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CABINET DRYING EFFECTS ON PROXIMATE COMPOSITION OF TWO VERIATIES OF GINGER RYHIZOMS

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Abstract: Ginger (Zingiber officinale Roscoe) of two verities {UG I ('Tafin-Giwa', a yellowish variety with plump rhizomes) and UG II ('Yatsun-Biri', a black or dark variety with small compact rhizomes)} were analysed to identify its proximate composition. The effects of drying as a processing technique on ginger were investigated with respect to the proximate composition of the produce. The UG I and UG II were collected, sorted (whole, peeled and unpeeled) and (slice, peeled and unpeeled), and were subjected to Unblanched and Blanched (50°Cat 3,6 and 9minuts respectively) treatments and dried using cabinet dryer for a period of two weeks. The initial moisture content of UG I and UG II were 71.12% and 72.47% respectively, the final moisture content were reduced to 4.99% SP (Unblanched) and 5.02% WUP (Blanched at 3mins) for UG I, while that of UG II were 4.41% SP (Unblanched) and 5.63% WUP (Blanched at 3mins). For Carbohydrate content, 58.74%was the lowest level at Unblanched (Whole Unpeeled), and 67.57% indicates higher CHO content at Blanched 50°Cat 9mins (Split peeled) treatments for UG I samples. Similarly, for UG II, CHO's presence was low at 55.91%for Unblanched (Whole Unpeeled) and high at 75.70%for Blanched 50°Cat 9mins (Whole peeled) treatment. Ash content was observed to be low at 5.47%for Blanched 50°Cat 9mins (Split peeled) and high at 7.59%for Unblanched (Whole Unpeeled) treatment for UG I samples, and 3.86%low for Blanched 50°Cat 9mins (Split peeled) with higher ash content of 7.76%Unblanched (Whole Unpeeled) treatment for UG II samples. UG I and UG II samples determination for Crude fibre was observed at 4.64%for Blanched 50°Cat 9mins (Split peeled) and 7.53%at Unblanched (Whole Unpeeled) treatment, 3.72%Blanched 50°Cat 9mins (Split peeled) and 8.98%at Unblanched (Whole Unpeeled) treatment, respectively. Determination of Fat content, at UG I and UG II samples, it was observed that Fat content are less at 7.56%for Blanched 50°Cat 9mins (Split peeled) and at 3.21%for Blanched 50°Cat 9mins (Split peeled) treatments, respectively. Higher Fat content presences were observed at 9.56%for Unblanched (Whole Unpeeled) and 9.89%for Unblanched (Whole Unpeeled) treatments. Crude protein content shows that its presence was higher at 10.72%for Unblanched (Whole Unpeeled) UG I and 11.96%for Unblanched (Whole Unpeeled) treatment UG II. In comparison, it was less at 8.23%Blanched 50°Cat 9mins (Split peeled) UG I and 6.13%Blanched 50°Cat 9mins (Split peeled) treatment UG II. The Cabinet drying is effective in sufficient moisture removal and also for the enhancement of some nutritional composition of the produce (ginger ryhizoms).

Keywords: drying, ginger, proximate, composition, blanched, unblanched

INTRODUCTION

Ginger (Zingiber officinale Roscoe) is an herbaceous perennial crop, grown as an annual crop for its spicy underground rhizomes. The plant has fibrous roots that emerge from the branched rhizomes. Closely grouped, unbranched, pseudostems or overial shoots are produced from the rhizomes. The pseudostems reach a height of 50 - 120cm. The simple, lanceolate, and smooth leaves are alternate and about 25cm long. Ginger is asexually propagated from portions of the rhizome. The flowers of ginger are usually sterile and rarely set seed (Valenzuela, 2011). The shoot, leaf and the stem emit pleasant aroma. The anchorage roots are succulent and when squeezed exude appreciable fluid and emit aroma similar to the one from the other plants parts (Okwuowulu and Ene, 1988; Onu and Simonyan, 2015).Over 25 varieties of ginger are grown worldwide. Varieties differ in the size of the rhizome, flower, aroma, pungency, colour and fiber content (Valenzuela, 2011). Nigerian ginger is darker in colour, minute in size and has more pungent taste when compared to others. Cochin ginger is usually larger, well scraped, contains more starch and breaks with a shorter fracture. African ginger is darker in colour, more pungent in taste and has less flavor than Jamaica ginger (Ghosh, 2011). Two main varieties are grown in Nigeria. Umudike ginger I (UG I) known as the "black yellow ginger" and Umudike ginger II (UG II) known as the "black" ginger. The stem cluster of the yellow ginger is fat and robust, resembling the elephant's foot hence the name "Taffin-giwa". Similarly, the black ginger because of its shriveled and slander nature typical of the monkey's finger, it is called "Yatsun biri" (Okwuowulu and Ene, 1988; Onu and Simonyan, 2015).

