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Short Communication

Effects of slice thickness and blanching time on the proximate properties of dried ground yam

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Abstract

Yam (*Dioscorea* spp.) is an important class of food that basically provides energy in the human diet in form of carbohydrate, some minerals and essential vitamins. Fresh yams are difficult to store and are subjected to post harvest losses during storage. These losses serve as an impetus for processing this staple food into a product of longer shelf life. Therefore, yam tubers are usually processed into dried ground yam which invariably makes it more stable with prolonged shelf life. The effect of blanching time and slice thickness on the proximate properties of dried ground yam was investigated from 'Ehuru' *(Dioscorea rotundata)*. The yam was peeled, washed, sliced at 2, 3 and 4 mm thickness, blanched at 100°C for 5, 7 and 10 minutes, dried at 65°C and milled into flour. The proximate analyses of the dried ground yam samples were determined using (AOAC, 2005). A complete randomized design was used for the experiment. The data generated were analysed using Analysis of Variance (ANOVA) at 95 % confidence level, to know if there are significant differences between the values of the proximate analyses for each sample of dried ground yam and the means were separated using Duncan Multiple Range Test. The results showed that blanching time and slice thickness has significant effect ($P < 0.05$) on the moisture content, crude protein, crude fat, crude fibre, ash content and carbohydrate of the dried ground yam.

Introduction

Yam (*Dioscorea* spp.), with its appreciable contents of essential dietary nutrients, has been reported to have nutritional superiority when compared with other tropical root crops (Shajeela *et al*., 2011). It is an important class of food that provides energy in the human diet in the form of carbohydrate, some minerals and essential vitamins. Babaleye (2003) reported that yam contributes more than 200 dietary calories per capita daily for more than 150 million people in West Africa and serves as an important source of income to the people. According to FAO (2005) statistics, 48.7 million tonnes of yams were produced worldwide in 2005, and 97% of this was in sub-Saharan Africa while West and Central Africa accounted for about 94% of world production. Nigeria is the leading producer of yam with 34 million tonnes and yam is the second most important root and tuber crop in Africa with production reaching just under one third the level of cassava (Abioye, 2012).

There are over 600 species of yam which are grown for food and for medicinal purposes, but only six are mostly grown as staple foods and these are; White yam (*Dioscorea rotundata* P.), Yellow yam (*Dioscorea cayenensis* L.), Water yam (*Dioscorea alata* L.), Lesser yam *(Dioscorea esculenta)*, Aerial yam *(Dioscorea bulbifera)* and Bitter yam *(Dioscorea dumentorum)* (Ike and Inoni, 2006). Out of the six species commonly found in West Africa, White yam (*Dioscorea rotundata* P.) is the most widely grown and the preferred yam species. It has many varieties which are distinguished by colour and shape and are generally considered to be the best in terms of food quality, thus commanding the highest market value (Markson *et al.*, 2010).

Yam can be processed into different forms of food such as fried yam, baked yam, boiled yam, roasted yam and pounded yam. Yams are characterized by high moisture content, which renders the tubers more susceptible to microbial attacks and brings about high perish ability of the tubers (Akinoso and Olatoye, 2013). However, yam can also be processed into less perishable products such as yam flour and dried ground yam (instant pounded yam flour) which makes it a product with longer shelf life. The quality of the yam flour produced is dependent on the parameters taken into consideration during its processing operation. These parameters include blanching temperature, blanching time and slice thickness (Adejumo *et al.*, 2013). There were much information on the production of dried ground yam but there are limited or scanty information on the right

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slice thickness and appropriate blanching time that will yield the best proximate properties of the dried ground yam. Therefore, the aim of this research is to study the effect of blanching time and slice thickness on the proximate properties of dried ground yam.

Materials and Methods

Materials

The main material used for this research was white yam *(Dioscorea rotundata)* which was known locally as name "Ehuru" in Yoruba land of Nigeria. It was obtained from a local market in Gambari, Oyo State, Nigeria. Ehuru was considered for the study because it is in abundance in the country and moreover the most preferred species for preparation of pounded yam according to research findings (Otegbayo *et al.*, 2010).

