PROXIMATE COMPOSITION OF SOME NEW SWEET POTATO VARIETES GROWN AT GIDAN KWANO, MINNA, NIGER STATE, NIGERIA

Gana1 *, D;. Daniya, E1.; Saidu1 , A.; Tsado1 E.K; Waziri2 A.; Adesina, O.A, Maxwell3, Y. M. O A; and Sokwo, G1 1Department of Crop Production, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger State. 2Department of Crop Production, Ibrahim Badamasi Babangida University, Lapai, Niger State. 3Department of Food Science, Federal University of Technology Minna, Niger State, Nigeria. Corresponding Author E- mail: davslm@yahoo.com Abstract This study investigated the, proximate composition of some new sweet potato varieties grown in Gidan Kwano, Minna, Niger State, Nigeria. Sweet potato is an important security crop in Nigeria because it is less expensive to grow. They are cultivated via their vines. Little studies have really being carried out to identify the chemical composition of these sweet potato varieties - Solo-gold, Mother's delight, purple fleshed sweet potato and a local white fleshed potato. four varieties of sweet potatoes (White fleshed sweet potato (WFSP), Orange fleshed Sweet Potato (OFSP1), Purple fleshed sweet potato (PFSP), and Orange fleshed sweet potato (OFSP2)) were taken as the treatments. The treatments were arranged in a randomized complete block design and replicated three times in the field. The result showed that proximate composition of the fresh and dry samples of the four selected sweet potato varieties was significantly different among the varieties for all the parameters. The study showed that all the tested sweet potato varieties had different levels of proximate and phytochemical contents. However, high contents of moisture, ash, crude fibre, dry matter, beta carotene, phenols and anthocyanin were found in the Purple Fleshed Sweet Potato variety. This variety is therefore recommended for farmers at Gidan Kwano.

Keywords: Sweet potato, Varieties, proximate composition; Total polyphenol content; Total carotenoids content

INTRODUCTION Sweet potatoes are an important food crop of the tropical and subtropical areas and have nutritional advantage for the rural and urban dwellers of these regions as seen by the increase in its production and consumption (Low et. al., 2020; Ettah et. al., (2022). Sweet potato is cultivated mainly because of its tuberous roots that are sweet and tasty. It has a long and tapered structure and its smooth internal colour can be varied from deep orange, yellow, purple, violet, beige and white, depending on its varieties (Mu and Singh, 2019). Sweet potato varieties may vary in terms of their nutritional compositions such as carbohydrates, lipids, proteins, vitamins, dietary fibres, and other bioactive compounds including anthocyanin and beta-carotene.

Phytochemicals can be found in both the leaves and roots of sweet potato plants containing antioxidants, anti-inflammatory, anti mutagenic, antimicrobial and anti carcinogenics which all promotes health functions in humans (Ginting, and Yulifianti, 2015; Buzo, et., al., 2016 and Wang, et., al., 2016). The

phytochemical composition varies according to the different flesh colour of sweet potato. There is little information available on the chemical composition of sweet potato varieties. such as - Mother's delight, Solo-Gold, Purple Fleshed Sweet Potato - PFSP and local White Fleshed Sweet Potato WFSP widely grown in Nigeria. Sweet potato varieties and to identifying the proximate composition, (mineral composition and photochemical analysis) of Solo gold, Mother's delight, purple fleshed sweet potato - PFSP and a local white fleshed sweet potato varieties especially in the study area. The objective of this study was to compare the selected nutritional content/composition of four varieties of sweet potatoes cultivated in Minna, Nigeria. These are Mother's delight, Solo gold, Purple fleshed sweet potato - PFSP and a local white variety found in Minna, Niger state, Nigeria. MATERIALS AND METHODS Experimental Site The experiment was carried out under rain fed conditions from July – October in 2021 at the Horticultural farm, Federal University of Technology Gidan Kwano, Minna, Niger state, Nigeria. Source of Planting Material The vines of the sweet potato varieties were sourced from the Naeson Ventures of the Federal University of Agriculture, Makurdi and local farmers for their local sweet potato. The sweet potato varieties used in this study were Solo gold; Orange fleshed sweet potato (OFSP1) Mother delight; (OFSP2) Purple fleshed sweet fleshed sweet potato (PFSP) - and the White fleshed sweet potato (WFSP) – local variety, as the control. Treatment and Experimental Design Four varieties of sweet potatoes (White fleshed sweet potato (WFSP), Orange fleshed Sweet Potato (OFSP1), Purple fleshed sweet potato (PFSP), and Orange fleshed sweet potato (OFSP2)) were taken as treatments. The treatments were arranged in a randomized complete block design and replicated three times in the field. The plot size used was 4m × 3m (12-m2). Proximate Analysis