NUTRIENT/METABOLIC CONSTITUENTS OF GINGER RHIZOME

Fresh ginger contains 80.9% moisture, 2.3% protein, 0.9% fat, 1.2% minerals, 2.4% fibre and 12.3% carbohydrates *(Hoffman, 2007)*. The minerals present in ginger are iron, calcium and phosphorous. It also contains vitamins such as thiamine, riboflavin, niacin and vitamin C. The composition varies with the type, variety, agronomic conditions, curing methods, drying and storage conditions *(Hoffman, 2007)*. The branching fleshy rhizome composed of 40-60% starch, 10-40% yellow colour volatile oil responsible for its flavour and the remaining percentage for protein, mineral matter and

fiber content (*Simonyan et al., 2003)*. Table 1 comprises of the nutrient/metabolic content of freshly harvested black and yellow ginger rhizome.

Table 1: Nutrient/Metabolic Constituents of Freshly Harvested Ginger Rhizome

S/N	Nutrient/Metabolite	Yellow (Tafin Giwa)	Black (Yatsun biri)
1	Moisture (g/100g)	78.00	80.90
2	Starch (g/100g dry weight)	55.8	57.19
3	Total reducing sugars (g/100g dry weight)	4.80	3.68
4	Crude protein (g/100g dry weight)	17.15	10.15
5	True protein (g/100g dry weight)	3.18	1.84
6	Total free amino acids (g/100g dry weight)	5.27	4.38
7	Crude fiber (g/100g dry weight)	3.24	4.77
8	Total lipids (g/100g dry weight)	2.74	3.61
9	Total ash (g/100g dry weight)	7.75	7.35
10	Acid –insoluble ash (g/100g dry weight)	2.00	2.00
11	Total carotenoids (mg-carotene/100g dry weight)	6.64	5.41
12	Ascorbic acid (g/100g dry weight)	1.23	1.30
13	Ginger oleoresin (g/100g dry weight)	5.61	6.26

Source: Njoku et al. (1995)

The main objective of this research is to determine the effect of Cabinet drying on proximate composition of two verities of ginger rhizomes (UG I and UG II), for Blanched and Unblanched treatment. Proximate analysis is referred to as the partitioning of compounds in a feed into six categories based on the chemical properties of the compounds.

The six categories are moisture, ash, crude protein, crude lipid, crude fibre and nitrogen-free extracts (digestible carbohydrates).

MATERAILS AND METHOD

— Research Materials

A costarred bowl (4 kg) of two ginger varieties, namely Umudike Ginger I and Umudike Ginger II (UG I and UG II), were purchased, respectively from the National Root Crop Research Institute, (NRCRI) Umudike, Abia State, Nigeria. 4 Kilogram of UG I and UG II was cleaned and separated into groups. One of the groups was peeled and splitted with a sharp stainless steel knife. The UG I and UG II split and whole, (peeled and unpeeled) was blanched with the aid of Electric water bath in the Soil and Water Laboratory, Department of Agricultural and Bioresources Engineering, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Ginger rhizomes were blanched at (3, 6and 9minute), for **50℃,** 0**℃** respectively. Each group with various treatments were subjected to Cabinet drying in sequence. The unblanched UG I and UG II split and whole, (peeled and unpeeled) was also subjected to Cabinet drying for about a period of two weeks, before taken to the laboratory for proximate analysis. All treatments were done at 10mm thickness of UG I and UG II rhizome.

