VARIETAL DIFFERENCES IN SOME NUTRITIONAL COMPOSITION OF TEN MAIZE (Zea mays L.) VARIETIES GROWN IN NIGERIA

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ABSTRACT

Grains of ten maize varieties grown in Eastern part of Nigeria were collected from national seed company of Nigeria and investigated for their nutritive value to assess their dietary value for humans. Proximate composition shows moisture content in the range of (9.85 ± 0.01^{f} - 11.35 ± 0.01^{a}), ether extract (3.17 ± 0.01 - 4.09 ± 0.01^{a}), protein (10.72 ± 0.04^{i} - 12.33 ± 0.03^{a}), crude fiber (1.84 ± 0.01^{e} -2.06 ± 0.02^{a}) and carbohydrates (68.73 ± 0.05^{e} -72.17 ± 0.01^{a}), starch (59.72 ± 0.08^{h}-71.14 ± 0.05^{a}), sugar (7.53 ± 0.01^{f}-8.78 ± 0.02^{a}). The data indicate that seeds of these varieties vary greatly in term of protein, fats and crude fiber contents as well as in carbohydrate, sugar and starch contents. ART/98/SW1-1 and SDM-2 varieties were determined to contain higher protein content (>12 protein) while SUWAN-1-SR-Y and SDM-2 contain high fats content of (>4%). TZPB-SR-W and BR9943-DMR-SR-W contain higher starch content. In minerals the level of sodium is (61.77 ± 0.03^{g}-180.68 ± 0.24^{a} ppm), K (315.71 ± 0.09^{i}-342.78 ± 0.02^{a} ppm), Ca (163.77 ± 0.03^{i}-180.68 ± 0.24^{a} ppm), Fe (2.79 ± 0.01^{e}- 3.46 ± 0.02^{a} ppm).
Keywords: maize varieties, nutritional composition, minerals, grains, sugar.

INTRODUCTION

Maize (*Zea mays* L., $2n = 2x = 20$) belonging to family Poaceae is one of the most important crops in the word and preferred staple food for more than 1 billion people in sub Saharan Africa and Latin America (Gupta *et al*., 2009). Maize is a multipurpose crop, providing food and fuel for human beings, feed for animals, poultry and livestock. Its grains have great nutritional value and are used as raw material for manufacturing many industrial products (Afzal *et al*., 2009). Its grains are important for the production of oil, starch and glucose (Niaz and Dawar, 2009). Moreover, Food composition data is important in nutritional planning and provides data for epidemiological studies (Ali *et al*., 2008). However, there is limited information about the nutritional composition of the different maize varieties growing in Nigeria. Considering that a significant number of metabolic disorders and diseases are caused by malnutrition and the fact that the majority of the world population consumes maize as the main bread grain, one of the important objectives in this research is the identification of varieties with the improved nutritive value. Development of maize cultivars with high productivity coupled with enhanced sugar and starch content in the kernels may cater to their enhanced use in human consumption and industrial usage Therefore, a more detailed knowledge of nutritional properties of maize genotypes will be beneficial in the production of maize food with improved nutritional quality.

MATERIALS AND METHODS

Plant material: Seeds of 10 maize (*Zea mays* L.) varieties namely Oba-98, SAMMAZ-28, SUWAN-1-SR-Y, BR9928-DMR-SR-Y, ART/98/SW-1-1, MDV-3, BR9943-DMR-SR-W, TZPB-SR-W, Oba super-2, SDM-2 were kindly provided by National Seed Company of Nigeria were studied for their nutrition composition. The seeds were also planted in pots under natural illumination and were used for pigment analysis when the plant had developed 4-5 leaves.

Proximate composition: Proximate analyses of the samples were performed as follows:
%Moisture content: Moisture Content was determined by the method of (Lee *et al*., 2007; Ezeagu *et al*., 2011). Five grams of the samples was weighed into the moisture cans. The can and its sample content were dried in an oven at 105^{o}c for 3 hours in the first instance. The can was removed, cooled in a desiccator and reweighed. The weight was recorded. The drying, cooling and weighing were continued repeatedly until a constant weight was obtained by the difference. The weight of the moisture lost was determined and expressed in percentage. The procedure was repeated for samples.
It was calculated as shown below:

$$\% \text{ moisture content} = \frac{W_2 - W_3}{W_2 - W1} \times 100$$

Where,

W_1 = weight of empty moisture can
W_2 = weight of can before drying
W_3 = weight of can + sample after drying to a constant weight

