acid

The method of Hagerman and Butler (1978) was employed for the extraction of tannic acid from the *M. obanensis* seed samples. Extracts were prepared using the Folin–Denis method of Hoff and Singleton (1977) and