— Chemical analysis

The dried UG I and UG II Samples were subjected to proximate analysis. The proximate composition of the samples UG I and UG II with various treatments, in respect to moisture, protein, fat, ash, fibre and carbohydrate percentage, were determined following the standard methods of association of official analytical chemists (AOAC, 2002).

The UG I and UG II dried samples, were ground into fine powder, using a milling machine. The powdered samples were sieved through mesh 300 μm sieve and stored in air-tight cellophane bag as stock sample in a refrigerator, until required for analysis (Nwinuka et al 2005). Thermal drying method was used in the determination of moisture content of the samples (Nwinuka et al 2005: Ugwoke and Nzekwe 2010).

— Moisture content determination

Moisture was determined by the loss in weight of samples dried with solar and cabinet dryers respectively. The percentage moisture content was calculated by computing the loss in weight on drying as a fraction of the initial weight of sample used and multiplied by 100.

$$\text{Mc}\ (\%) = \frac{\text{Wo}}{\text{Wi}} \times 100$$

where:
Wo = loss in weight (g) on drying
Wi = initial weight of sample (g)

— Crude fat content determination

Crude fat content determination of the sample was done using soxhlet type of the direct solvent extraction method. Crude fat represents total fat in most samples. At the extraction end, the solvent was evaporated and the flask dried in the oven (at 60**℃**). The flask was then cooled and reweighed. The percentage Crude fat (lipid) was calculated using the formula:

$$\text{CL}\ (\%) = \frac{\text{Mex}}{\text{Mg}} \times 100$$

where:
Mex = mass of extract (g)
Ms = mass of sample used (g)

— The Ash content determination

The Ash content was determined using the ignition method by burning the sample in a muffle furnace at 600**℃**for 2 hrs. The percentage ash content was calculated using the formula:

$$\text{Ash}\ (\%) = \frac{\text{Ma}}{\text{Ms}} \times 100$$

where:
Ma = mass of ash (g)
Ms = mass of sample used (g)

— Determination of Crude protein

Determination of Crude protein was done by determining the total organic nitrogen, using the Macro-Kjeldhal method. This involved digestion, distillation and titration. The technique determined the amino nitrogen of the sample, after which the total organic nitrogen was then calculated using the formula:

$$\%\ \text{TON} = \frac{\text{TV} \times \text{NE} \times \text{TVd}}{\text{Ms} \times \text{Vd}} \times 100$$

where:

Tv = Titre value,
NE = mg nitrogen equivalent to molarity of acid,
TVd = total volume to which digest was diluted,
Ms = mass of sample (g)
Vd = volume of digest distilled.

— Determination of Carbohydrate content

Determination of Carbohydrate content of the sample was estimated by 'differences' (Ugwoke and Nzekwe 2010). In this, the sum of the percentages of all the other proximate components was subtracted from 100.

Total CHO (%) = 100 – (**% moisture + % crude protein + % crude fat + % ash**+ % crude fat + % ashotein+ % crude fat+ % ash

RESULTS AND DISCUSSION

— Results

The results obtained in the study and results of the proximate analysis are presented in Table 2.It shows the variation range of values for Cabinet dried samples of UG I and UG II proximate analysis results for blanched and unblanched treatments respectively.