Methods

White yam tubers *(Dioscorea rotundata)* without rot and decay were selected and washed in clean water to remove adhering soil and other undesirable materials. The yam tubers were peeled using a sharp knife and under water to prevent browning. The peeled yams were then thoroughly washed, sliced to 2, 3, and 4 mm thicknesses, respectively. Samples were blanched at 100^{o}C for 5, 7 and 10 minutes, respectively and dried at 65^{o}C in a cabinet dryer. The dried samples were milled, sieved to produce fine flour and packaged in cellophane bags separately for further analyses.

Proximate analyses

The proximate analyses of the yam flour sample were determined as prescribed by Association of Official Analytical Chemist (AOAC, 2005).

Results and Discussion

The results of the mean value of the proximate composition at different slice thickness and blanching time are presented in Table 1. The analyses of variance for the effect of blanching time and slice thickness on the proximate properties of dried ground yam at 95% confidence level are also presented in Table 2.

Table 2 shows that blanching time and slice thickness has a significant effect ($P < 0.05$) on the moisture content of dried ground yam. Table 1 show that the moisture contents range for all the slice thicknesses at 5 min, 7 min and 10 min were 7.82% - 8.13%, 7.83% - 8.03% and 6.06% - 8.08%, respectively. The range in moisture content recorded from the yam samples were slightly above those observed by Abioye (2012) while higher range of values were also observed by Adejumo *et al.* (2013). Samples slice at 4 mm thickness blanched at 10 min had the lowest moisture content of 6.06% while the samples with 3 mm slice thickness blanched at 5 min retained the highest value of 8.13% moisture content. The value of moisture content decreases as slice thicknesses increased from 2 mm to 4 mm at 10 min blanching time. The moisture content of any sample is an index of keeping quality and thus an indicator of the shelf life (Abioye, 2012).

Blanching time and slice thickness have a decreasing effect on the crude protein of the dried ground yam. Samples sliced at 2 mm thickness and blanched at 5 min had the highest value of 6.52% protein content while samples sliced at 4 mm and blanched at 10 min have the least value of 4.55% protein content (Table 1). This is probably due to the denaturizing of protein caused by the effect of heat on the yam slice samples during blanching. This result was in conformity with the findings of Onwueme *et al*. (1991) and Adejumo *et al.* (2013) who reported that blanching reduces the protein content of yam flour.

The fat and fibre contents decrease with increase in slice thickness and at the same time decreases as blanching time increased from 5 min to 10 min (Table 1). The highest values of 3.50 % and 2.00 % was retained by samples sliced at 2 mm thickness and blanched at 5 min while the lowest value of 2.42% and 1.34% was retained by samples sliced at 4 mm and blanched at 10 min for fat and fibre content respectively. The lower fat content observed at higher blanching times could be associated with the oxidation of fat during blanching. This result was in agreement with Koné-Daouda *et al.* (2014) who inferred that high loss of fat content resulted from longer cooking time. The low content of fat will enhance the storage life of the flour due to the lowered chance of rancid development. He also stated that decrease in the biochemical characteristic contents of flours from cooked yam may be due to the heat treatment, which caused loss of these parameters in yam tubers. The low fibre contents of the yam flours agreed with the report of Abara *et al*. (2011) that white yams are low in fibre.

Blanching time and slice thickness have a significant effect ($P < 0.05$) on the ash content of the dried ground yam samples. The ash content increased with increase in slice thickness but decreased with increase in the blanching time (Table 1). Samples sliced at 4 mm thickness and blanched at 5 min retained the highest value of 2.13 % ash content, this could be as a result of more ash content generated

Table 1. Effect of blanching time and slice thickness on the proximate properties of dried ground yam

Blanching Time		5 min			7 min			10 min	
Slice Thickness	2 mm	3 mm	4 mm	2 mm	3 mm	4 mm	2 mm	3 mm	4 mm
Moisture Content (%)	8.00^{a,b}	8.13^{a}	7.82^{b}	8.03^{a}	7.04^{b}	7.83^{a}	8.08^{a}	8.04^{a}	6.06^{b}
Crude Protein (%)	6.52^{a}	6.00^{b}	5.98^{b}	5.91^{a}	5.55^{a}	5.31^{a}	5.29^{a}	4.95^{b}	4.55^{c}
Crude Fat (%)	3.50^{a}	3.27^{b}	3.20^{b}	3.20^{a}	3.15^{a}	3.13^{a}	3.19^{a}	2.57^{b}	2.42^{c}
Crude Fibre (%)	2.00^{a}	2.00^{a}	1.82^{b}	1.72^{a}	1.67^{b}	1.54^{c}	1.45^{a}	1.39^{a,b}	1.34^{b}
Ash Content (%)	2.03^{c}	2.20^{b}	2.31^{a}	1.82^{c}	2.17^{b}	2.25^{a}	1.70^{c}	2.15^{b}	2.18^{a}
Carbohydrate (%)	78.50^{a}	78.41^{a,b}	78.34^{b}	79.37^{b}	80.42^{a}	79.95^{a,b}	80.30^{b}	80.65^{b}	83.45^{a}

