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Full Length Research Paper

Effect of boiling and roasting on the proximate properties of asparagus bean (*Vigna Sesquipedalis*)

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The proximate properties of asparagus bean flour obtained after boiling and roasting at 100 and 160°C, respectively for varied period were evaluated and compared in this study. Results showed that boiling for 40 min significantly ($p<0.05$) reduced protein and moisture contents by 10 and 6% respectively, but increased carbohydrate (CHO) content by 8%. Furthermore, it insignificantly ($p>0.05$) reduced fat, fibre and ash contents by 28, 13 and 21%, respectively. On the other hand, roasting for 20 min significantly ($p<0.05$) reduced protein and moisture by 11 and 43%, respectively, but increased CHO content by 14%. However, roasting reduced fat, fibre and ash by 20, 18 and 10%, respectively. However, the observed reduction was statistically insignificant ($p>0.05$). Overall, the effects observed in this study were time dependent, suggesting possible enhancement with increasing processing time. Roasting markedly decreased the moisture content, implying that 20 min roasting probably enhanced the stability and kept the quality of the asparagus bean flour. Thus, roasting may be preferred to boiling for commercial production and storage of asparagus bean flour.

Key words: Asparagus bean, boiling, roasting, crude protein, ash, fibre, moisture, fat, carbohydrate.

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. Asparagus bean is an annual crop of the family Leguminoseae and sub-family Papilionadeae. Otherwise known as 'yard long bean' in apparent recognition of its usually long bean pods (Audrey, 1993), it is related closely to cowpea (*Vigna unguiculata*). Asparagus bean is highly nutritious and, 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). Boiling is a common food processing method. As a thermal process, boiling 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.

The aim of this study was to compare the effect of boiling and roasting at varying time on the proximate qualities of asparagus bean ("black akidi") flour. This may provide basis for improved keeping quality and subsequent utilization of commercial production and storage of asparagus bean flour.

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 was obtained from the laboratory of Food Science and Technology

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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.

Preparation of samples

The dry grains were sorted by hand. The grains were then washed with distilled water at room temperature to remove foreign particulates and dust. Then the grains were divided into two equal parts. The first part was boiled at 100°C for 10, 20, 30 and 40 min. The second part was roasted at 160°C for 5, 10, 15 and 20 min (Figure 1). The moist asparagus beans were 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.

Proximate analysis

The protein content was determined by the method of Kjeidahl as described by James (1996). The fat content was determined by the continuous solvent extraction method using soxhlet apparatus as described by Pearson (1976) and James (1996). The crude fibre content was determined by the method described by James (1996). The total ash content was determined by the furnace incineration gravimetric method (AOAC, 1990). The moisture content was determined by the method of James (1996). The carbohydrate content was determined by the nitrogen free extractive (NFE) method described by Pearson (1976).

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 ± SEM.

RESULTS

Boiling significantly ($p<0.05$) reduced protein from 19.84 ± 0.10% to 17.92 ± 0.02%, representing 10% reduction (Table 1) and moisture from 9.53 ± 0.03% to 8.99 ± 0.09% (6% reduction) (Figure 4), but increased CHO content from 58.70 ± 0.7% to 63.37 ± 0.11% (8% increase) (Figure 2). Furthermore, it insignificantly ($p>0.05$) reduced fat from 2.5 ± 0.2% to 1.8 ± 0.4% (28% reduction) (Table 2), fibre from 5.72 ± 0.14% to 5.00 ± 0.50% (13% reduction) (Table 3) and ash from 3.71 ± 0.11% to 2.92 ± 0.02% (21% reduction) (Figure 3).

On the other hand, roasting significantly ($p<0.05$) reduced protein from 19.84 ± 0.10% to 17.63 ± 0.03%, representing 11% reduction (Table 1) and moisture from 9.53 ± 0.03% to 5.45 ± 0.10% (43% reduction) (Figure 4), but increased CHO content from 58.70 ± 0.7% to 66.87 ± 0.16% (14% increase) (Figure 2). However, it reduced ($p>0.05$) fat from 2.5 ± 0.2% to 2.08 ± 0.3% (20% reduction) (Table 2), fibre from 5.72 ± 0.14% to 4.70 ± 0.70% (18% reduction) (Table 3) and ash from 3.71 ± 0.11% to 3.35 ± 0.35% (10% reduction) (Figure 3).