Table 2: Proximate (nutrients) contents of UG I and UG II varieties of ginger rhizome, with various treatments for Cabinet dried samples

	UG I				UG II			
	WP	WUP	SP	SUP	WP	WUP	SP	SUP
UNBLANCHED								
%MC	5.42	5.86	4.99	5.53	5.20	5.54	4.41	4.53
% CP	9.98	10.72	9.82	10.44	8.63	11.94	3.22	11.76
%FAT	8.81	9.54	8.63	9.19	8.78	9.89	8.53	9.63
% CF	6.48	7.53	6.38	7.32	7.15	8.96	7.16	8.89
%ASH	6.64	7.59	6.54	7.42	6.29	7.76	6.38	7.73
%CHO	62.67	58.74	63.64	60.22	63.95	55.91	65.40	57.46
BLANCHED @ 3 MINS								
% MC	5.24	5.02	5.86	5.18	5.94	5.63	6.82	6.71
% CP	8.96	9.38	8.82	8.94	6.87	7.32	6.78	7.21
% FAT	8.34	8.47	8.14	8.35	3.62	3.31	3.53	3.74
% CF	5.27	5.46	5.10	5.36	4.27	4.56	4.17	4.48
%ASH	5.09	6.13	5.77	5.92	4.33	4.60	4.27	4.52
%CHO	66.29	65.54	66.31	66.25	74.97	74.08	74.43	73.34
BLANCHED @ 6 MINS								
% MC	5.77	5.58	6.21	5.66	6.24	5.99	7.21	7.18
% CP	8.74	9.18	8.64	8.75	6.28	7.15	6.42	6.93
% FAT	8.22	8.35	7.97	8.25	3.56	3.68	3.45	3.61
% CF	5.11	5.25	4.88	5.19	4.10	4.37	3.98	4.25
%ASH	5.80	6.02	5.61	5.84	4.17	4.46	4.00	4.33
%CHO	66.36	65.62	66.69	66.31	75.25	74.35	74.94	73.70
BLANCHED @ 9 MINS								
% MC	6.26	6.00	6.48	6.27	6.65	6.49	7.78	7.52
% CP	8.35	8.74	8.26	8.37	6.32	6.86	6.15	6.69
% FAT	7.84	7.97	7.56	7.80	3.39	3.42	3.21	3.33
% CF	4.94	5.03	4.66	4.92	3.90	4.14	3.74	4.02
%ASH	5.62	5.84	5.47	5.63	4.06	4.29	3.86	4.10
%CHO	66.99	66.42	67.57	67.01	75.68	74.80	75.26	74.24

WP – Whole peeled; MC – Moisture content; WUP – Whole unpeeled;
CP – Crude protein; SP – Split peeled; CF – Crude fibre;
SUP – Split unpeeled; CHO – Carbohydrate

— Discussions

The proximate analysis experiment for both UG I and UG II, with various treatments, indicates higher values in percentage for unblanched UG, I, and UG II, the table's result shows increased moisture content, ash content, crude fiber, crude protein, fat, and carbohydrate. While the results for the blanched treatments of UG I and UG II show a reduction in percentage moisture content, ash content, crude fiber, crude protein, fat, and carbohydrate.

The initial moisture content of UG I and UG II were 71.12% and 72.47% respectively, the final moisture content were reduced to 4.99% SP (Unblanched) and 5.02% WUP (Blanched at 3mins) for UG I, while that of UG II were 4.41% SP (Unblanched) and 5.63% WUP (Blanched at 3mins).

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This study's findings agreed with earlier reports on ginger's proximate composition (Nwinuka et al. 2005) and that of phytochemistry and proximate composition of ginger (Ugwoke and Nzekwe 2010).

CONCLUSION AND RECOMMENDATION

The results obtained in this research, can be concluded that the proximate composition for both UG I and UG II, indicates higher values in percentage for the unblanched treatment, which shows increased moisture content, ash content, crude fiber, crude protein, fat, and carbohydrate. While that of blanched treatments, shows a reduction in percentage moisture content, ash content, crude fiber, crude protein, fat, and carbohydrate. The cabinet drying is effective in sufficient

moisture removal and also for the enhancement of some nutritional composition of the produce (ginger ryhizoms).
There is an increase in market demand for good quality dried ginger, hence this study shows that cabinet drying method is suitable for a better end product, which will meet the market demand taking note of the high nutritional components as part of the quality source by customers. Therefore, blanching and cabinet drying at two weeks interval is recommended for post-harvest storage and for ginger powder production because cabinet drying effect enhances its proximate composition.

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ISSN: 2067-3809