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Investigation on the effect of Germination on the Proximate Composition of African Yam Bean (*Sphenostylis stenocarpa* Hochst ex A Rich) and Fluted Pumpkin (*Telferia occidentalis*)

ONWUKA, C. FRANK; IKEWUCHI, C. CATHERINE; IKEWUCHI, C. JUDE;* AYALOGU, O. EDWARD

Department of Biochemistry, Faculty of Science, University of Port Harcourt, P.M.B. 5323, Port Harcourt, Nigeria. (e-mail: ecoli240733@yahoo.com, Tel: +2348033715662)

ABSTRACT: The effect of germination on the proximate composition of African yam bean (*Sphenostylis stenocarpa*) and fluted pumpkin (*Telferia occidentalis*) was investigated. The moisture and total lipid content of the ungerminated African yam bean seeds is significantly lower ($p<0.05$) than that of the germinated seeds, while their crude protein, total carbohydrate, ash and total metabolizable energy content was higher. The ungerminated fluted pumpkin seeds had significantly lower ($p<0.05$) moisture, crude protein, ash and total lipid content, higher total carbohydrate and a comparable metabolizable energy content. The proximate compositions of seeds of both plants were variably affected by germination. @ JASEM

Southern Nigeria is rich in nutritious food plants. Amongst them is the African yam bean (*Sphenostylis stenocarpa*) and fluted pumpkin (*Telferia occidentalis*). African yam bean which belongs to the family Papilionaceae, is grown mainly in the Southern parts of Nigeria for its edible seeds, although its tubers are also edible. It is called "Okpodudu, Ijiriji, Azama" by the Ibo people of South Eastern. The seeds can be roasted and eaten with palm kernel as snacks, or boiled and eaten with local seasoning, starchy, roots, tubers and fruit, or even converted to paste for the production of a local type of "moi moi' (Ezueh, 1984; Elegbede, 1998). It has medicinal value (Okeke *et al*., 2008). Fluted pumpkin (family Cucurbitaceae) is a perennial vine whose stem can grow as long as 10m. Its leaves are an important food vegetable for the people in Southern parts of Nigeria (Elegbede, 1998; Oguntona, 1998). It is called "ugu" (Igbo) and "Iroko" (Yoruba). The seeds, called "Mkpuru ugu" by the Ibo people of South Eastern Nigeria, are boiled and eaten as snack, and can be used as a soup thickener (Okeke *et al*., 2008). Oftentimes, the quality of foodstuffs may be improved by processing. This may involve roasting, boiling, autoclaving and even sprouting or germination. Several studies have shown that germination improves the nutritive value of cereals and legumes. Germination has also been found to decrease the levels of antinutrients present in cereals and maximizes the levels of some of the utilizable nutrients (Mohamed *et al.*, 2007; Inyang and Zakari, 2008). In the present study, we investigated the effect of germination on the proximate composition of the seeds of African yam bean (*Sphenostylis stenocarpa*) and fluted pumpkin (*Telferia occidentalis*).

MATERIALS AND METHODS

Fresh samples of African yam bean seeds were purchased from markets in Umuahia, Abia State, Nigeria, while fresh samples of fluted pumpkin seeds were purchased from markets in Port Harcourt, Rivers State, Nigeria. After due identification, they were rid of dirt and stored for subsequent use.

The moisture, crude protein, fat, ash and total carbohydrate contents of the samples were determined in triplicates according to standard methods (AOAC, 1980). The energy value was calculated using the Atwater factors of 4, 9 and 4 for protein, fat and carbohydrate respectively (Chaney, 2006).

RESULTS AND DISCUSSION

The effect of germination on the proximate composition of African yam bean seeds is given in Table 1. The moisture and total lipid content of the ungerminated seeds is significantly lower ($p<0.05$) than that of the germinated seeds, while their crude protein, total carbohydrate, ash and total metabolizable energy content was higher. The observed decrease in the fat contents of the germinated seeds might be due to the increased activities of the lipolytic enzymes during germination. They hydrolyze fats to simpler products which can be used as a source of energy for the developing embryo. Similar observation was made for bambara groundnuts (Elegbede, 1998) and malted millet (Inyang and Zakari, 2008). This decreased fat content implies an increased shelf-life for the germinated seeds compared to the ungerminated ones. The observed decrease in crude protein content of the germinated seeds negates an earlier report by Lasekan (1996), while the decrease in the total carbohydrate content corroborated the observation of a decrease in carbohydrate content after germination,

* Corresponding author: Ikewuchi, C. Jude

by Inyang and Zakari (2008) and Yagoub *et al*. (2008). The decreased carbohydrate levels of the germinated seeds might be due to increase in α-amylase activity (Lasekan, 1996). α-Amylase breaks down complex carbohydrates to simpler and more absorbable sugars which are utilized by the growing seedlings during the early stages of germination.

