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COMPARATIVE STUDY OF AMINO ACID COMPOSITION IN THE DIFFERENT VARIETIES OF WATERMELON (*CITRULLUS VULGARIS*) SEEDS SOLD IN KANO METROPOLIS, NIGERIA.

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ABSTRACT
This research looked into the different varieties of watermelon (*citrullus vulgaris*) seeds sold in Kano metropolis to determine their qualitative and quantitative composition of amino acids using the Multi –sequential sample amino acid analyzer. Seventeen (17) amino acids were found and nine (9) among them were essential amino acids. The most concentrated essential amino acid (g/100g protein) are lysine in *Dan – Bunkure* and leucine in *Dan – Maiduguri* and *Dan – Niger* varieties. Glutamic was found to be the dorminant amino acid in all the seed varieties . The least concentrated amino acid content in all the seed varieties is methionine. The *Dan – Maiduguri* variety has proved to be the best with the highest content of total amino acids (82.38g/100g protein) and the highest content of leucine (6.57g/100g protein). These seed varieties of *citrullus vulgaris* are good sources of essential and non – essential amino acids and can be used as animal feed supplement and adult health supplement.

Keywords: *Citrullus vulgaris*, Watermelon seeds, Amino acid composition

INTRODUCTION

The watermelon fruit or *Kankana* in Hausa is a warm season crop. The specie belongs to the genus *citrullus* and a family of *cucurbitaceae* (Purseglove, 1968; Kumawat *et al*., 2007). The watermelon (*citrullus vulgrais*) fruit has deep green or yellow colored smooth thick exterior rind with gray or light green vertical stripes. Inside the fruit is pink, red or even yellow in color with small black or dull brown seeds embedded in the middle of the flesh. Generally, watermelon flesh, is the main consumable portion (Arash *et al*, 2013). *Citrullus vulgaris* is called watermelon because of large amount of water it contains, which is about 93% of weight. Watermelon fruits give chilling effect and reduce thirst when consumed (Kumawat *et al*, 2007). However, the outer rind is also used in some parts of the world for the control of some infections. Watermelon seeds are cooling, diuretic and strengthening aphrodisiac. The seeds are also said to be demulcent, vermifuge and nutritive (Rabul and Shrinivas, 2015). The seeds are rich sources of oil and the enzyme, urease (Rabul and Shrinivas, 2015). It has also been reported that the discovery of the nutritional and amino acid components of *citrullus vulgaris* seeds will enhance their potential use as food supplements and in food formulation to fortify the protein and fat content of food substances for local consumption and industrial applications. Amino acids are a class of organic compounds that play a major role in the less developed organisms and humans. Amino acids are classified nutritionally as essential amino acids (EAA) and non – essential amino acids (NEAA) (Zead *et al*, 2016).

Essential amino acid (EAA) are those amino acids not synthesized by animal cells and must be obtained from the diet, while non – essential amino acids (NEAA) are those amino acids that can be synthesized by the species. The essential amino acids are; threonine, valine, methionine, isoleucine, leucine, phenylalanine, histidine, lysine, arginine and tryptophan. The non- essential amino acids are; aspartic acid, serine, glutamic acid, proline, glycine, alanine, cysteine and tyrosine (Zead *et al*, 2016).

This present study is designed to analyze the amino acid content of the varieties of *citrullus vulgaris* seeds sold in Kano metropolis, Nigeria and its use in food supplements and feeds.

MATERIALS AND METHODS

Collection and Preparation of Sample

Samples of watermelon seeds (*citrullus vugaris*) were bought from *Yan – Lemo* fruit market of Kano, Nigeria. Different varieties were purchased and seeds collected from the fruits. The seeds of the *citrullus vulgaris* were collected according to their colors. The whitish green fruits were characterized with smaller seeds and were identified as *Dan – Bunkure* in Hausa. The vertical striped oblong fruits have black seeds and were identified as *Dan – Maiduguri*. The dark green fruits contain black seeds and are identified as *Dan – Niger*. The shells of the seeds were removed on drying. The dried de – hulled seeds were crushed using pestle and mortar. The powder was stored in dry airtight containers.

Amino acid Analysis

The defatted sample (0.21 g) was hydrolyzed in 7 cm^3 of 6M HCl at 105^0C for 22 hours in nitrogen flush. The hydrolysates were further analyzed for amino acids using the sequential multi – sample amino acid analyzer (Speckman *et al*, 1958). The

chromatograms of the samples were compared using norleucine as a standard (Ayodele *et al*., 2001).