% Fat content (Ether extract): Fat content of the samples were determined by the continuous solvent extraction method using a soxhlet apparatus. The method is described by James (1995). A soxhlet extractor with a reflux condenser and a small round bottomed flask (250ml) was fixed up. The flask was weighed after washing, dried and half filled with normal hexane and then fitted back to the unit. Five grams (5.0g) of each sample was wrapped in a porous paper (whatman No. 1 filter paper). The sample was put into a soxhlet enflux flask containing 200ml of petroleum ether. The upper end of the reflux was connected to a condenser. By heating the solvent in the flask through electric- thermal heater, it vapourizes and condensed into the reflux flask. Soon the wrapped sample was completely immersed in the solvent and remained in contact with it until the flask filled up and siphoned over thus carrying oil extract from the sample down to the boiling flask. This process was allowed on repeatedly for about 4 hours before the defatted sample was removed and reserved for crude fibre analysis. The weighed round bottomed flask containing the lipid was dried in an oven at 60^{o}c for 3 minutes. This is done to remove any residual solvent. The flask was later cooled in a desiccator and reweighed. This procedure was repeated for root sample.

The weight of the fat (oil) extracted were determined and calculated in percentage as follows:

$$\% \text{ fat} = \frac{W_2 - W_1}{W} \times \frac{100}{}$$

Where,
W_2 = weight of flask and oil extract

W_1 = weight of empty extraction flask
W = weight of sample

Determination of crude fibre: This was determined by the wende method (James, 1995). Five grams (5g) of the sample was deffated during fat analysis. The pre-extracted sample was placed in fibretech crucible, which was in turn placed in beaker containin 200ml of sulphuric acid (1.25%H_2SO_4) and heated on a steam bath at 95^0c for 2 hours. The acid was removed by suction and washed several times with boiled distilled water using two fold muslin cloths to trap the particle. The washed samples was carefully transferred quantitatively back to the flask and 20ml of 1.25% NaOH solution was added to it and heated again on steam bath for 30 minutes. The sample was washed as before with boiled water and was carefully transferred to a weighed porcelain crucible and dried in the oven at 105^ocfor 3 hours. After cooling in a dessicator, it was reweighed (W_2) and then put in a muffle furnace and burned at 550^oc for 2 hours (until it became ash). Again it was cooled in a dessicator and reweighed. This procedure was repeated for root sample. The crude fibre contents were calculated in percentage.

$$\% \text{ Crude fibre (CF)} = \frac{\text{Amount of crude fibre}}{\text{Weighed of sample}} \times \frac{100}{1}$$

% Protein: The protein content was determined by kjeidahl method described by James (1995). The total nitrogen was determined and multiplied with the factor 6.25 to obtain the protein. Then 0.5g of each sample was accurately weighed into a kjeidahl digested flask and mixed with 10ml of concentrated sulphuric acid (H_2SO_4) that is Analytical Reagent Grade. A tablet of selenium catalyst ($CuSO_4$ and $N_a\ SO_4$) was added to it and the mixture was digested (heated) under a fume cupboard until a clear solution was obtained in a separate flask. The acid and other reagent were digested but without sample to form the blank control. All the digests were carefully transferred to 100ml volumetric flask using distilled water and made up to a mark in the flask. A 100ml portion of the digest was mixed with equal volume of 45% N_aOH solution in kjeldahl distilling unit. The mixture was distilled and the distillate collected into 10ml of 4% Boric acid solution containing three drops of mixed indicator (bromocresol, green and methyl red) and ammonia gas was released. The distilled sample was titrated against a 0.02MH_2SO_4 solution. Titration was done from the initial green colour to a deep red end point.
The nitrogen content was calculated in percentage.

$$\% \text{ Nitrogen } (N_2) = \frac{(100 \times N \times 14\ Vf)\ T}{W \quad 100 \quad Va}$$

Where,
W = weight of sample analyzed
Vf = Total volume of filtrate
Va = Volume of digest distilled of the assay
N = Normality (concentration of H_2SO_4 titrant)
T = Titre value – Blank

% Total ash: This was done using the furnace incineration gravimetric method (AOAC 2000). Porcelain crucible was weighed and 5g of the sample was measured and put into a weighed porcelain crucible. The sample in the crucible was put in muffle furnace set at 550^oc and allowed to burn for 2-3 hours. It was incinerated until light grey ash was obtained. This sample was

cooled in a desiccator and reweighed. The procedure was repeated for root sample. The weight of the ashes were obtained and calculated in percentage.

$$\% \text{ Ash} = \frac{(W_3 - W_2) \times 100}{W}$$

Where,
W_2 = original weight of crucible + sample
W_3 = weight of crucible + crucible content after Ashing
W = weight of sample.