Table 1: Effect of germination on the proximate composition of African yam bean (*Sphenostylis stenocarpa*)

Parameter	Composition							
	Ungerminated				Germinated			
	/100g Wet weight		/100g Dry weight		/100g Wet weight		/100g Dry weight	
	Amount	%DV	Amount	%DV	Amount	%DV	Amount	%DV
Moisture (g)	16.73±0.02[a]		-		30.36±0.02[b]		-	
Crude Protein (g)	18.94±0.01[a]	37.93±0.02	22.75±0.01*	45.56±0.02	16.14±0.01[b]	32.32±0.02	23.18±0.01**	46.42±0.02
Total Carbohydrate (g)	51.84±0.11[a]	17.50±0.04	62.26±0.13*	21.02±0.04	41.90±0.01[b]	14.15±0.00	60.16±0.01**	20.31±0.00
Ash (g)	4.92±0.04[a]	-	5.91±0.05*	-	3.97±0.03[b]	-	5.70±0.05**	-
Total Lipid (g)	7.56±0.03[a]	11.72±0.05	9.08±0.04*	14.07±0.06	7.63±0.02[b]	11.83±0.03	10.96±0.03**	16.99±0.05
Total metabolizable energy (kcal)	351.20±0.77[a]	17.37±0.04	421.18±0.92*	20.83±0.05	300.84±0.24[b]	14.88±0.01	432.00±0.35**	21.36±0.02

Values are means ± S.D. of three determinations. Percent Daily Values (%DV) are for adults or children aged 4 or older, and are based on a 2,000 calorie reference diet. The daily values may be higher or lower based on individual needs (NutritionData, 2008). Value having the same superscript on the same row are significantly different, $p<0.05$. Note: a, b compares wet weight while *, ** compares dry weight.

Table 2: Effect of germination on the proximate composition of fluted pumpkin (*Telferia occidentalis*)

Parameter	Composition							
	Ungerminated				Germinated			
	/100g Wet weight		/100g Dry weight		/100g Wet weight		/100g Dry weight	
	Amount	%DV	Amount	%DV	Amount	%DV	Amount	%DV
Moisture (g)	19.98±0.01[a]	-	-	-	26.79±0.18[b]	-	-	-
Crude Protein (g)	24.33±0.06[a]	48.72±0.12	30.40±0.07*	60.88±0.14	29.72±0.04[b]	59.52±0.08	40.60±0.05**	81.30±0.10
Total Carbohydrate (g)	26.44±0.01[a]	8.93±0.00	33.04±0.01*	11.15±0.00	6.81±0.07[b]	2.30±0.02	9.30±0.09**	3.14±0.03
Ash (g)	4.45±0.01[a]	-	5.56±0.01*	-	5.49±0.06[b]	-	7.50±0.08**	-
Total Lipid (g)	24.81±0.06[a]	38.46±0.09	31.00±0.08*	48.05±0.12	31.19±0.06[b]	48.34±0.09	42.60±0.08**	66.03±0.12
Total metabolizable energy (kcal)	426.37±0.83[a]	21.09±0.04	532.83±1.04*	26.35±0.05	426.81±0.64[a]	21.11±0.03	583.00±0.88**	28.83±0.04

Values are means ± S.D. of three determinations. Percent Daily Values (%DV) are for adults or children aged 4 or older, and are based on a 2,000 calorie reference diet. The daily values may be higher or lower based on individual needs (NutritionData, 2008). Value having the same superscript on the same row are significantly different, $p<0.05$. Note: a, b compares wet weight while *, ** compares dry weight.

Table 2 shows the effect of germination on the proximate composition of fluted pumpkin seed. The ungerminated seeds had significantly lower ($p<0.05$) moisture, crude protein, ash and total lipid content, higher total carbohydrate and a comparable metabolizable energy content. Our result corroborates earlier reports of increased protein content during germination of various cereals, legumes and other seeds (Inyang and Zakari, 2008; Yagoub *et al*., 2008). This increase could be attributed to a net synthesis of enzymic protein (e.g. proteases) by germinating seeds (Nzeribe and Nwasike, 1995). Other researchers have attributed the increase to the degradation of stored protein and synthesis of new protein and other materials while stated that the increase in protein on germination of corn seed was due to mobilization of storage nitrogen producing the nutritionally high quality proteins which the young plant needs for its development. In this study, germination increased the lipid contents of the fluted pumpkin seeds. This negates earlier reports of increases in lipid content by germination in bambara groundnuts (Elegbede, 1998) and malted millet (Inyang and Zakari, 2008). The observed decrease in total carbohydrate content after germination of the fluted pumpkin seeds corroborated earlier reports (Lasekan, 1996; Inyang and Zakari, 2008; Yagoub *et al*. 2008).

Finally, germination did affect the proximate composition of the seeds of the two plants, but though, differently.

* Corresponding author: Ikewuchi, C. Jude

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* Corresponding author: Ikewuchi, C. Jude