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Short Communication

Effect of processing on the toxicity of *Mucuna jaspada* flour

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Raw and heat processed *Mucuna Jaspada* were evaluated for proximate composition and bioactivity. The values obtained for proximate compositions are; protein: 27.85 ± 0.21%, ether: 5.02 ± 0.21%, ash content: 3.33 ± 0.21%, crude fibre: 6.76 ± 0.36% and carbohydrate: 46.91 ± 0.01%. Bioactivity studies using brine shrimp lethality tests showed that raw *M. Jaspada* and the processed samples exhibited some levels of toxicity. The raw *M. Jaspada* gave LC_{50} of 3.98 µg/ml, roasted sample extract gave 7.9 µg/ml, and boiled extract was 8.9 µg/ml while autoclaved extract gave 10 µg/ml. The result of this work has shown that *M. Jaspada* seeds if properly processed by heat treatment could be improved nutritionally for both animal and human consumption.

Key words: Toxicity, bioactivity, lethal concentration, brine shrimp.

INTRODUCTION

Mucuna Jaspada is an under utilized minor legume commonly used as cover crop to control soil erosion and to improve soil fertility. *Mucuna* beans, though high in protein (Ukachukwu and Obioha, 1997; Udensi et al., 2000), have limited utilization because of the presence of anti-nutritional factors found in them (Udensi et al., 2004). Phytate is known to lower the bioavailability of minerals (Eradman, 1979) and inhibits several proteolytic enzymes (Singh and Krikorian, 1982). Trypsin inhibitor when ingested by man in large quantities disrupts the digestive process and leads to undesirable physiological reactions (Booth et al., 1960). The presence of large amount of saponins in legumes imparts bitter taste to legume plant foods (Oakenfull, 1981).

The anti-nutritional factors are the main drawback limiting the nutritional and food values of the velvet beans. However, some heat treatment methods such as boiling, roasting and autoclaving have been used by various workers to reduce anti-nutritional factors in *Mucuna* beans (Ukachukwu et al., 2002; Udensi et al., 2005) thereby improving their nutritional values.

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Though the effect of heat treatment on some anti-nutritional factors in *Mucuna* beans has been reported in literature (Udensi et al., 2004; Ukachukwu and Obioha, 1997), but the lethal concentration, $LC_{50,}$ of *M. Jaspada* has not been widely reported. The objective of this study was therefore to determine the LC_{50} of the *M. Jaspada* and the effect of heat treatment on their toxicity.

MATERIALS AND METHODS

M. Jaspada

Whole seeds of *M. Jaspada* were obtained from the National Root Crop Research Institute (NCRI) Umudike, Abia State, Nigeria, while the brine shrimps were collected from Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Salt water was obtained from the high sea at Port-Harcourt, River State, Nigeria.

Preparation of samples

Mature whole *Mucuna* beans were divided into four portions. Three portions were subjected to boiling autoclaving and roasting, respectively, while the fourth portion was left raw. About 450 g of *Mucuna* beans were boiled in water at 100°C for 10 min, dehulled and dried at 60°C for 8 h. The dried seeds were milled in an attrition mill to pass through 60 mesh sieve size. The same 450 g of *Mucuna* beans was autoclaved at a pressure of 151b at 120°C for 30min.

The autoclaved seeds were dehulled and oven dried at 60°C for 8 h and then milled into flour with attention mill to obtain the same particle size. To obtain the roasted sample, about 450 g of *M. Jaspada* was soaked in 900 ml of water for 3 h and dehulled. The dehulled seeds were roasted at 100°C for 8 h and then milled using attrition mill to pass through 60 mesh sieve size. The same quantity, 450 g of *M. Jaspada* was soaked in water for 3 h and then dehulled to obtain the raw sample. The seeds were oven dried for 8 h at 60°C and milled to obtain the same particle size.