The moisture content, ash content, crude fibre and dry matter of the sweet potatoes' varieties were determined as described by the Association of Official Analytical Chemists (A.O.A.C., 2010). Determination of Moisture Content Moisture was determined by oven drying method. Two grams of each of the samples was taken into crucible was accurately weighed in clean, dried crucibles (W1). The crucibles were allowed into an oven at 100-1050C for 6-12 h until a constant weight was obtained. Then the crucibles were then placed in the desiccators for 30 min to cool. After cooling, they were then weighed again (W2). Per cent moisture content was determined using the formular below:

$\%\ Moisture\ content$

$W1{-}wW2\ Weight\ of\ sample$

x 100

Where W = Initial weight of crucible + Sample 1 W = Final weight of crucible + Sample 2 Determination of Ash Content For the determination of ash, clean empty crucibles were then placed in a muffle furnace at 5500C for an hour, cooled in desiccators and then weight of empty crucible was noted (W1). Two grams of each of sample was taken into crucibles (W2) and was purchased over a burner, until it was charred. Then the crucible was placed in muffle furnace for ashing at 5500C for 2-4 h. the appearance for grey white-ash indicates complete oxidation of all organic matter in the sample. After ashing the crucibles were then cooled and weighed (W3). The per cent ash was calculated by adopting the formular below: % Ash = Difference in Weight of Ash x 100 equation Weight of Sample

Difference in weight of ash = W3 – W1 Determination of Crude Fibre Two grams (2g) of samples were defatted with per ether; boiled under reflux for 30min with 200ml a solution containing 1.25g of H_2SO_4 per 100ml of solution (Edeoga et al., 2005). The solution was filtered through linen or several layers of cheese cloth on fluted funnel, washed with boiling water until the washings are no longer acidic then the residue was transferred into a beaker and boiled for 30 min with 200 ml of solution containing 1.25 g of carbonate free NaOH per 100 ml, the final residue was filtered through a thin but close pad of washed and ignited asbestos in a Gooch crucible, then dried in an electric oven and weighed after which it was incinerated, cooled