DISCUSSION

Asparagus bean is nutritious with high protein content (Bressani, 1985). However, thermal processing methods may affect its nutrient value. Thus, this study evaluated and compared the effect of boiling and roasting on the nutrient value of asparagus bean flour. Results of this study demonstrated time dependent effect on the studied proximate properties of asparagus bean; seemingly, suggesting that increasing the processing time might have enhanced the observations.

In particular, the time dependent increase in crude carbohydrate content suggests improved carbohydrate content, hence good dietary energy source. Carbohydrates may absorb water to bulk up via cross-linking reaction probably induced by heat generated by boiling or roasting process. This may increase the stability of the carbohydrates thereby enhancing resistance to further heat. In comparison with boiling (40 min), this study indicated that roasting for 20 min increased the carbohydrate content and therefore, should be the preferred processing method for optimum carbohydrate content in asparagus bean flour.

Reduced moisture content ensured the inhibition of microbial growth, hence is an important factor in food preservation (Chew et al., 2011). Thus, the time dependent reduction in moisture content as observed in this study may indicate good stability (Ijeh et al., 2004; Edem et al., 2009) probably due to reduced microbial attack (Abdullahi, 2000). This may ensure high storage quality of the asparagus bean flour. Exposure to high temperature may favour moisture loss probably via enhanced evaporation. Furthermore, low moisture content may result in low acid value and free fatty acids, hence high keeping quality (Ejikeme et al., 2010). As would be expected, roasting markedly decreased the moisture content in comparison with boiling; indicating that roasting may favor keeping quality of asparagus bean flour.

Ash content may be associated with the amount of mineral present in a sample; hence the decreased crude ash noted in this study apparently suggests a reduction in mineral contents of the asparagus bean flour. The anti-nutrients may have interfered with the bioavailability of minerals as suggested by Alonso et al. (2010) and Anigo et al. (2009). In contrast with boiling, roasting further increased the ash content of the asparagus bean flour, seemingly, suggesting that roasting may improve the mineral contents of the asparagus bean flour.

Crude fibre decreased in the boiled and roasted samples as against control, but the value (5.72 ± 0.14% to 5.00 ± 0.50% for boiling or 5.72 ± 0.14% to 4.70 ± 0.70% for roasting) falls within the acceptable range of 2.7 to 7.9 % in foods as reported by Eke et al. (2008).