RESULTS AND DISCUSSION

Results of the amino acid analysis of the different varieties are shown in table 1 and table 2. Table 1 is the essential amino acid profile of the varieties of *Citrullus vulgaris* seeds while table 2 is the non – essential amino acid (NEAA) profile of the different varieties. The chromatogram reveal seventeen (17) amino acids including nine (9) essential amino acids (EAA) such as arginine, histidine, isoleucine, lysine, leucine, methionine, phenylalanine, threonine and valine (Table 1) and eight (8) non – essential amino acids namely, aspartic acid, cysteine, glycine, glutamic acid, alanine, proline, serine, and tyrosine (Table 2). The total amino acids (TAA) for the different varities of *C. vulgaris* seeds are clearly shown in table 3. The TAA content in the *Dan – Bunkure*, *Dan – Maiduguri* and Dan – Niger varieties are 81.02, 82.38 and 79.85 g/100g protein respectively. The highest content was found in *Dan – Maiduguri* variety with 82.38 g/100g protein. The total essential amino acid (TEAA) in *Dan – Bunkure, Dan – Maiduguri* and Dan – Niger varieties are 37.88, 38.00 and 36.41 g/100g protein respectively. The total non – essential amino acids (TNEAA) are 43.14, 44.38 and 43.44 g/100g protein in *Dan – Bunkure, Dan – Maiduguri* and *Dan – Niger* respectively (table 3). The corresponding percentages of TEAA in *Dan – Bunkure, Dan – Maiduguri* and *Dan – Niger* seed varieties were 46.76, 46.13 and 45.60 respectively, while for TNEAA were 53.25%, 53.87% and 54.40% in *Dan – Bunkure, Dan – Maiduguri* and *Dan – Niger* varities respectively (table 3). These results obtained from this study conforms to other reports (Zead *et al*, 2016) on *citrullus colocynthis* seeds with TEAA of 39.78% and TNEAA of 60.22%.

Table 4 is the amino acid profile of the different varieties of the *Citrullus vugrais* seeds and the percentages of chemical score relative to the FAO/WHO/UNU reference values. The different varieties of the seeds have high content of arginine, cysteine, glutamic acid, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tyrosine and valine with relative score of 70% or even higher. The amino acid profile of this study shows that the varieties of the watermelon seeds analyzed are excellent sources of essential amino acids (EAA) and non – essential amino acids (NEAA). The results of this study conform to the sesame seeds amino acid profile (Nweke *et al*., 2011). The highest EAA in the sesame seeds (*sesamum indicum L*.) is arginine with 115.25% chemical score relative to the FAO/WHO/UNU reference value while the score is 157.80% in the *Dan – Maiduguri* variety of the water melon seeds.

Table 1: Essential Amino Acid (EAA) Profile of Varieties of *C. vulgaris* Seeds (g/100g protein)

Amino Acid	*Dan - Bunkure*	*Dan - Maiduguri*	*Dan – Niger*
Arginine	5.74 ± 0.57	6.31 ± 0.53	5.70 ± 0.54
Histidine	3.40 ± 0.57	3.25 ± 0.91	3.25 ± 0.49
Isoleucine	3.20 ± 0.30	3.29 ± 0.47	3.27 ± 0.35
Lysine	6.65 ± 0.43	6.31 ± 0.80	5.75 ± 0.57
Leucine	6.23 ± 0.46	6.57 ± 0.77	6.30 ± 0.30
Methionine	1.28 ± 0.38	1.45 ± 0.07	1.17 ± 0.04
Phenylalanine	3.80 ± 0.09	3.62 ± 0.13	3.76 ± 0.04
Threonine	3.78 ± 0.16	3.19 ± 0.74	3.51 ± 0.43
Valine	3.80 ± 0.21	4.01 ± 0.34	3.70 ± 0.14

Table 2: Non - essential Amino Acid (NEAA) Profile of Varieties of *C. vulgaris* Seeds (g/100g protein)

Amino acid	*Dan - Bunkure*	*Dan - Maiduguri*	*Dan – Niger*
Aspartic Acid	8.70 ± 0.40	9.85 ± 0.35	8.41 ± 0.70
Cysteine	1.65 ± 0.07	1.75 ± 0.15	1.24 ± 0.25
Glycine	4.50 ± 0.32	4.01 ±0.75	3.54 ± 0.59
Glutamic Acid	13.75 ± 0.60	14.91 ± 0.55	15. 71 ± 0.69
Alanine	3.89 ± 0.32	3.98 ± 0.03	3.85 ± 0.07
Proline	4.55 ± 0.64	4.30 ± 0.64	4.46 ± 0.49
Serine	3.76 ± 0.36	3.11 ± 0.13	3.80 ± 0.14
Tryosine	2.34 ± 0.17	2.47 ± 0.11	2.43 ± 0.04