% Carbohydrate: The total carbohydrate was determined by differential method. This was achieved by subtracting the total protein, fat, moisture and ash content from 100 thus: % carbohydrate (100 – (% moisture + % ash+ % fat + % protein + %fibre).

% Starch: Modified method of total starch determination described by Goni *et al* (1997) was used. 100mg of the ground starch were dispersed in 5ml of 2M KOH and incubated for 30min at room temperature. Solubilized starch was hydrolyzed by boiling 60microlitre of amyoglucosidae by incubating at 60C for 45 min in a shaking water bath. After centrifugation for 15min at 4500rpm, the glucose content in the supernatant was measured using spectrophotometer at wavelength of 630nm and total starch content was calculated as mg of glucose x 0.9.

%Sugar: Anthrone method described by Ojiako and Akubugwo (1997) was used. One (1g) of the sample was boiled in 10ml of INHCL Solution until it was negative to iodine starch test. It was centrifuged and the supernatant was used for analysis. Five (5ml) of the supernatant was mixed with 4ml of anthrone reagent and boiled. In a water bath for 10min and covered. The mixture was filtered and diluted with distilled water. Standard sugar solution was prepared and treated as stated above. The absorbance of the test sample and the standard were measured using Jenway spectrophotometer at wavelength of 625nm.
Calculation:
Total sugar = An/As *C *VF/VX *100/W
Where An is absorbance of sample,
AS is absorbance of standard
VF IS total vol of extract
Vx is vol of sample
W is weight of sample

Mineral analysis: The mineral analysis was carried out using Atomic Absorption Spectrophotometer (AAS). This was determined by the dry ash extraction method following, which specified mineral element. 2.0g of the sample (seed) was burnt to ashes in a muffle (as in ash determination) the resulting ash was dissolved in 100ml of dilute hydrochloric acid (1mlHCL) and the diluted to 100ml in a volumetric flask using distilled water. The digest so obtained was used for the various analyses. The procedure was repeated for the root sample.

Determination of Phosphorus: Phosphorus in the sample was determined by the vanadomohybdate (yellow) spectrometry as described by James (1995) 1ml extract from each samples was dispensed into a different test tube. Similarly, the same volumes of standard phosphorus solution as well as water were put into the other test tube to serve as standard blank respectively. The content of each tube was mixed with equal volume of the vanadomohbdate

colour reagent. They were left to stand for 15 minutes at room temperature (28^{o}c) before their absorbance were measured in Jenway electronic spectrophotometer at a wavelength of 420nm. Measurement was given with the blank at zero. The phosphorus contents were given by the formular (mg/100) =

$$\frac{100}{W} \times \frac{Au}{As} \times C \times \frac{Vf}{Va}$$

Where,
W = weight of sample analyzed
Au = Absorbance of test sample
AS = Absorbance of standard solution
Vf = Total volume of filtrate
Va = Volume of filt

Determination of Potassium and Sodium*:* The method of AOAC (2000) was used. Potassium and sodium in the sample were determined by flame photometry method using an instrument called flame photometer. The instrument was set up according to the manufacture's instruction. The equipment was switched on and allowed to stay for 10 minutes. The gas and air lets were opened as the start knob was turned on. The equipment being self-igniting and the flame were adjusted to a non-luminous level (that is blue colour). However, standard potassium (K) and sodium (Na) solutions were prepared separately and each was diluted to concentration of 2, 4, 6, 8, and 10ppm. When analyzing for specified element say potassium, the appropriate filter was selected and the instrument flushed with distilled water. The highest concentrated standard solution was put in place and the reading adjusted to 100ml. Thereafter, starting with least concentration that is 2ppm, all the standard solutions were sucked into the instrument caused to spray over the non-luminous flame. The reading were recorded and later plotted into a standard curve used to extrapolate the potassium (K) level in the sample. After the standard, the simple digest were siphoned in turns into the instrument, their readings were recorded. The sample was repeated with sodium standard and the place of the potassium filter. The concentration of the test mineral in the sample was calculated with reference to the graph and obtained by galvanometric reading.
It was given by the formula:

$$MKmg/100g = \frac{100}{W} \times Vt \times \frac{1}{1} \times \frac{X}{10^3} \times D$$

