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Review.

Proximate and Amino Composition of *Citrullus Vulgaris* Seeds Sold in Kano State, Nigeria.

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Three varieties of watermelon (*Citrullus vulgaris*) seeds sold in Kano Nigeria were analyzed for proximate and amino acid composition. The samples were high in crude fats (ether extract), fibres and protein. Results of amino acid analysis showed high content of essential amino acids *arginine, isoleucine, leucine, methionine, phenylanaline, histidine, threonine* and *valine*. When compared with FAO|WHO recommended levels, the three varieties have high essential amino acids.

Keywords: *Citrullus vulgaris, proximate and amino acid composition*

INTRODUCTION

Taxonomical trend shows that the specie belongs to the genus *Citrullus* and a member of the family *Cucurbitaceae* (Purseglove, 1968). Some authors name watermelon as *Citrullus lanatus* as the name is synonymous with *Citrullus vulgaris schrad* / *Colocythis citrullus* (Tindall, 1983). The botanical name: *Citrullus lanatus* and *citrullus vulgaris* are used in the literature by some authors (Tindall, 1983). Some authors classify *egusi* (melon) and watermelon as *Citrullus lanatus.* Watermelon is grown for its oily seeds. *Egusi* is cultivated in the South – Eastern Africa in Zimbabwe and parts of West Africa (Blench, 1996). Both *Egusi* and Watermelon are indigenous to the West African region. The progenitor of watermelon was domesticated for its seeds in West Africa and the breeding of sweet melon with edible flesh in North Africa. The *Egus*i type belongs to either *Colocynthis citrullus* or *Colocynthis lanatus* (Gusmini *et al.,* 2004; Maynard, 2001, Oyolu, 1977). The watermelon fruit has variations within the species ranging from small hard bitter inedible fruit to large succulent sweet fruit (Purseglove, 1968). The cultivars vary in their maturity period and productivity, sugar content of the flesh, the colour of the fruit and number of seeds (Purseglove, 1968).

Watermelons are grown throughout the tropics and subtropics in the hot drier areas with abundant sunshine. The fruits are ready for harvesting 5 months after planting (Purseglove, 1968). Ripe fruits can be recognized by giving a dull thud with withering of tendrils. An average fruit weighs about 2.5kg with many seeds of black, brown, red, yellow and rarely white flat and smooth (Tindall, 1983). The sweet juicy pulp of the ripe fruit is eaten fresh and is a valuable alternative to drinking water in the desert areas (Purseglove, 1968), but the effective use of the seeds have not been adequately exploited. In the search for adequate nutritional supplement of plant legumes in daily diet, the proximate and amino acid compositions of three varieties of watermelon seeds (*Citrullus vulgaris*) were assessed.

MATERIALS AND METHODS

Samples of the watermelon seeds (*Citrullus vulgaris*) were bought from *yan – lemo* fruit market in Kano, Nigeria. Three different varieties were purchased and the seeds collected from the fruits. The seeds were collected according to their colours. The whitish green fruits were characterized with smaller seeds and were identified as *Dan – Bunkure* in Hausa. The striped oblong fruits have black seeds and were identified as *Dan – Maiduguri*. The dark green fruits contain black seeds and were 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. Percent moisture, crude fat, ash and crude fibre contents were determined using the methods of Association of Official Analytical Chemists (AOAC, 2006,). The dry seed flour (2g) was defatted. The crude protein content of the defatted seed flour was determined using the micro - Kjeldahl method as described by (AOAC 1980; Baruah and Barthaker, 1991). 0.21g of the defatted samples were hydrolysed in 7cm^3 of 6M HCl at 105^{0}C for 22 hours in nitrogen flush. The hydrolysates were further analyzed for amino acids using the sequential muti - sample amino acid analyzer (Spackman *et al.,* 1958). The chromatograms of the samples were

compared using norleucine as a standard (Ayodele *et al*., 2001).

RESULTS AND DISCUSSION

The proximate compositions of the different varieties as presented in Table 1. The moisture content of *Dan Bunkure* variety is 2.88 ± 0.11%, *Dan Maiduguri* variety is 2.77 ±0.15% and Dan *Niger* variety recorded a moisture content of 2.78 ± 0.01%. The moisture content of the different varieties of watermelon seeds is low than in most legume seeds (Temple *et al*., 1991, Giani, 1993). This implies that the shelf life of each variety of Citrullus vulgaris seeds may be longer.