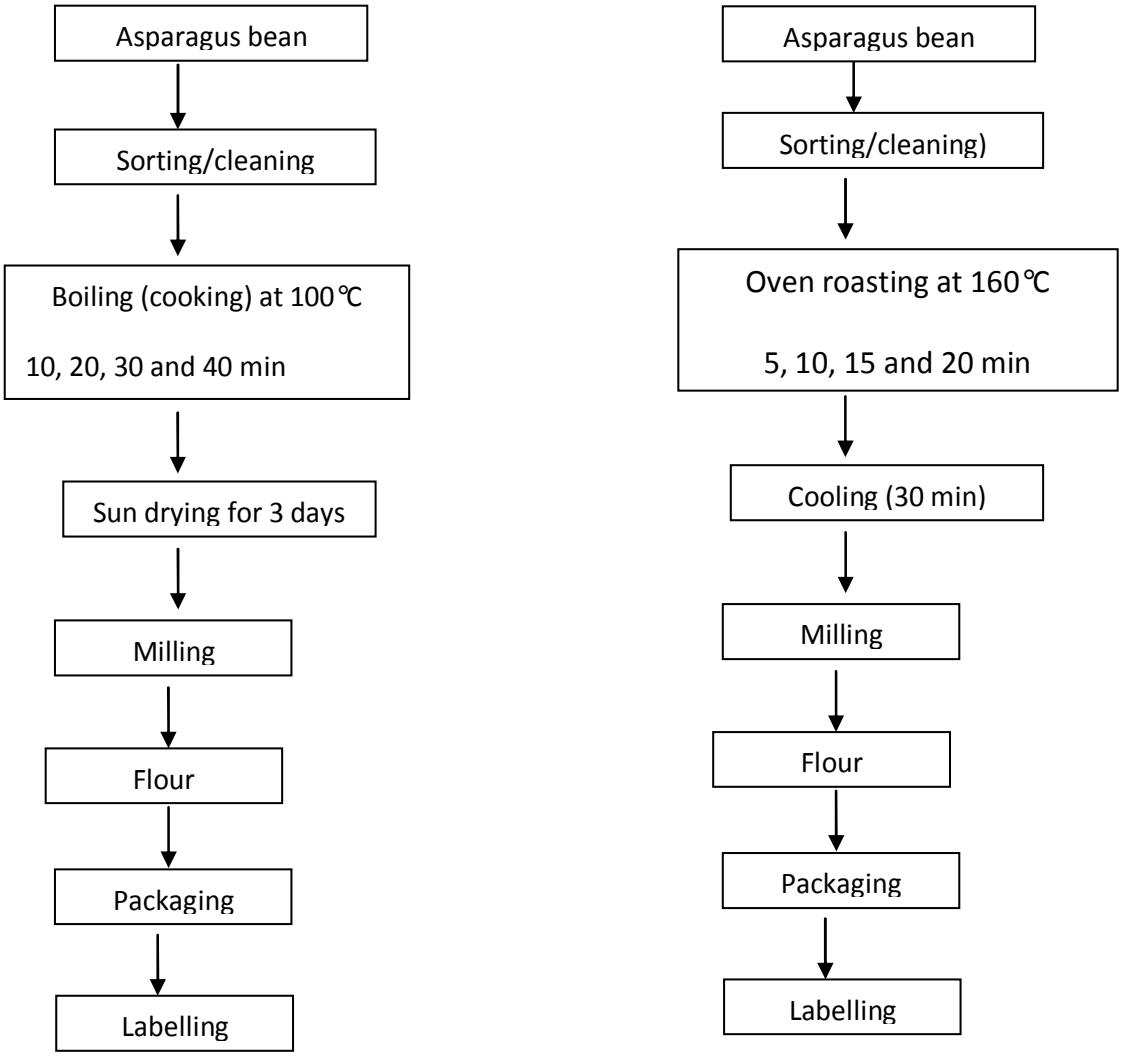

Figure 1. Schematic diagram of processing of the asparagus bean.

Table 1. Protein content of boiled and roasted asparagus bean flour.

Boiling time (min)	Protein (%)	Relative decrease (%)	Roasting time (min)	Protein (%)	Relative decrease (%)
0	19.84 ± 0.10		0	19.84 ± 0.10	
10	18.75 ± 0.10*	5	5	18.81 ± 0.10*	5
20	18.57 ± 0.10*	6	10	18.53 ± 0.10*	7
30	18.31 ± 0.10*	8	15	17.93 ± 0.03*	10
40	17.92 ± 0.02*	10	20	17.63 ± 0.03*	11

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

Furthermore, the observation was insignificant ($p>0.05$), hence may represent influence of extraneous factors beyond the control of this study.

Generally, as with other legumes, asparagus bean may contain anti-nutritional factors including phytate, tannins and trypsin inhibitor (Burbano et al., 1999; Barampama and Simard, 1993). In particular, tannins may form insoluble complexes with proteins, thereby decreasing protein digestibility and quality (Uzoechina, 2007). The relation of this to significant reduction in protein contents observed in this study is not known. This may be an interesting area for further study. However, the