Where,
W = weight of sample used
Vt = Total extract volume since 1ml was siphoned into the instrument
X = Concentration from the graph
D = Dilution factor where applicable similarly for sodium concentration, it was given:

$$Kmg/100g = \frac{100}{W} \times \frac{Vf}{1} \times \frac{1}{10^3} \times D$$

Determination of Calcium and Magnesium: Calcium (Ca) and magnesium (Mg) contents of the test sample was determined by the Versanale Ethylene diamine tetraacetic acid (EDTA) complexiometric titration method as described by Pearson (1976). Twenty (20) ml of each extract was dispersed into a conical flask. Pinches of the masking agent's hydroxyl tannin, hydrochlorate, potassium cyanide were added and 20ml ammonia indicator, Erichrome black T.

The mixture was shaked very well and titrated against 0.02N EDTA solution. The titration changed from mauvo colour to a permanent blue colouration. A reagent blank consisting of 20ml distilled water was also treated as described above. The titration gave a reading from combined calcium and magnesium complexes in sample. A separate titration was then conducted for calcium alone. Titration for calcium alone was a repeat of the previous one with slight change. 10% NaOH solution at P^H 12.0 was used in placed of the ammonia buffer while solechiome dark blue (calcon) was used as indicator in place of Erichrome black.
Calcium and Magnesium contents were calculated separately using the formular below:

$$\% \text{ Calcium (Ca or Magnesuim (Mg)} = \left\{\frac{100}{W} \times \frac{EW}{100} \times \frac{N}{VA} \times Vf\right\} T$$

Where,
W = weight of the sample analyzed
EW = Equivalent weight
Vf = Total volume of extract
N = Normality of EDTA = 0.02n
VA = Volume of extract titrated
T = titre value less blanks

RESULTS AND DISCUSSION

The determination of proximate and mineral element compositions of maize varieties will go a long way in providing substantive nutritional information on maize, for effective guide on dietetics. The results of the proximate composition of grains table1 showed that maize contained appreciable level of crude protein, sugar, low levels of fat, crude fibre and ash but high levels of carbohydrate and sugar which have been similarly observed by previous workers (El-Hkier and Hamid, 2008; Gernah *et al.,* 2011). Statistical analysis, using Anova, shows significant differences exists ($P<0.05$) between the mean values of the nutrient content of the maize varieties. The moisture contents of maize were low (9.85 ± 0.01^{f} -11.35 ± 0.01^{a}). The highest value of moisture content was found for BR9943-DMR-SR-W (11.35 ± 0.01^{a}) and the lowest was found for SAMMAZ-28 ($9.85\%\pm0.01^{f}$). Aisha and El-Tinay (2004) found the moisture value in 12 corn genotypes in the range of 4.3-6.7% which is not in agreement with the results of this study. Ullah *et al*. (2010) reported the value of moisture content in ten varieties of corn seeds in the range of (10.908 - 9.201%) which is in close agreement with result of this study.

Percent ash content of different maize varieties were found in the range of ($1.96\pm0,02^{h}$ – 2.32 ± 0.02^{a} %). Similar results 0.70-2.50% in different maize hybrids were reported by Saleem *et al* (2008), keshun (2009), Egesel and Kalriman (2012) and Nutli *et al* (2013). This is in agreement with the present study. Maziya-Dixon *et al*. (2000) found results in the range of 1.4-3.3%, which are in close consistency with the values determined in the present study.

