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Full Length Research Paper

Effects of soaking and boiling and autoclaving on the nutritional quality of *Mucuna flagellipes* ("ukpo")

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The effect of soaking and boiling, and autoclaving on nutritional factors (proximate and mineral) and anti-nutritional qualities of the legume, *Mucuna flagellipes* were studied. Batches of seeds were soaked for 6, 12, 18 and 24 h in distilled water at room temperature, then boiled in water for 30, 45, 60 or 90 min respectively. Another batch of *M. flagellipes* was autoclaved for different duration of 30, 45, 90 and 120 min respectively. Results showed that soaking followed by boiling produced products with lower crude fibre content (10% for soaking for 24 h followed by boiling for 90 min). However it increased the carbohydrates. Autoclaving resulted in products with lower mineral contents (1042.5 mg/100 g phosphorous for autoclaving for 120 min.

Key words: Legumes, *Mucuna flagellipes,* nutritional factors, soaking, boiling, autoclaving.

INTRODUCTION

Legumes are good sources of cheap and widely available proteins for human consumption. They are staple foods for many people in different parts of the world (Youseff et al., 1989). Legume seeds have an average of twice as much protein as cereals and the nutritive value of the proteins are usually high (Vijaykumarri et al., 1997). They range between the highly utilized legumes such as soybeans, cowpeas to the lesser known ones like African yam beans (*Sphenostylis stenoscarpa), Mucuna conchinchinesis* and *Mucuna flagellipes* ("ukpo"). Studies have shown that the lesser known legumes together with other conventional legumes can be used for combating protein malnutrition prevalant in the third world. This can be achived by the consuption of the legumes whole and in various processed forms (condiments) (Arisa and Aworh, 2007).

M. flagellipes ("ukpo") contains high percentage of proteins (20.4%), carbohydrates (61%) and fat (9.6%) on fresh weight (Enwere, 1998). The excellent nutritional value of the legume in terms of proximate, mineral composition makes it necessary for it be used as compli-ments in African dietss which are mainly roots and tuber based (Pirie, 1975). Due to the fact that the seedss are rich in protein and carbohydrates and the protein content content range from 11.82 ± 0.25 g/100 g to 24.94 ± 0.18 g/100 g dry matter basis, they compare favourably with high protein animal sources such as oyster, beef, pork and marine fishes (Ajayi et al., 2005).

The cotyledons of seeds are widely used as soup thickener when they have been broken, boiled sufficiently to soften them and milled into powder in the Eastern part of Nigeria. They are sometimes broken, roasted with hot charcaol and ash, milled and used soup thickners. It has been reported that nutritive value of some seeds; rape seed, *M. conchinchinensis*, *Mucuna utilis* have been improved by heat treatment due the reeduction of their antinutritional factors content by them (Manssour et al., 1993; Ukachuku and Oioha, 2000; Udensi et al., 2004).

This study was undertaken to evaluate the effect soaking and boiling or autoclaving will have on the nutrients present in the seeds with a view of recommending a process that will produce flour with high nutritional content.

MATERIALS AND METHODS

M. flagellipes seeds obtained from Umuahia main market, Abia State Nigeria were cleaned and broken to remove the seed coat. They were divided into three portions (each weighing 300 g). First

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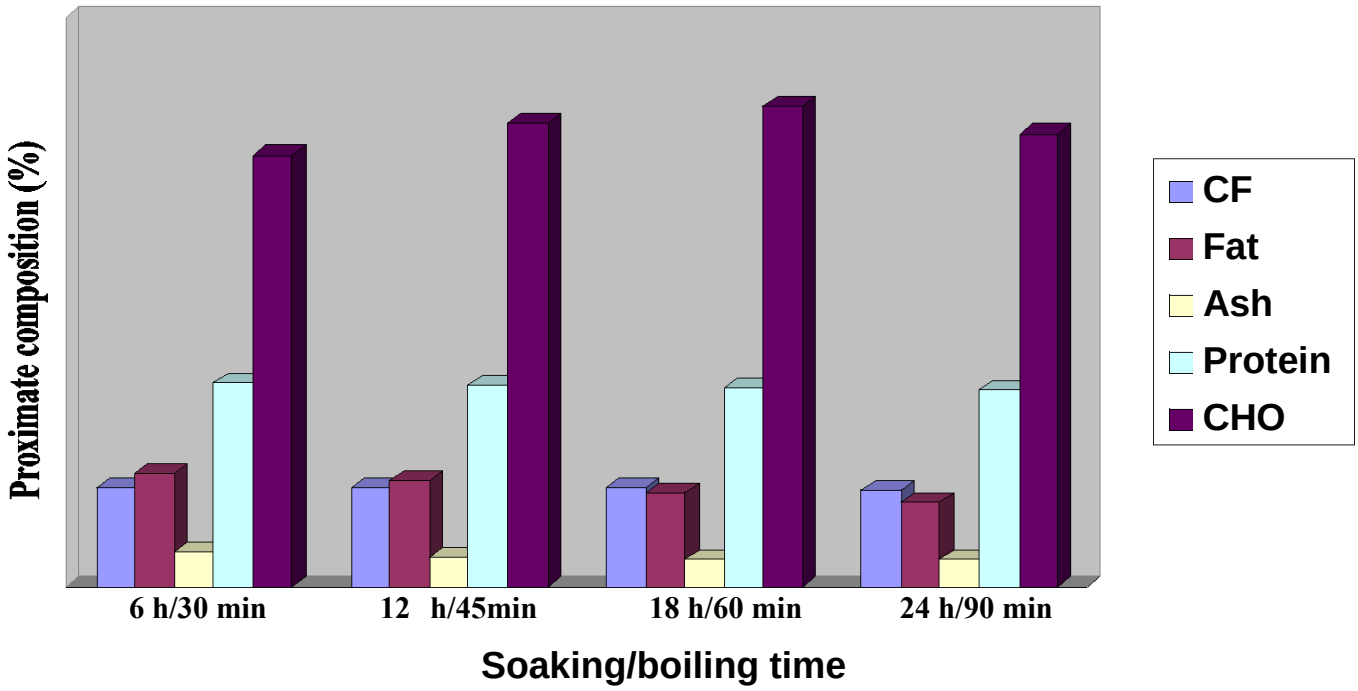

