

Full Length Research Paper

# Effect of boiling and roasting on some anti-nutrient factors of asparagus bean (*Vigna Sesquipedalis*) flour

Nzewi Daniel C<sup>1</sup> and Egbonu Anthony C. Cemaluk<sup>2\*</sup>

<sup>1</sup>Department of Food Technology, School of Industrial and Applied Sciences, Federal Polytechnic Nekede Owerri, Nigeria

<sup>2</sup>Nutrition and Toxicological Biochemistry Unit, Department of Biochemistry, University of Nigeria Nsukka, Nigeria

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**Asparagus bean grains, separately processed by boiling and roasting at (100 °C) and (160 °C) respectively for varied period, were milled into flour using attrition mill. Evaluation of the anti-nutritional properties of the flour showed that boiling significantly ( $p < 0.05$ ) reduced phytate from  $1.54 \pm 0.04$  mg/g to  $0.18 \pm 0.11$  mg/g, representing 88 % reduction, tannins from  $3.72 \pm 0.12$  mg/g to  $1.88 \pm 0.08$  mg/g or 49 % reduction and trypsin inhibitor from  $5.58 \pm 0.89$  Tui/g to  $0.74 \pm 0.04$  Tui/g or 87 % reduction. On the other hand, roasting significantly ( $p < 0.05$ ) reduced phytate from  $1.54 \pm 0.04$  mg/g to  $0.13 \pm 0.03$  mg/g or 92 % reduction), tannins from  $3.72 \pm 0.12$  mg/g to  $1.82 \pm 0.02$  mg/g or 51 % reduction and trypsin inhibitor from  $5.58 \pm 0.89$  Tui/g to  $0.16 \pm 0.06$  Tui/g or 96 % reduction. The observed effects occurred in a time dependent manner, suggesting possible enhancement in quality and safety with increasing boiling or roasting time. Roasting further improved the studied anti-nutritional properties of asparagus bean flour, hence may be preferred to boiling for processing asparagus bean.**

**Keywords:** Phytate, trypsin inhibitor, tannins, anti-nutritional factors, asparagus bean, boiling, roasting.

## INTRODUCTION

The asparagus bean (*Vigna Sesquipedalis*), commonly known as 'black akidi' in the Igbo speaking tribe of Nigeria, is grown in West and central African countries. It is also known as 'yard long bean' in apparent recognition of its usually long bean pods. (Audrey, 1993). Asparagus bean is an annual crop of the family and sub-family *leguminosae* and *papilionadeae*, respectively. It is related closely to cowpea (*Vigna unguiculata*) or black-eyed pea. Asparagus bean is highly nutritious but is underutilized in Nigeria. As with other legumes, it is used in the preparation of diets particularly for its high protein contents (Bressani, 1985). However, it may contain anti-nutritional factors including phytate, tannins and trypsin inhibitor (Burbano et al., 1999; Barampama and Simard, 1993).

As the name suggests, these anti-nutrients does not contribute to nutrition in anyway. Instead, they are toxicants that may cause low protein digestibility and mineral availability when consumed (Uzoehina, 2007).

In essence, anti-nutrients are compounds that act to reduce the nutrient utilization of ingested food (Osagie, 1998). Anti-nutritional factors may be classified under those that interfere with the digestion of proteins (e.g trypsin inhibitor), minerals (e.g phytates) and vitamins (e.g tannins) (Carolyn et al., 2007).

Boiling/cooking and roasting are important household food processing methods. As a thermal process, boiling/cooking asparagus bean could enhance tenderization of the cotyledons thereby increasing palatability and nutritional value by inactivating endogenous toxic factors (Thomas, 1988). Roasting is similar to cooking/boiling but involves higher temperature and reduced time.