Table 1: Proximate composition of the maize varieties grown in Nigeria

	%MC	%DM	%ASH	%CF	%EE	%CP	%CHO	%STA	SUG
OB	10.74 ± 0.02^{d}	89.26 ± 0.02^{b}	2.17 ± 0.01^{e}	1.95 ± 0.01^{b}	3.67 ± 0.03^{b}	11.73 ± 0.02^{e}	69.74 ± 0.02^{d}	65.77 ± 0.03^{e}	7.62 ± 0.02^{e}
S-28	9.85 ± 0.01^{f}	90.15 ± 0.01^{a}	2.10 ± 0.01^{f}	1.91 ± 0.01^{c}	3.87 ± 0.04^{b}	11.82 ± 0.02^{d}	70.46 ± 0.07^{c}	67.54 ± 0.26^{c}	7.53 ± 0.01^{f}
COM	10.28 ± 0.12^{e}	89.72 ± 0.12^{c}	2.18 ± 0.02^{c}	1.85 ± 0.01^{e}	3.79 ± 0.01^{b}	11.36 ± 0.04^{g}	70.54 ± 0.19^{c}	65.82 ± 0.02^{e}	8.17 ± 0.02^{c}
B99	9.95 ± 0.02^{f}	90.05 ± 0.02^{a}	2.12 ± 0.01^{f}	1.93 ± 0.02^{c}	3.61 ± 0.09^{b}	10.72 ± 0.04^{i}	71.67 ± 0.09^{b}	64.77 ± 0.03^{f}	7.62 ± 0.02^{e}
SSY	11.23 ± 0.01^{b}	88.86 ± 0.06^{d}	2.32 ± 0.02^{a}	1.86 ± 0.01^{e}	4.09 ± 0.01^{a}	11.87 ± 0.03^{c}	68.73 ± 0.11^{e}	59.72 ± 0.08^{h}	7.46 ± 0.02^{f}
AR	11.15 ± 0.01^{b}	88.62 ± 0.41^{d}	2.06 ± 0.01^{g}	2.06 ± 0.02^{a}	3.54 ± 0.13^{b}	12.33 ± 0.03^{a}	68.85 ± 0.14^{e}	63.77 ± 0.03^{g}	8.15 ± 0.04^{c}
TSW	10.81 ± 0.03^{d}	89.19 ± 0.03^{c}	1.96 ± 0.02^{h}	1.88 ± 0.01^{d}	3.17 ± 0.01^{c}	10.86 ± 0.04^{h}	72.17 ± 0.01^{a}	72.17 ± 0.05^{a}	8.78 ± 0.02^{a}
OB2	10.87 ± 0.03^{c}	89.13 ± 0.03^{c}	2.21 ± 0.03^{b}	1.93 ± 0.02^{c}	3.57 ± 0.58^{b}	11.78 ± 0.02^{e}	69.63 ± 0.52^{d}	66.78 ± 0.02^{d}	7.84 ± 0.01^{d}
BK	11.35 ± 0.01^{a}	88.65 ± 0.01^{d}	2.10 ± 0.01^{f}	1.84 ± 0.01^{e}	3.86 ± 0.05^{b}	11.41 ± 0.02^{f}	69.48 ± 0.16^{d}	69.19 ± 0.04^{b}	8.52 ± 0.18^{b}
SDM	10.77 ± 0.03^{e}	89.23 ± 0.03^{b}	2.14 ± 0.02^{e}	1.88 ± 0.02^{d}	4.05 ± 0.02^{a}	12.20 ± 0.04^{b}	68.96 ± 0.04^{e}	63.72 ± 0.12^{g}	7.66 ± 0.14^{e}

Note: Means ± SD in the same column with different superscripts are significantly different ($p<0.05$).

OB= OBA-98, S-28= SAMMAZ-28, COM= MDV-3, B99= BR-9943-DMR-SRW, SSY= SUWAN-1-SR-Y, AR= ART/98/SW1-1, TSW= TZPB-SR-W, OB2 = OBA SUPER-2, BK= BR-9928-DMR-SRY and SDM-2

MC= Moisture content, DM= Dry matter, CF= Crude fibre, EE= Ether extract, CP= Crude protein, CHO =Carbohydrate, STA= Starch and SUG= Sugar

Percent protein content was found in the range of (10.72±0.04^{i} - 12.33±0.03^{a}). This result is also in agreement with the findings of (Saleem *et al* 2008; Idikut *et al*., 2009; Berardo *et al*., 2009). Ijabadeniyi and Adebolu, (2005) found the % protein content of three maize varieties grown in Nigeria in the range of 7.71 – 14.60% for the maize grains. The present study shows that ART/98/SW1-1 and SDM-2 varieties contain higher protein content of 12.33% and 12.20%, whereas the variety BR9928- DMR-SRY had the lower (10.26 %). In the literature some authors reported protein contents in maize hybrids from 7.77 to 13.84 % (Jiang *et al*., 2007).