Means with the same alphabet are not significantly different at ($P \leq 0.05$)

Table 2. The analysis of variance of the effect of blanching time and slice thickness on the proximate properties of dried ground yam

Qualities	Source of Variation	Df	Sum of Square	Mean Square	Observed F	Required F (0.05)
Moisture Content	Blanching Time	2	1.5853	0.7927	77.76	3.55
	Slice Thickness	2	2.9326	0.9775	95.83	3.55
	Interaction	4	6.8309	1.7077	167.42	2.93
	Error	18	0.1835	0.0102		
	Total	26	11.5323			
Crude Protein	Blanching Time	2	6.8810	3.4405	97.19	3.55
	Slice Thickness	2	1.0021	0.5011	14.16	3.55
	Interaction	4	0.9301	0.2325	6.57	2.93
	Error	18	0.6369	0.0354		
	Total	26	9.4501			
Crude Fat	Blanching Time	2	1.7096	0.8548	176.61	3.55
	Slice Thickness	2	0.7178	0.3589	74.16	3.55
	Interaction	4	0.4292	0.1073	22.17	2.93
	Error	18	0.0871	0.00484		
	Total	26	2.9437			
Crude Fibre	Blanching Time	2	1.3323	0.6662	788.92	3.55
	Slice Thickness	2	0.1179	0.0590	69.87	3.55
	Interaction	4	0.0151	0.0038	4.50	2.93
	Error	18	0.0152	0.0008		
	Total	26	1.4805			
Ash Content	Blanching Time	2	0.1314	0.0657	147.83	3.55
	Slice Thickness	2	0.8083	0.4042	909.45	3.55
	Interaction	4	0.0636	0.0159	35.78	2.93
	Error	18	0.008	0.0004		
	Total	26	1.0113			
Carbohydrate	Blanching Time	2	41.8961	20.9481	266.99	3.55
	Slice Thickness	2	6.5079	3.2540	41.45	3.55
	Interaction	4	13.1100	3.2775	41.75	2.93
	Error	18	1.4123	0.0785		
	Total	26	62.9263			

due to the increase in the thickness of the yam slices while samples sliced at 2 mm thickness and blanched at 10 min had the lowest value of 1.70 % ash content. This result was in agreement with the findings of Oluwalana *et al*. (2011) who inferred that increase in blanching temperature and duration will lead to decrease in the ash content. Koné-Daouda *et al*. (2014) also pointed out that decrease in ash contents may be due to leaching of minerals in boiling water. Range of values of ash content observed in this study was similar to those reported by Abioye (2012), Adejumo *et al.* (2013) and Olaoye and Oyewole (2012).

The carbohydrate content of the entire dried ground yam for different slice thickness ranged between 78.34% - 78.50%, 79.95% - 80.42 % and 80.30% - 83.45% for the samples blanched at 5 min, 7 min and 10 minutes, respectively. Samples blanched at 10 min with 4 mm thickness had the highest amount of carbohydrate 83.45% while when blanched at 5 min with 4 mm thickness had the least amount of carbohydrate 78.34 %. It was also observed that higher amount of carbohydrate content was retained in all the slice thicknesses blanched at 10 min. This result agrees with the findings of Leng *et al.* (2011) who reported that yams are rich in starch and blanching at high temperatures induce starch gelatinization.

Conclusions

From the results of this study, blanching time and slice thickness and the interactions have significant effect ($P \leq 0.05$) on the proximate analyses of dried ground yam. Increase in blanching time decreases the crude protein, fat and fibre of the dried ground yam. Majority of the yam samples have their highest value of proximate properties at the lowest level of 2 mm slice thickness and at 5 min blanching time. The low fat content of the yam sample may be beneficial to those people suffering from non-communicable diseases, such as, heart disease and stroke, diabetes, and so on. The data on the proximate properties may serve as useful baseline information for industrialization.

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