Most of the anti-nutritional factors become ineffective by simple processing measures such as heating, soaking, germination or autoclaving (Nowak and Haslberger 2000). The knowledge of the distribution of these anti-nutritional factors in asparagus bean following these processes may, therefore, provide basis for the improvement of its nutritive quality. Although the effect of processing on some anti-nutritional properties of asparagus bean was studied (Nwosu, 2010), the

\*Corresponding author E-mail:  
tonycemalukegbonu@yahoo.com; Tel: +23480-3636-6565

effect of varying boiling/cooking and roasting time on the anti-nutrient properties of asparagus bean flour, to the knowledge of the authors, has not been compared. Thus, it is the aim of the present study to compare the effect of boiling and roasting at varying time on the anti-nutritional qualities of asparagus bean ("black akidi") flour. This may provide basis for improved keeping quality and subsequent utilization of asparagus bean flour for optimized nutrient value.

## MATERIALS AND METHODS

### Source and preparation of materials

Brown variety of Asparagus bean was bought from Onitsha main market, Anambra State, South East Nigeria. The dry grains were purchased randomly from retail sellers. The equipment used were obtained from the laboratory of Food Science and Technology Department, Federal Polytechnic Nekede Owerri, Imo State and from the Central laboratory of National root and crop research institute Umudike, Abia State, Nigeria. All the chemicals used are of analytical grades.

### Samples Preparation

The dry grains were sorted by hand. The grains were then washed with distilled water at room temperature to remove foreign particulates and dust. Thereafter, the grains were shared into two equal parts. One part was subsequently shared into four equal parts and respectively processed by boiling at 100 °C for 10 min, 20 min, 30 min and 40 min. The other part was shared into four parts and respectively processed by roasting at 160 °C for 5 min, 10 min, 15 min and 20 min. Thereafter, the moistened asparagus beans were separately sun dried for three days and subsequently milled into flour using attrition mill. The control sample was not subjected to either boiling or roasting process before milling into flour. The flour samples thus generated were packaged separately in a properly labeled airtight container prior to analysis.

### Anti-nutritional factors analysis

#### Determination of tannins

The tannin determination was by the Follin-Denis Spectro photometric method as described by Pearson (1976). The absorbance of the developed color was measured at 760 nm wavelength with the reagent blank set at zero, using GENWAY Model 6000 electronic spectro-photometer.

#### Determination of phytates

The phytate content of the samples was determined by the colorimetric method described by Oberleas (1978). The absorbance was measured at 519 nm in a spectrophotometer (GENWAY Model 6000 electronic spectro-photometer) with the reagent blank at zero.

#### Determination of trypsin Inhibitor

The trypsin inhibitor activity (TIA) was determined by the spectro-photometric method of Arnfield et al., 1985. The absorbance was read at 410 nm using a spectrophotometer (GENWAY Model 6000

electronic spectro-photometer).

## Statistical analysis

Data collected were analysed by Analysis of Variance (ANOVA) with the statistical package for social sciences (SPSS) for Windows version 16. The Bonferroni *post hoc* test was used to identify the means that differ significantly at  $p < 0.05$ . Results were expressed as Mean  $\pm$  SEM.

## RESULTS

Boiling significantly ( $p < 0.05$ ) reduced phytate from  $1.54 \pm 0.04$  mg/g to  $0.18 \pm 0.11$  mg/g or 88 % (Table I), tannins from  $3.72 \pm 0.12$  mg/g to  $1.88 \pm 0.08$  mg/g or 49 % (Table II) and trypsin inhibitor from  $5.58 \pm 0.89$  Tui/g to  $0.74 \pm 0.04$  Tui/g or 87% (Table III) in a time dependent manner. On the other hand, roasting significantly ( $p < 0.05$ ) reduced phytate from  $1.54 \pm 0.04$  mg/g to  $0.13 \pm 0.03$  mg/g or 92 % (Table I), tannins from  $3.72 \pm 0.12$  mg/g to  $1.82 \pm 0.02$  mg/g or 51 % (Table II) and trypsin inhibitor from  $5.58 \pm 0.89$  Tui/g to  $0.16 \pm 0.06$  Tui/g or 96 % (Table III) in a time dependent manner.

