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Full Length Research Paper

Proximate, functional and anti-nutritional properties of boiled ukpo seed (*Mucunaflagellipes*) flour

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Abstract
Ukpo (Mucunaflagellipes) seed flour is one of the soup thickeners used in most rural Ibo-speaking communities of Southern Nigeria. Its preparation is usually associated with long cooking time which is required to soften the cotyledon before grinding as well as reduce the antinutritional components of the seed. This work was therefore aimed at determining the effect of boiling time on some functional properties and antinutritional properties of the ukpo seed flour. The result obtained showed that there were slight reductions in the protein, fat and ash content as boiling time increased probably due to leaching. All the functional properties analysed increased significantly ($p \leq 0.05$) with increasing boiling time. The water absorption, oil absorption and emulsion capacities increased from values of 1.60ml/g, 1.23ml/g and 9.3ml/g respectively at 0 minutes to 3.2ml/g, 2.8ml/g and 17.66ml/g respectively at 60 minutes. The bulk density and swelling index also increased from 0.72g/ml to 1.17cm^3/cm^3 and from1.02g/ml to 1.36cm^3/cm^3 respectively. The oxalate, tannin, saponin, phenol and phytate contents decreased significantly ($p \leq 0.05$) with increasing boiling time. The values at 60 minutes boiling time were 0.14%, 0.182%, 0.434%, 0.146% and 0.719% respectively. This suggests that heat treatment improves the performance of the *ukpo*flour in soup thickening while reducing to a large extent the anti-nutritional properties.

Keywords: *Thickners,antinutritional, functional properties*

Introduction

Mucunaflagellipes which is popularly known as "ukpo" by the Ibo-speaking people of south-eastern Nigeria is a legume belonging to the sub-family *papilonacea*. It comprises of pods covered with brownish dense whisker – like hairs called trichomes that are irritating when it comes in contact with the skin or eyes . Each pod may contain 1 to 3 seeds with a hard coating which is white when immature, and turns black when mature and dry. (Enwere,1998)

Mucuna species generally have high protein content of 24% to 1.44%, lipids ranging from 2.86% to 9.8%, crude fibre (5.3-11.5%), ash (2.9-5.5%), and carbohydrate ranging from 59.2% to 64.88% (Arianthan et al, 2003, Vadivel and Janardhanan 2000; Adebowale et al 2005a; Ezeagu et al; 2003).

The anti-nutritional factors found in Mucuna species include L-dopa, phenolics, tamins, haemagglutinins, trypsin and chymotrypsin inhibitors, phytic acid, saponins and cyanogenic compounds. (Vadivel and Janardhanan, 2000). However, most of these anti-nutritional factors are eliminated to low levels during processing. Ukachukwu and Obioha(1997a) reported detoxification by cooking for 90 minutes or toasting for 60 minutes.

In Eastern Nigeria, ***Mucunaflagellipes***is used as a soup thickener in traditional soups preparation. Here the seeds are cracked, boiled, dehulled, ground to powder and added to the soup. In some localities, it is prepared as a choice dish. In this case the ***Mucunaflagellipes*** is cracked, boiled overnight and dehulled. The cotyledons are spiced to tasteand served as a delicacy. (Ezueh 1997, Anumnu 1991, Eneobong 1992).

The functional properties as well as the anti-nutritional properties of Mucunaflagellipes have been studied by some authors (Ukachukwu and Obioha 1997b, Vadivel and Janardhanan 2000). This research therefore was aimed at finding out the actual cooking time that may be applied in ukpo processing for maximum detoxification as well as maintain the necessary functional properties.

Results and Discussion

Effect of boiling time on proximate composition.

The proximate composition of the processed ukpo seed flour is shown on Table 1. The values indicate that significant difference($P<0.05$) exists among the processed samples. The ash, fat and crude protein content decreased from 4.41%, 3.87% and 27.69% respectively in the raw sample to values of 4.08%, 3.62% and 26.59% respectively at 60mins boiling time. These decreases in ash, fat and crude protein content can be attributed to losses due to leaching of soluble components into the boiling water. Crude fibre also decreased from 8.98% in the raw sample to 8.84% at 60mins of boiling. This is possibly due to thermal hydrolysis of large molecules into smaller ones and subsequent leaching of such compounds into the boiling water.

The moisture content of the ukpo seed flours increased from 12.14% in the raw sample to 12.61% at 60mins boiling time. This may be attributed to high cell damage due to long boiling time which resulted in high moisture retention (Uzoma and Osuji, 2004).

Effect of boiling on anti-nutrients

The values for the various anti-nutritional factors showed a significantly ($P<0.05$) steady increase as the boiling time increased (Table 2). The oxalate tannins, saponins, phenols and phytates reduced from values of 0.838%, 0.314%, 0.539%, 0.152% and 1.327% respectively in the raw sample to low values of 0.140%, 0.812%, 0.434%, 0.148% and 0.719% respectively after 60mins boiling. This is as a result of thermal breakdown of these compounds and subsequent leaching of soluble components into the boiling medium. This reduces the levels of these anti-nutrients to safer levels.

The results also showed that the values of the tanins and phenols did not decrease significantly($P<0.05$) after 40mins. This suggests that these compounds have been reduced to minimal levels in the ukpo seed flour. Therefore, for economical purposes, it may be advisable to terminate the boiling after 40mins since further cooking does not reduce these substances further.
The reduction in these anti-nutritional factors will enhance the availability of nutrients especially minerals and also increase the safety of the products(Akpatta and Nelligaswatta, 2005).