Percent Fats were determined in the range of 3.17±0.01^{c} (TZPB-SR-W variety) to 4.09± 0.01^{a} (SDM-2 variety). The percentage fat obtained for maize varieties in this study was consistent and in agreement with that of Ikenie *et al*, (2002) but slightly differs from the findings of Ijabadenyi and Adebolu (2005) that found higher fat content in the range 4.17 – 5.0%. Ullah *et al* (2010) reported percent fats were determined in Pakistan in the range of 3.21% to 7.71% which also is in agreement with the present study. The results of the present study show that SUWAN-1-SR-Y and SDM-2 contain high fats content greater than 4 %.

Percent crude fiber was found in the range of fiber (1.84±0.01^{e} -2.06±0.02^{a}). Ijabadeniyi and Adebolu (2005) reported higher values (2.07-2.77%) of the fiber content for the maize varieties grown in Nigeria which is also not in agreement with the present study. The variation of the crude fibre content has been well demonstrated by numerous studies. Ullah *et al*. (2010) reported percent crude fiber was found in the range of 0.80- 2.32 which is in close agreement with the present study.

Percent Carbohydrate: Maize is generally known to be high in carbohydrate and as such a good source of calories (Nuss and Tanumihardjo, 2004). It was found in the range of 68.73±0.05^{e} (ART/98/SW1-1) – 72.17±0.01^{a} (B9928 DMR-SR-Y). The carbohydrate content of maize varieties obtained for this study varied, TZPB-SR-W having the highest significant ($P<0.05$) carbohydrate content, followed by maize variety BR9928 DMR-SR-Y. Ijabadeniyi and Adebolu

(2005) reported slightly lower values (65.63-70.23) of the carbohydrate content for the maize varieties grown in Nigeria. Ullah *et al*. (2010) reported percent carbohydrate was found in the range of 69.659% - 74.549% which is in close agreement with the present study.

Percent starch: Starch is the main carbohydrate reserve in plants and an important part of our nutrition. The mean starch yield of the maize varieties ranged from 59.72 ±0.08^{h} (SUWAN-1 variety) - 72.17±0.05^{a} (TZPB-SR-W variety). The starch obtained from TZPPB-SR-W (TSW) variety was significantly (P< 0.01) higher followed by BR-9943DMR-SR-W (BK) variety 69.19± 0.04^{b} .While SUWAN-1-SR-Y(SSY) variety with values 59.72 ±0.08^{h} had the lowest. The starch yield is less than the values obtained by Nadiha *et al* (2010) for potato and corn starch, which were 93.4% and 96.5% respectively. While the wide range of starch content among the cultivars is interesting, further information regarding specific starch components should be more helpful in formulating an effective strategy for their further utilization.

Percent Sugar: The mean sugar value of the maize varieties ranged from (7.53±0.01^{f} - 8.78±0.02^{a}). This corroborates the general observation of higher sweetness of some maize and their popularity and preference for direct human consumption at green ear stage. The sugar content of TZPB-SR-W variety exhibited significantly (P< 0.05) highest value (8.78±0.02^{a}), followed byBR-9943-DMR-SR-W (8.52 ± 0.18) as compared with the other varieties. However, there were no significance differences in sugar content between Oba-92 (7.62 0.02^{e}), BR-9928-DMR-SR-Y (7.62± 0.02^{e}) and (SDM-2 7.66± 0.14^{e}). Many studies (Harrigan *et al*., 2010; Skogerson *et al*., 2010) suggested a high level of natural variability inherent to the biochemical composition of maize.