Figure 1. Effect of soaking/boiling on the proximate composition of *Mucuna flagellipes*. CF: Crude fibre, CHO: Carbohydrates, h: Hours and min: Minutes.

portion (300 g) of the dehulled cotyledons were soaked for 6, 12, 18 or 24 h in water at room temperature respectively. They were subsequently boiled in water for 30, 45, 60 and 90 min respectively, dried in a forced draught oven at 70 °C and milled into powder using a hammer mill (100 µ mesh size). The other portion (300 g) of dehulled cotyledons was autoclaved at 15 Ib pressure (121 °C) for a period of 30, 60, 90 or 120 min respectively. Then dried in a forced draught oven at 70 °C and milled into powder using a hammer mill 100 µ mesh size). The third portion (300 g) was processed as is (raw) control. The untreated and processed cotyledons and the flours from the different treatments were analyzed in trplicates for nutritional factors, antinutritional and some mineral content.

Analysis of nutritional factors

Moisture was determined by drying to constant weight at 105 °C in a forced draught oven. Crude protein content of the samples was determined using the micro Kjedhal digestion method described by AOAC (1984). The method described by Kirk and Sawyer (1991) was used to determine the crude fibre content of the samples. The protocol for crude fibre content was given below. Defatted (2 g) sample was boiled in 200 cm^3 of 0.1275 M sulphuric acid solution for 30 min with constant agitation. The boiling mixture was poured into a buckner funnel and washed with boiling water twice. Then, the residue was boiled in a 0.313 M sodium hydroxide solution for 30 min with constant stirring. The residue was then washed twice with boiling water followed by 1% hydrochloric acid, then washed with boiling water until free from acid. It was then dried in an oven to a constant weight.

The fat content of the samples were determined using the procedure described by Pearson (1976). Total ash content was determined using the method of Kirk and Sawyer (1991). The total ash present in 5 g of the samples was determined by incinerating the sample in a muffle furnace at 550 °C 3 h. The carbohydrate content was determined by the method described by Pearson (1976).

Analysis of the mineral content

The mineral content of the various samples were determined using the procedures described by Kirk and Sawyer (1991).

RESULTS AND DISCUSSION

Soaking for a period of time followed by boiling (Figure 1) resulted in decrease in the crude fibre content of the *M. flagellipes* flour with soaking for 24 h followed by boiling for 90 min giving product with the least crude fibre content (10.10%). This is in line with Ukachukuwu and Obioha (2000) who reported a decrease in crude fibre content of *M. cochinchinensis* as boiling time was increased. The same trend of reduction was observed in the other proximate compositions (fat, ash and protein) as the time of soaking/boiling increased. The reduction in the nutrients content could have been as aresult of the leaching out of the some water soluble nutrients into the the soak water and boiling water. This trend of decrease is similar to the observation made by Obasi and Wogu (2008), who reorted decrease in protein content of soaked yellow maize during soaking. The reduction in the protein content may also be attributed to the progressive solubilization and leaching out of the nitrogenous substances during soaking and boiling of the legume