## DISCUSSION

Asparagus bean is highly nutritious with high protein content (Bressani, 1985). However, it may contain anti-nutritional factors (Burbano et al., 1999; Barampama and Simard, 1993) that may negate its nutrient value by way of impaired protein digestibility and mineral availability (Uzoehina, 2007). The anti-nutritional factors are heat labile (Udensi et al., 2004) hence may be inactivated by processing methods involving heat generation.

In the present work, the studied anti-nutritional factors decreased in comparison with control. This may imply improved nutrient value or quality of the asparagus bean flour. Boiling and roasting are thermal processes hence the resultant heat may inactive these anti-nutrients. This appears in agreement with the report of Akinyele (1989) that boiling and roasting reduced trypsin inhibitor activity (and probably other major anti-nutrient) following perhaps their enhanced leaching into the heated water (Ene Obong and Obizoba, 1996).

The present study demonstrated significant reduction of the studied anti-nutrients in a time dependent manner. This seemingly suggests that increasing the processing time may ensure complete elimination of these anti-nutrients in asparagus flour. In apparent support of the present study, Nwosu (2010) reported a time dependent reduction in phytate, tannins and trypsin inhibitor contents following cooking. Furthermore, tannin content of other legumes - pigeon pea (*Cajanus cajan*) and vegetable cowpea (*Vigna unguiculata*) – decreased with increasing processing time (Onwuka, 2006).