Table 3: Total Amino Acids (TAA) Composition of Varieties of citrullus vulgaris Seeds (g/100g protein)

Amino Acid	*Dan – Bunkure*	*Dan – Maiduguri*	*Dan - Niger*
Total Essential Amino Acids (TEAA)	37.88	38.00	36.41
Total Non – Essential Amino Acid (TNEAA)	43.14	44.38	43.44
Total Amino Acid (TAA)	81.02	82.38	79.85
% TEAA	46.75	46.13	45.60
% TNEAA	53.25	53.87	54.40

The study revealed that all the varieties of *Citrullus vulgaris* seeds contain seventeen (17) amino acids including nine (9) EAA and eight (8) NEAA (Table 1 and 2). Tryptophan was not determined. The obtained results of amino acid composition from the different varieties of *Citrullus vugaris* seeds correspond well with some earlier study of oil seeds (Nweke *et al*., 2011; Abbeh *et al*., 2014 and Igwenyi *et al*., 2011).

The different varieties of the seed are rich in aspartic acid, arginine, glutamic acid, leucine and lysine. The most concentrated EAA found in the varieties of seeds are arginine, lysine and leucine , while the concentrated NEAA are aspartic acid and glutamic acid. The amino acid profile of c. vulgaris seeds varieties investigated suggest that the varieties of seeds are excellent source of essential amino acids notably arginine, lysine, histidine, isoleucine, leucine, phenylalanine, theronie and valine, while the non – essential amino acids present in excellent quantity are cysteine, glutamic acids and tyrosine.

The other amino acids are present in moderate amounts with methionine as the limiting amino acid in the seeds. The nutritive value of plant protein quality is usually assessed by comparing its essential amino acids with reference standard for ideal protein quality set by the World Health Organization (FAO/WHO/UNU, 1991), which is based on the amino acids requirement for children aged 2 – 5 years (Nweke *et al*., 2001). Therefore our results showed that the different varieties of *c. vugaris* seeds contain almost all the essential amino acids needed with some above the 100% relative chemical score (Table 4). This implies that the different varieties of *c. vulgaris* seeds have a high biological value and could contribute meaningfully in meeting the human and livestock requirements for these essential amino acids.

Table 4: Amino Acid Profile of Watermelon Seed Varieties and % Chemical Score Relative to the FAO/WHO/UNU Reference Value (g/100g)

Amino Acid	*Dan Bunkure* Variety	*Dan – Maiduguri* variety	*Dan – Niger Variety*	FAO/WHO/UNU Reference Value	% Chemical score (*Dan – Maiduguri*)
Alanine	3.89	3.98	3.85	20.30	19.60
Arginine	5.74	6.31	5.70	4.00	157.80
Aspartic Acid	8.70	9.85	8.41	-	-
Cysteine	1.65	1.75	1.24	2.20	79.50
Glutamic Acid	13.75	14.91	15.71	6.30	236.70
Glycine	4.50	4.01	3.54	18.30	21.90
Histidine	3.40	3.25	3.35	3.40	95.60
Isoleucine	3.20	3.29	3.29	4.20	78.30
Leucine	6.23	6.57	6.30	4.20	156.40
Lysine	6.65	6.31	5.75	4.20	150.20
Methionine	1.28	1.45	1.17	2.20	65.90
Phenylalanine	3.80	3.62	3.76	2.80	129.30
Proline	4.55	4.30	4.46	-	-
Serine	3.76	3.11	3.80	-	-
Threonine	3.78	3.19	3.51	2.80	113.90
Tyrosine	2.38	2.47	2.43	2.80	88.20
Valine	3.80	4.01	3.70	4.20	95.50

CONCLUSION

The highest content of total amino acid (TAA) was found in the *Dan – Maiduguri* variety with 82.38g/100g protein with the lowest in the *Dan – Niger* variety with value of 79.85g/100g protein. The *Dan – Maiduguri* variety has leucine as the highest essential amino acid (EAA) with value of 6.57g/100g protein while methionine is the lowest EAA in *Dan – Niger* variety with the value of 1.17g/100g protein. The highest non – essential amino acid (NEAA) is glutamic acid found in the *Dan –Niger* variety with a value of 15.71g/100g protein while cysteine is the lowest NEAA with a value of 1.24g/100g protein.

We conclude from the above-mentioned inquiry outcomes that the *c.* varieties of *vulgaris* seeds are excellent protein sources because they contain EAA and NEAA. These seeds may be used as a complement to food. Amino acids are also regarded as functional protein units used daily in calculated amounts for the excellent health of adolescents (Zead *et al*., 2016).

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