and reweighed. The loss in weight after incineration x 100 is the percentage crude fibre. Determination of Dry Matter 100 grams of the representative sample was weighed and placed in an oven that was set at 250F. This was allowed to stay in the oven at the set temperature for 30 minutes. The weight of the dry sample was recorded and from this, the dry matter (DM) content was calculated by using the equation shown below as described by Association of Official Analytical Chemists (AOAC, 2010). % Dry Matter (DM) = Final Dry Weight (grams) Initial Wet Weight (grams) X 100 Phytochemical Analysis Total Phenol Three grams of the samples were defatted with 100ml of diethyl other using a Soxhlet apparatus for 2hr. the fat free sample was boiled with 50ml of petroleum ether for the extraction of the phenolic component for 15min (Edeoga et al., 2005). Five (5 ml) of the extract was pipetted into a 50 ml flask, then 10 ml of distilled water was added. Also, 2 ml of ammonium hydroxide solution and 5ml of concentrated amyl alcohol were also added. The samples were made up to mark and left to react for 30min for colour development. This was measured at 505nm. Tannic acid was used to establish the calibration curve. Anthocyanin Anthocyanin was determined according to Killet (1994) Method. 0.2g of potato samples were homogenized with 3 ml 1 HCL-methanol (99:1), the extract were centrifuged at 18000 g for 30 min at 4℃, the supernatant were left overnight in dark place at 5℃. Anthocyanin content were measured at 550 nm using spectrophotometer. Beta-carotene The Beta-carotene determination was carried out using the method of the Association of Official Analytical Chemists (AOAC, 2010). A conical flask containing 50 ml of 95% ethanol, 10 g of the macerated sample was placed and maintained at a temperature of 70-80oC in a water bath for 20 minutes with periodic shaking. The supernatant was decanted, allowed to cool and its volume was measured by means of a measuring cylinder and recorded as initial volume. The ethanol concentration of the mixture was brought to 85% by adding 15 ml of distilled water and it was further cooled in a container of ice water for about 5 minutes. The mixture was transferred in to a separating funnel and 25 ml of petroleum ether (pet-ether) was added and the cooled ethanol was poured over it. The funnel was swirled gently to obtain a homogenous mixture and it was later

allowed to stand until two separate layers were obtained. The bottom layer was run off into a beaker while the top layer was collected in to a 250 ml conical flask. The bottom layer was transferred in to the funnel and re-extracted with 10ml pet-ether for 5-6 times until the extract became fairly yellow. The entire pet-ether was collected in to 250 ml conical flask and transferred in to separating funnel for re-extraction with 50ml of 80% ethanol. The final extract was measured and poured into sample bottles for further analysis. The absorbance of the extracts was measured using a spectrophotometer at a wavelength of 436 nm. The concentration of β-carotene was calculated using Bear-Lamberts Law, which states that the absorbance (A) is proportional to the concentration (C) of the pigment, as represented by the equation:

A ∝L (if concentration (C) is constant). A=ECL; C=A/EL Where: C= concentration of carotene A= absorbance E=extinction coefficient L= thickness of cuvettes (path length) =1cm E of β-carotene =1.25x104 µg/l Data Analysis The data collected were subjected to analysis of variance (ANOVA) using statistical analysis system (SAS) 2013 package version 9.0. Treatment means were compared using the least significant difference (LSD) at P≤ 0.05.

Results Proximate composition The proximate composition of the fresh and dry samples of the four selected sweet potato varieties was significantly different among the varieties (Table 1). Moisture content was significantly different among the potato varieties in both samples. The Purple Fleshed Sweet Potato produced the highest moisture content (68.40 % and 48.26 %) in the fresh and dry samples respectively compared to the White Fleshed Sweet Potato which had the least moisture content (54.67 % and 37.52 %) for the fresh and dry samples, respectively. In terms of the ash content of the fresh and dry samples of the sweet potato varieties the Purple Fleshed Sweet Potato variety also produced significantly higher ash content (2.03) than the other sweet potato varieties. The White Fleshed Sweet Potato variety had the lowest ash content (0.18 what unit for the fresh samples and 0.28 what unit for the dry samples).

The crude fibre content of the fresh and dry samples of sweet potato varieties showed that Purple Fleshed Sweet Potato had the highest values of 1.06 and 1.04, respectively, which was in turn similar with the fresh Yellow Fleshed Sweet Potato. Irrespective of the treatments/samples, the White Fleshed Sweet Potato consistently had the lowest crude fibre content.

Regarding the dry matter content, the Purple Fleshed Sweet Potato produced significantly heavier dry matter (48.52 for the fresh sample and 41.53 for the dry sample) compared to the other sweet potato varieties. Inversely, the Orange Fleshed Sweet Potato consistently produced the least dry matter by in both fresh and dry samples, respectively.