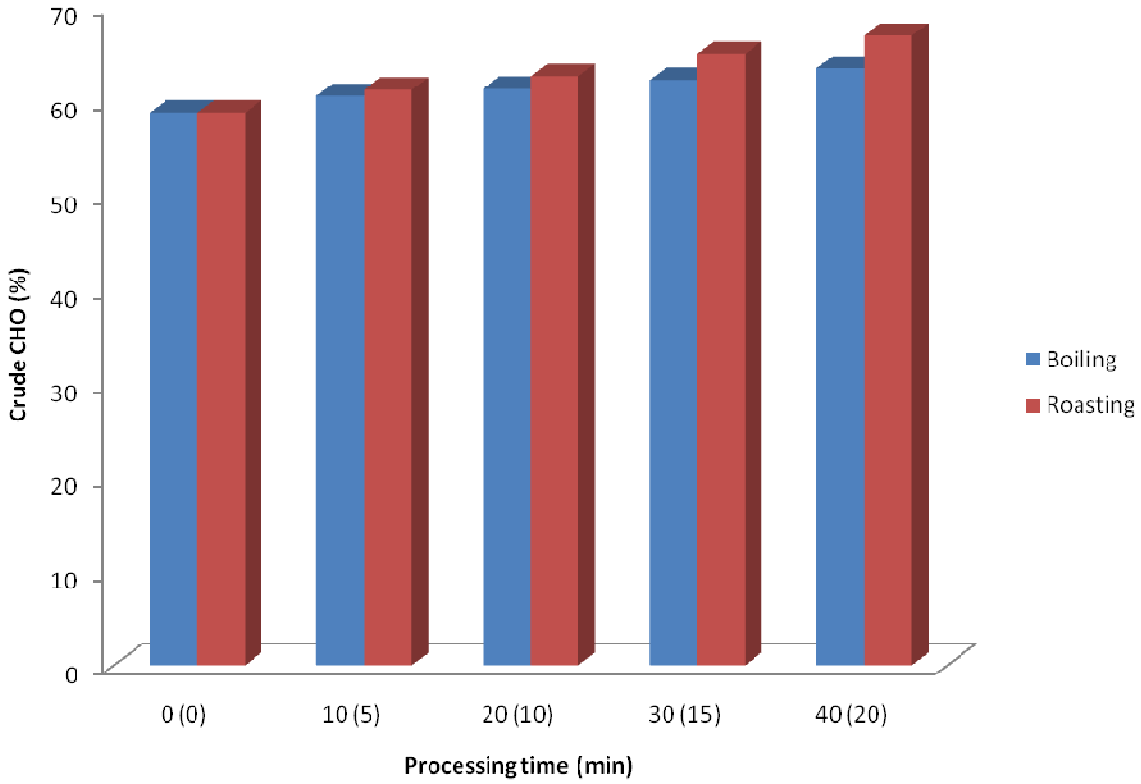

Figure 2. Crude CHO composition of boiled and roasted asparagus bean flour (roasting time in bracket).

Table 2. Fat content of boiled and roasted asparagus bean flour.

Boiling time (min)	Fat (%)	Relative decrease (%)	Roasting time (min)	Fat (%)	Relative decrease (%)
0	2.5 ± 0.2		0	2.5 ± 0.2	
10	2.3 ± 0.2	8	5	2.4 ± 0.4	4
20	2.2 ± 0.2	12	10	2.2 ± 0.2	12
30	2.0 ± 0.2	20	15	2.1 ± 0.1	16
40	1.8 ± 0.04	28	20	2.0 ± 0.3	20

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

Table 3. Fibre content of boiled and roasted asparagus bean flour.

Boiling time (min)	Fibre (%)	Relative decrease (%)	Roasting time (min)	Fibre (%)	Relative decrease (%)
0	5.72 ± 0.14		0	5.72 ± 0.14	
10	5.60 ± 0.40	2	5	5.42 ± 0.10	5
20	5.42 ± 0.10	5	10	5.25 ± 0.10	8
30	5.22 ± 0.20	9	15	4.93 ± 0.03	14
40	5.00 ± 0.50	13	20	4.70 ± 0.70	18

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

percentage reduction in protein content of asparagus bean flour following roasting and boiling was similar, suggesting similar processing influence on the protein content of asparagus bean flour.

Overall, the effects observed in this study were time dependent, suggesting possible enhancement with increasing processing time. As compared with boiling, roasting markedly decreased the moisture content,