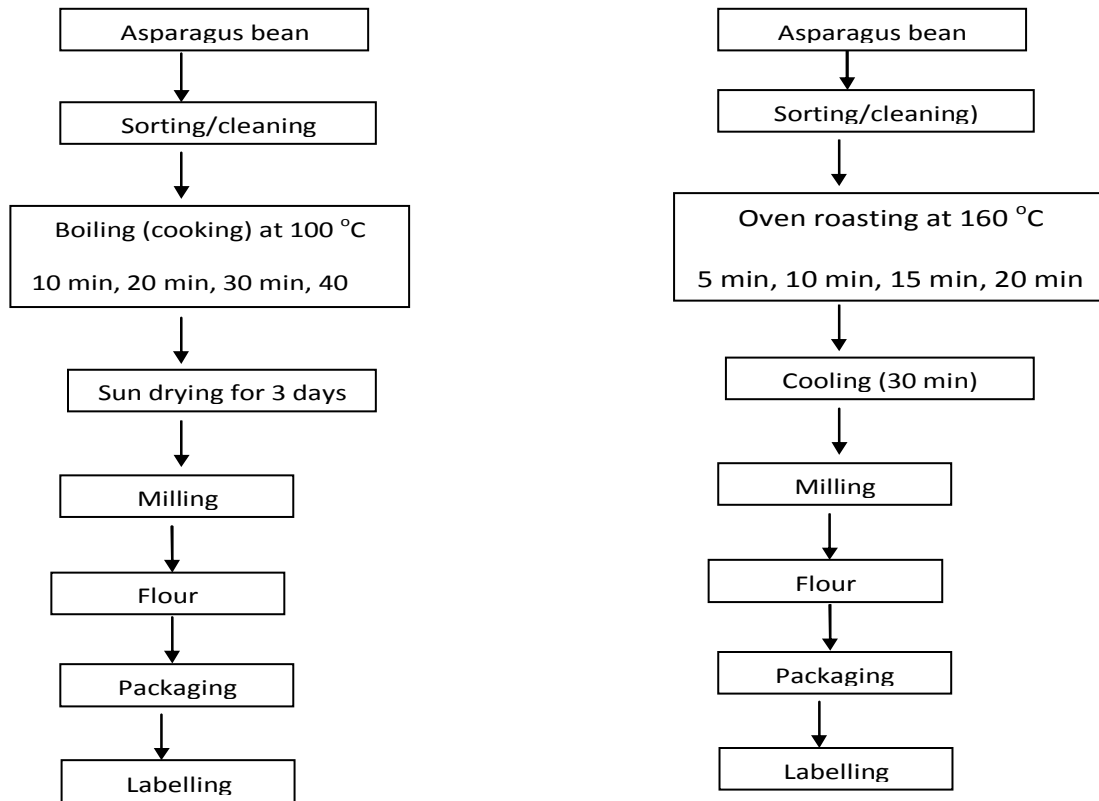


Figure. I: **Flow diagram of processing of asparagus bean**

**Table I:** Phytate contents of boiled and roasted asparagus bean flour

Boiling time (min)	Phytate (mg/g)	Relative decrease (%)	Roasting time (min)	Phytate (mg/g)	Relative decrease (%)
0	1.54 ± 0.04		0	1.54 ± 0.04	
10	1.14 ± 0.10 <sup>*</sup>	26	5	1.11 ± 0.11	28
20	0.80 ± 0.20 <sup>*</sup>	48	10	0.72 ± 0.02 <sup>*</sup>	53
30	0.51 ± 0.07 <sup>*</sup>	67	15	0.37 ± 0.07 <sup>*</sup>	76
40	0.18 ± 0.11 <sup>*</sup>	88	20	0.13 ± 0.03 <sup>*</sup>	92

Mean±SEM for duplicate analysis; <sup>\*</sup> The mean difference is significant at the 0.05 level.

**Table II:** Tannins content of boiled and roasted asparagus bean flour

Boiling time (min)	Tannins (mg/g)	Relative decrease (%)	Roasting time (min)	Tannins (mg/g)	Relative decrease (%)
0	3.72 ± 0.12		0	3.72 ± 0.12	
10	3.10 ± 0.10	17	5	3.15 ± 0.05 <sup>*</sup>	15
20	2.31 ± 0.01 <sup>*</sup>	38	10	2.27 ± 0.07 <sup>*</sup>	39
30	2.16 ± 0.06 <sup>*</sup>	42	15	2.09 ± 0.09 <sup>*</sup>	44
40	1.88 ± 0.08 <sup>*</sup>	49	20	1.82 ± 0.02 <sup>*</sup>	51

Mean±SEM for duplicate analysis; <sup>\*</sup> The mean difference is significant at the 0.05 level.

**Table III:** Trypsin inhibitor contents of boiled and roasted asparagus bean flour

Boiling time (min)	Trypsin inhibitor (Tui/g)	Relative decrease (%)	Roasting time (min)	Trypsin inhibitor (Tui/g)	Relative decrease (%)
0	5.58 ± 0.89		0	5.58 ± 0.89	
10	2.41 ± 0.14*	57	5	0.77 ± 0.09*	86
20	1.41 ± 0.06*	75	10	0.45 ± 0.07*	92
30	1.08 ± 0.11*	81	15	0.28 ± 0.11*	95
40	0.74 ± 0.05*	87	20	0.16 ± 0.08	98

Mean±SEM for duplicate analysis; \* The mean difference is significant at the 0.05 level.

Generally, anti-nutrients are considered toxic. For instance, tannins may form insoluble complexes with proteins thereby decreasing the digestibility of proteins (Uzoehina, 2007). Tannins may decrease protein quality by decreasing digestibility and palatability, damaging the intestinal tract, and enhancing carcinogenesis (Makkar and Becker, 1996). Furthermore, tannins could impair iron availability (Svanberg et al., 1993; Udayasakhara-Rao, 1995) whereas phytates up to 1 % could interfere with mineral bioavailability (Anigo et al., 2009), including iron and calcium (Alonso et al., 2001). Thus, the significant reduction of these anti-nutrients as observed in this study is indicative of improved safety, hence is desirable.

In conclusion, the processing by boiling and roasting improved the anti-nutritional properties of asparagus bean flour in a time dependent manner. This may suggest possible enhancement in quality and safety of the flour with increasing boiling or roasting time. Roasting (even at reduced roasting time relative to boiling time) further improved the anti-nutritional properties of asparagus bean flour, implying that longer time should be employed to process asparagus bean by cooking. Hence, roasting should be preferred to boiling for processing asparagus bean.

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