Phytochemical composition

The beta carotene, phenol and anthocyanin contents of fresh and dry samples of four sweet potato varieties is shown in Table 2. The fresh and dry samples of Purple and Yellow Flesh Sweet Potato varieties produced significantly higher Beta carotene contents by 4.49 and 4.50 than the other sweet potato varieties. In contrast, the White Fleshed Sweet Potato (fresh sample) and Orange Flesh Sweet Potato (dry sample) produced the lowest Beta carotene content by 1.03 and 2.34, respectively in this study.

Furthermore, the phenol content of the fresh and dry Purple Fleshed Sweet Potato was significantly higher by 53.54 and 55.40, compared with the other varieties. The fresh White Fleshed Sweet Potato and dry Yellow Fleshed Sweet Potato produced the lowest phenol contents by 26.60 and 23.19, respectively.

The anthocyanin content of some fresh and dry sweet potato varieties differed significantly in this study. Irrespective of the sweet potato sample, the Purple Flesh Sweet Potato variety produced significantly higher anthocyanin content by 131.56 and 133.04 than all the other sweet potato varieties. The White Fleshed Sweet Potato variety consistently produced the lowest anthocyanin content in both fresh and dry conditions by 94.23 and 94.01, respectively.

Table 1: Proximate analysis of fresh and dry Sweet potato varieties for moisture, ash, crude fibre and dry matter contents Moisture content Ash Content Crude fibre Content Dry matter Content Potato variety Fresh Dry Fresh Dry Fresh Dry Fresh Dry Control - WFSP 54.67c 37.52d 0.18d 0.28d 0.44c 0.33d 30.78c 25.25c Orange - OFSP1 55.01c 42.30c 0.47c 0.84c 0.74b 0.53c 28.29d 23.13d Purple - PFSP 68.40a 48.26a 1.42a 2.03a 1.06a 2.03a 48.52a 41.53a Orange - OFSP2 62.59b 46.74b 0.82b 0.92b 1.04a 0.92b 33.56b 30.02b LSD (0.05) 0.77 0.17 0.22 0.03 0.07 0.11 0.39 0.22 Means with the same letter(s) under the same column are not significantly different from each other at P≤ 0.05 by LSD.

Table2: Proximate analysis of Beta carotene, phenols and anthocyanin contents of Some fresh and dry potato varieties Beta carotene Content Phenols Content Anthocyanin Content Potato variety Fresh Dry Fresh Dry Fresh Dry Control - WFSP 1.03c 2.71c 26.60d 32.63c 94.23d 94.01d Orange - OFSP1 1.55b 2.34d 26.03c 39.07b 117.54c 111.61c Purple - PFSP 4.49a 4.80b 53.54a 55.40a 131.56a 133.04a Orange – OFSP2 4.50a 5.02a 37.34b 23.19d 123.20b 120.48b LSD (0.05) 0.05 0.02 0.07 0.03 1.75 0.02 Means with the same letter(s) under the same column are not significantly different from each other at P≤ 0.05 by LSD. Discussion Generally, there was variation in proximate and phytochemical composition in sweet potato varieties evaluated in this study. This might be attributed to the genetic diversity that exist within the sweet potato genotypes. The high content of moisture, ash, crude fibre, dry matter, beta carotene, phenol and anthocyanin in the Purple Fleshed Sweet Potato is an indication of its superior genetic characteristics in production of proximate and phytochemical constituents of sweet potato. Although, the moisture content in this variety was high, this suggests the poor storability quality associated with this variety. Furthermore, in our study, the Yellow Fleshed Sweet Potato produced high content of crude fibre, and beta carotene which might be an expression of its genetic inheritance in the production of this components.

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CONCLUSION

It can be concluded from this study that all the tested sweet potato varieties had different levels of proximate and phytochemical contents. High contents of moisture, ash, crude fibre, dry matter, beta carotene, phenols and anthocyanin were found in the Purple Fleshed Sweet Potato variety. For the production of healthy food, the Purple Fleshed Sweet Potato variety is hereby recommended.

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