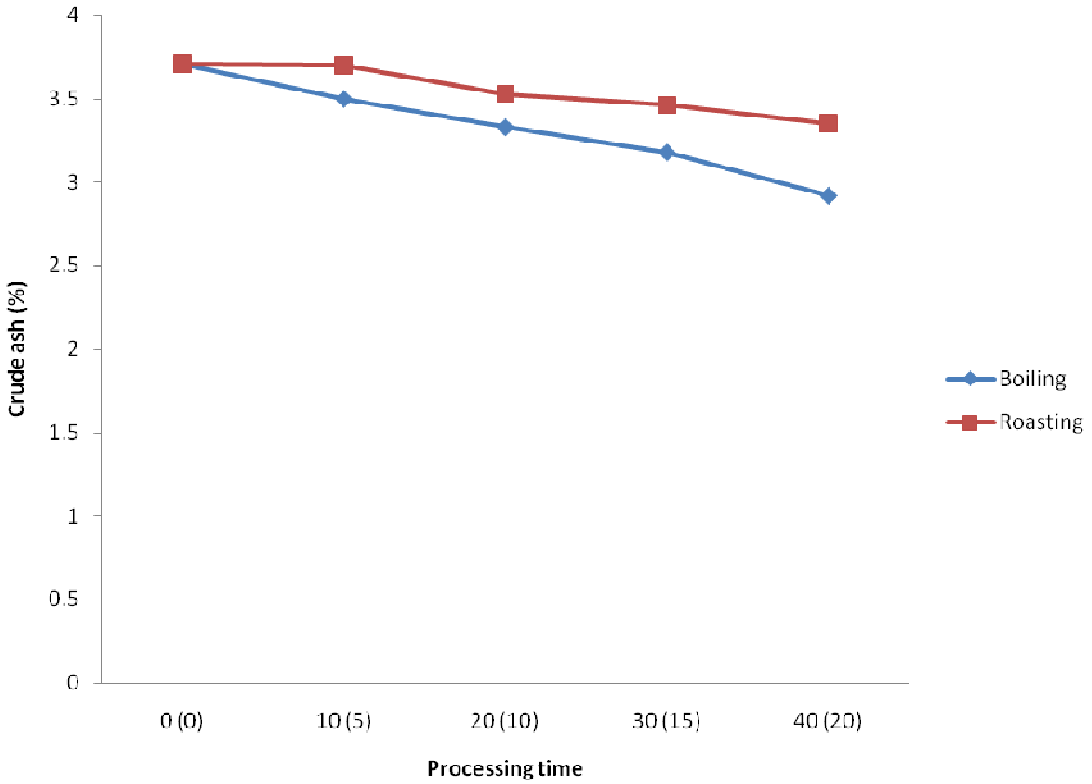

Figure 3. Crude ash composition of boiled and roasted asparagus bean flour (roasting time in bracket).

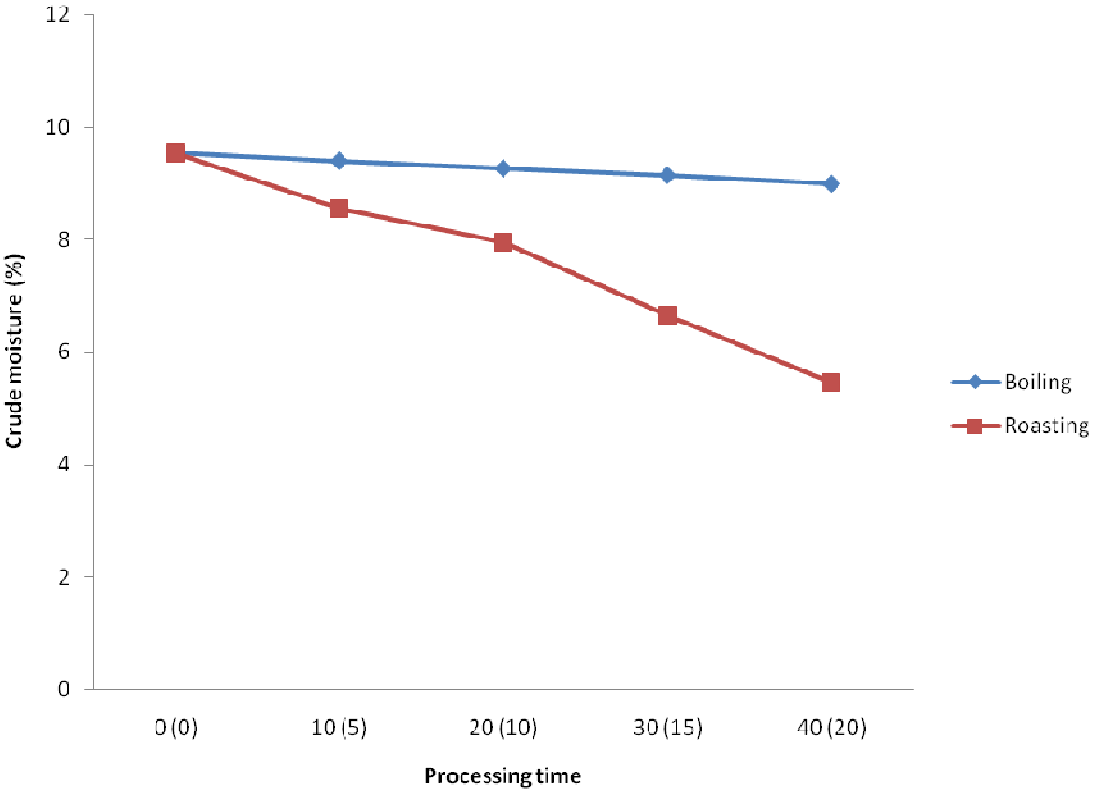

Figure 4. Crude moisture content of boiled and roasted asparagus bean flour (roasting time in bracket).

implying that 20 min roasting probably enhanced the stability and keeping quality of the asparagus bean flour. Thus, roasting may be preferred to boiling for commercial production and storage of asparagus bean flour.

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