Table 2: Mineral composition of the maize grains

	P	K	Na	Fe	Ca	Mg(mg/100g)
OB	284.61 ± 0.01^{b}	340.95 ± 0.01^{b}	63.62 ± 0.18^{e}	3.17 ± 0.01^{c}	176.82 ± 0.02^{c}	142.77 ± 0.07^{d}
S-28	281.66 ± 0.04^{d}	336.52 ± 0.11^{d}	61.77 ± 0.03^{g}	2.93 ± 0.02^{d}	175.85 ± 0.01^{e}	140.86 ± 0.04^{f}
COM	283.54 ± 0.09^{c}	335.83 ± 0.03^{e}	65.52 ± 0.18^{c}	3.22 ± 0.02^{b}	175.82 ± 0.02^{e}	141.45 ± 0.39^{e}
B99	275.34 ± 0.16^{h}	320.52 ± 0.08^{h}	63.85 ± 0.01^{d}	2.94 ± 0.02^{d}	173.76 ± 0.14^{h}	139.77 ± 0.03^{g}
SSY	285.78 ± 0.02^{a}	342.78 ± 0.02^{a}	180.68 ± 0.24^{a}	3.46 ± 0.02^{a}	180.68 ± 0.24^{a}	145.58 ± 0.13^{b}
AR	280.56 ± 0.02^{e}	336.77 ± 0.03^{c}	62.77 ± 0.03^{f}	2.93 ± 0.01^{d}	176.58 ± 0.23^{d}	141.58 ± 0.22^{e}
TSW	260.78 ± 0.02^{i}	315.71 ± 0.09^{i}	63.66 ± 0.06^{de}	2.79 ± 0.01^{e}	163.77 ± 0.03^{i}	136.87 ± 0.03^{h}
OB2	283.71 ± 0.09^{c}	342.78 ± 0.02^{a}	65.78 ± 0.02^{b}	3.17 ± 0.02^{c}	178.52 ± 0.08^{b}	145.49 ± 0.27^{b}
BK	280.23 ± 0.07^{f}	334.82 ± 0.02^{f}	65.82 ± 0.02^{b}	3.15 ± 0.01^{c}	175.44 ± 0.04^{f}	143.83 ± 0.01^{c}
SDM-2	278.46 ± 0.33^{g}	325.87 ± 0.03^{g}	63.52 ± 0.08^{e}	2.95 ± 0.01^{d}	174.82 ± 0.02^{g}	146.91 ± 0.04^{a}

Note: Means ± SD in the same column with different superscripts are significantly different (p<0.05).
OB= OBA-98, S-28= SAMMAZ-28, COM= MDV-3, B99= BR-9943-DMR-SRW, SSY= SUWAN-1-SR-Y, AR= ART/98/SW1-1, TSW= TZPB-SR-W, OB2 = OBA SUPER-2, BK= BR-9928-DMR-SRY and SDM-2

MC= Moisture content, DM =Dry matter, CF= Crude fibre, EE =Ether extract, CP= Crude protein, CHO= Carbohydrate, STA =Starch and SUG= Sugar

With the exception of Mg where SDM-2 was significantly higher, SUWAN-1-SR-Y had significantly ($p<0.05$) higher amount of the mineral contents determined compared to the other varieties. SUWAN-1-SR-Y had significantly higher Na (180.68 ± 0.24^{a}) followed by BR9943 DMR-SR (65.82 ± 0.02^{b}) and Oba Super-2 (65.78 ± 0.02^{b}) and the lowest is SAMMAZ-28 (61.77 ± 0.03^{g}) and SUWAN-1-SR-Y had higher potassium value of (342.78 ± 0.02^{a}) followed by Oba-98 (340.95 ± 0.01^{b}) and least is TZPB-SR-W (315.71 ± 0.09^{i}). The magnesium content of SDM-2 (146.91 ± 0.04^{a}) is highest followed by SSY (145.58 ± 0.13^{b}) and Oba Super-2 (145.49 ± 0.27^{b}) while the least is TZPB-SR-W (136.87 ± 0.03^{h}).

For iron SUWAN-1-SR-Y (3.46 ± 0.02^{a}) highest followed by MDV-3 (3.22 ± 0.02^{b}) while least is TZPB-SR-W (2.79 ± 0.01^{e}). All these minerals are necessary for physiological development and general well-being of human being and animals. The deficiency of one or more of these mineral elements may constitute nutritional disorder in human.

CONCLUSION

The data indicate that seeds of these varieties vary greatly in term of their nutritional and mineral contents. Determination of proximate and mineral element compositions of maize varieties will go a long way in providing substantive nutritional information on maize, for effective guide on dietetics. The observed variation may be attributed to the maize variety used, environmental factors and agronomic practices as well as genetic factor. These results will be useful to know about the nutritional properties of the local maize varieties

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