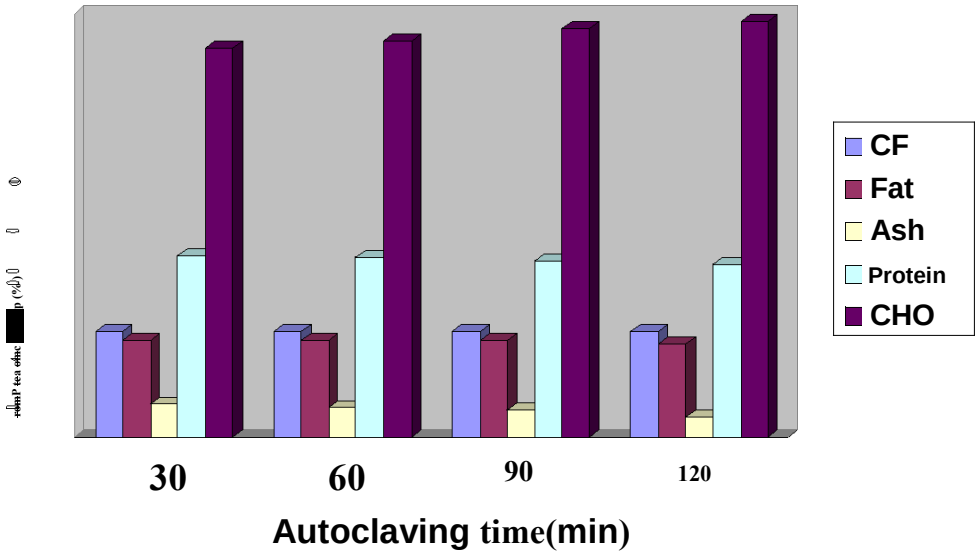

Figure 2. Effect of Autoclaving on the Proximate Composition of *Mucuna Flagellipes.* CF: Crude fibre, CHO; Carbohydrates, min; Minutes.

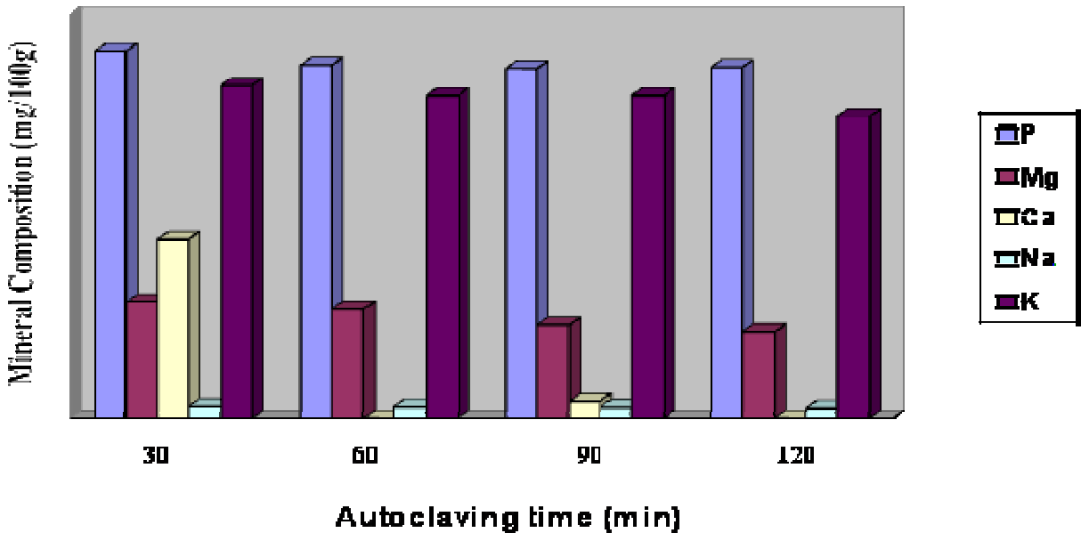

Figure 3. Effect of autoclaving on the mineral composition of *Mucuna Flagellipes.* Min; minutes.

(Ukachukwu and Obioha, 2000).

However the carbohydrate content seemed to increase (50.66% for soaking followed by boiling for period of 18 h and 60 min respectively), this could have been due to the break down of complex carbohydrates which were otherwise bound in the raw sample by boiling. Autoclaving (Figure 2) of the seeds yielded products which had lower protein and ash contents than the raw seeds. Increase in time of autoclaving progressively gave products with lower ash content (2.40% for autoclaving for 120 min). It gave products with higher fat content than the raw. Results have shown that processing (boiling, soaking, autoclaving and roasting) leads to products with reduced anti nutritional content and consequently this increase in some nutrients content (Udensi et al., 2008). This could have been due to the fact that the bound fat in the cells of the seeds may have been released as a result of the treatment. The carbohydrate content was also increased as the time of autoclaving increased (49.90%) for autoclaving 120 min being the highest.

Soaking followed by boiling gave products with reduced mineral contents (Figure 3) generally but soaking for 24 h followed by boiling for 90 min resulted in products with lowest mineral contents (1055.00 mg P, 374.40 mg Mg,

408.82 mg Ca, 31.00 mg Na, 945.00 mg K) when compared with the raw sample except for the values of P, Mg and Ca which were the same as those of soaking for 18 h and boiling for 60 min respectively.

Conclusion

Soaking followed by boiling resulted in products with reduced fibre, fat, ash and protein contents. The use of autoclaving in the treatment of the seeds yielded products with increased carbohydrates and fat contents. This could have been as a result liberation of the cell bound nutrients which otherwise would not have been available as pure nutrients. It is therefore suggested that any of the processes can be used for processing the mucuna, however due to the fact that autoclaves may not be readily available for the locals soaking followed by boiling can be done.

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