Effect of boiling on functional properties

The results of the analysis of the functional properties of the raw and processed ukpo are shown on Table 3. A significant increase was observed among the values. The water and oil absorption capacities of the raw sample were 1.60 and 1.23mg/g respectively. The values increased steadily to 3.2 and 2.8mg/g respectively after boiling for 60mins. This suggests an increase in cellular water uptake with increased boiling time. Some previous authors have also reported better water absorption as well as oil absorption capacities of mucuna seed flours as against raw flours(Ahenkora et al, 1999). The water absorption capacity of flour is useful in determining the suitability of the material in baked flours (Natt andNarasinga, 1981) while the increase in oil absorption capacity of the flour may help to maintain and improve mouthfeel, if such flours are used as meat extenders etc. The oil capacity increased from 9.3 at 0min to 17.66 at 60min of boiling.

Also, increase in boiling brought about an increase in emulsion capacity of the ukpo flour from 9.3% in the raw sample to 17.66% after boiling for 60 minutes. The ability to form emulsions is an important characteristic of soup thickeners in southern Nigeria since the oil and water phase in the soup must not be separated. Soup thickeners with high emulsion capacity are very highly recommended.

The bulk density also increased gradually and significantly from the value of 0.72g/ml at 0min to the value 1.77g/ml at 60 minutes. This indicates that the processed ukpo flour particles are better aligned and easily packed together. This is an advantage during transportation and distribution since a large amount of material may be accommodated in a smaller volume.

The swelling index increased from 1.02 at 0mins to 1.36 after 30mins boiling. This increase suggests that there was a partial breakdown of the starch thus making it possible for the starch to absorb more water and thereby swell. Boiling beyond 30mins did not result in an increase in this parameter. This trend was also observed in the water absorption capacity which also did not increase significantly after 30 minute. The ability of flours to absorb water and swell is an important factor in the choice of soup thickeners.

Conclusion

The results obtained show that the boiling affected the various properties of theukpo seed flour. The proximate composition showed slight reductions due to leaching. The anti-nutrients reduced significantly, suggesting that boiling is an effective means of detoxifying the seed. The functional properties of the ukpo seed flourswere improved by the boiling of the seeds. The bulk density, swelling index and water absorption and oil absorption capacitieswhich are important properties in soup thickening were improved after 40minutes of boiling.

Table 1: Mean value of the results of the proximate composition of ukpo flour

Sample boiling time (min)	Moisture content (%)	Ash (%)	Crude fat(%)	Fat (%)	Crude protein (%)	Carbohydrate (%)
0	12.14^{f}	4.40^{a}	8.98^{a}	3.87^{a}	27.69^{b}	42.96^{f}
10	12.20^{f}	4.41^{a}	8.97^{a}	3.80^{b}	27.64^{b}	43.04^{e}
20	12.30^{e}	4.34^{b}	8.95^{ab}	3.79^{b}	27.60^{b}	43.10^{e}
30	12.46^{d}	4.32^{b}	8.96^{a}	3.77^{bc}	26.27^{c}	43.25^{d}
40	12.61^{c}	4.19^{c}	8.92^{bc}	3.74^{c}	26.99^{d}	43.58^{c}
50	12.93^{b}	4.18^{c}	8.90^{c}	3.63^{d}	26.74^{e}	43.67^{b}
60	12.61^{a}	4.00^{d}	8.84^{d}	3.62^{d}	26.59^{a}	43.94^{a}

Mean value in the same column followed by the different superscript are significantly ($P \leq 0.05$)

Table 2: Mean value of the results of the anti-nutritional properties of ukpo flour

Sample boiling time (min)	Oxalate (%)	Tannin (%)	Saponin (%)	Phenol (%)	Phytate (%)
0	0.838^{a}	0.314^{a}	0.539^{a}	0.152^{a}	1.327^{a}
10	0.624^{b}	0.310^{a}	0.527^{b}	0.154^{b}	1.214^{b}
20	0.243^{e}	0.237^{b}	0.511^{c}	0.153^{b}	1.019^{c}
30	0.419^{c}	0.214^{c}	0.509^{c}	0.153^{b}	0.983^{d}
40	0.377^{d}	0.185^{d}	0.499^{d}	0.147^{c}	0.982^{d}
50	0.227^{e}	0.183^{d}	0.479^{e}	0.146^{c}	0.725^{e}
60	0.140^{f}	0.182^{d}	0.434^{f}	0.146^{c}	0.719^{f}

Table 3: Mean values for functional properties of ukpo at different boiling times

Samples boiling time (min)	WAC	OAC	Emulsion capacity %	Bulk density	Swelling index (cm^3/cm^3)
0	1.60^{b}	1.23^{c}	9.30^{c}	0.76^{ba}	1.02^{b}
10	1.70^{b}	1.33^{c}	11.10^{d}	0.68^{bc}	1.02^{b}
20	1.66^{b}	1.36^{c}	12.20^{c}	0.55^{a}	1.03^{b}
30	2.60^{a}	1.40^{c}	14.16^{b}	1.11^{b}	1.26^{a}
40	2.56^{a}	1.33^{c}	11.30^{d}	1.14^{ab}	1.30^{a}
50	2.70^{a}	2.06^{b}	12.70^{c}	1.14^{ab}	1.33^{a}
60	3.20^{a}	2.80^{a}	17.66^{a}	1.17^{a}	1.36^{a}

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