Extraction

200 g of the flour samples (boiled, autoclaved, roasted and raw) were extracted respectively in 500 ml of distilled water for 24 h at room temperature to obtain the aqueous extract. The solutions from different samples were filtered using a vacuum pump and the resulting extracts were oven dried at 40°C to obtain to dry residues. The dry solid samples were suspended in distilled water to prepare various concentrations of aqueous extract for brine shrimp lethality tests.

Brine shrimp lethality tests

Brine shrimp eggs were hatched in water as described by Maclaughin et al. (1991). Ten shrimps were counted into McCartnney bottles containing various concentrations of the aqueous extract, and incubated in the extract for 24 h. The number of surviving brine shrimps after 24 h was counted.

Statistical analysis

The data obtained was analysed using the Finney probit table (Finney, 1971) to calculate percentage probit kill from which the LC_{50} was determined.

RESULTS AND DISCUSSION

The result in Table 1 shows that the protein content (27.8%) of *M. Jaspada* is comparable to other published results for *Mucuna* sloanie (28.18%; Ijeh et al., 2004), and *Mucuna cochinchinesis* (30.06%) by Ukachukwu and Obioha (1997). The protein content of *M. jaspada* seeds falls within the range reported by Boutter (1997) for other legumes. The fairly high protein content shows *M. jaspada* to be a potential food that could be used to overcome the problem of protein malnutrition in Nigeria and other African countries when properly processed.

Table 2 shows the result of bioactivity tests of the aqueous extract of raw *M. jaspada* after 24 h. The calculated lethal concentration, LC_{50}, from the probit analysis was found to be 3.98 µg/ml. The LC_{50} value (3.98 µg/ml) obtained shows that raw *M. jaspada* aqueous extract has a much higher potency than the ED_{50} (19.95 µg/ml) obtained for *M.* sloanie (Ije et al., 2004) using the same brine shrimp lethality test for aqueous extract. The higher bioactivity potential of *M. jaspada* indicates that very low concentrations of the extract will be required to achieve medicinal effect. The result of bioactivity tests (Table 2) for the roasted *M. jaspada* flour aqueous extract shows the LC_{50} to be 7.94 µg/ml. The high LC_{50} of the roasted sample when compared to the raw sample indicate that roasting reduced the bioactivity of *M. jaspada* flour by increasing lethal concentration to 7.94 µg/ml. Roasting as a treatment process is therefore an effective processing method to reduce the toxicity of the test sample for both human and animal consumption. The LC_{50} of 8.91 □g/ml of the boiled sample is higher than the LC_{50} of both the raw (3.98 µg/ml) and roasted (7.94 µg/ml) *M. jaspada* flour aqueous extract. When compared with the raw and roasted sample, boiling appears to be a more effective heat processing technology to reduce toxicity of *M. jaspada* flour for safe consumption. The LC_{50} value of 10.00 µg/ml indicates that autoclaving reduced the bioactivity of *M. jaspada* flour (Table 2). The result also shows that autoclaving has greater reduction effect on the toxicity of aqueous extract of *Mucuna* flour than roasting and boiling. The use of pressure cooker as a form of autoclaving can be employed in the processing of *M. jaspada* to achieve the reduction of the toxicity in the test sample for safe inclusion in food systems.

Table 1. Proximate composition of *M. jaspala*.

Parameter	Percentage composition
Moisture	10.167 ± 0.09
Protein (N x 6.25)	27.825 ± 0.21
Fat	5.015 ± 0.07
Crude fibre	6.760 ± 0.36
Ash	3.33 ± 0.09
Carbohydrate	46.905 ± 0.01

Table 2. Bioactivity of aqueous extract of raw, autoclaved, boiled and roasted *M. jaspada* flour.

Heat treatment	LC_{50} µg/ml)
Raw (none)	3.98
Roasting	7.94
Boiling	8.91
Autoclaving	10.00

Conclusion

Considerable reduction of toxicity can be achieved in *M. jaspada* seeds by autoclaving, boiling and roasting, thereby offering nutritional benefits to potential users as food and animal food.

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