The oil yield of the different varieties ranged from 49.06 – 50.74 %. Oil seeds are characterized with the fat content of about 19% in soybean to 49.80% in groundnut (Oyenuga, 1968). This implies that the different varieties of *C. vulgaris* seeds have high oil content. The crude protein content of the different varieties is as shown in Table 1. This ranged from 23.60 – 23.80 %. Of all legumes, soybeans are the richest in its protein content (43%) while others have protein content ranging from 20 – 31% (Olaofe *et al*., 1994; Akpata and Ologhobo, 1994). The high crude protein content of the varieties coupled with their abundance may encourage its use as protein supplement in some food formulations. The ash content enhances digestibility and overall nutrient utilization. These values compare with the reported range of 3.4 – 6.17 for some melon seeds (Oyenuga, 1968: Akpata and Ologhobo, 1994). The crude fibre ranged from 8.14 – 8.38 % (Table 1). These values are adequate and compare with the reported values for most legume seeds (Oyenuga, 1968; Akbar *et al*., 2003; Oshodi *et al*., 1993; Nnenna, 1998). The carbohydrate content ranged from 7.45 – 8.76 %. These values agree with the reported values for Egusi melon of 10% and other varieties that ranged from 4.37 – 6.0% (Oyenuga, 1968). These different varieties of watermelon seeds are rich in crude fat and protein, and are sources of protein content. The biological value of protein depends on its amino acid composition. This is based on the ingested protein hydrolysed to their composite amino acids absorbed into the body. Therefore protein utility depends on the bioavailability of the amino acids, digestibility and interference due to anti - nutritional factors (Baldev *et al*., 1988).

Quantitative chromatographic analysis of the seeds hydrolysates revealed the presence of 17 amino acids though tryptophan was not determined (Table2). Among the 17 amino acids in water melon seeds glutamic acid offered the highest concentration of 15.71g/100gm while the limiting amino acid in the three varieties was methionine. The different varieties are rich in aspartic acid, arginine, leucine and lysine. The high arginine content implies that the seeds could be used as supplements in poultry feed as these amino acids are required for their optimum growth (Linstromberg and Baumgarten,1987). Their lysine content qualifies them for use at improving the protein quality of some cereal meal. However all the varieties are deficient in sulphur containing amino acids as in other leguminous seeds (Singh and Richie,1985; Vijayaraghan and Srinivao,1993). Comparing the FAO/WHO essential amino acid with the mean values of the different varieties of *C.vulgaris*, the seeds are rich in arginine, histidine, leucine,lysine, phenyalanine and threonine, as their levels exceed the FAO/WHO values (Table3).The chemical analysis of the ash content indicated that they are rich in ash, percent crude fats, fibres and protein contents. Their amino acid analysis showed that each variety contains high concentrations of essential amino acids (arginine, histidine ,leucine , phenylalanine and threonine).Thus, chemical analysis of the three *Citrullus vulgaris* seeds has indicated that they are rich in ash, percent crude fats, fibres and protein contents. Amino acids analyses showed that each variety contains high concentrations of essential amino acids (arginine, histidine, leucine, lysine, phenylalanine, and threonine).

Table 1:Mean percent proximate composition of different varieties of *Citrullus vulgaris* seeds

Component	***Dan Bunkure***	***Dan maiduguri***	***Dan Niger***
Moisture	2.88 ± 0.01	2.77 ± 0.15	2.78 ±0.01
Ash	7.10 ±0.05	7.23 ± 0.20	7.29 ± 0.08
Ether Extract	49.85 ± 0.11	49 ±0.30	50.74 ± 0.13
Crude Fibre	8.23 ±0.01	8.38 ±0.20	8.14 ±0.07
Crude Protein	23.70 ± 0.20	23.80 ± 0.20	23.60 ± 0.11
Carbohydrate	8.24 ± 0.06	8.76 ± 0.01	7.45 ± 0.02

Table2:Amino acids composition of the different varieties of *Citrullus vulgaris* seeds (gm/100gm)

Amino Acid	*Dan Bunkure*	*Dan maiduguri*	*Dan Niger*
Alanine	3.89 ± 0.32	3.98± 0.03	3.85 ± 0.07
Arginine	5.74 ± 0.57	6.31 ± 0.53	5.70 ± 0.54
Aspartic Acid	8.70 ± 0.40	9.85 ± 0.35	8.41 ± 0.70
Cystine	1.65 ± 0.07	1.75 ± 0.15	1.24±0.25
Glutamic Acid	13.75 ± 0.60	14.91 ± 0.55	15.71 ± 0.69
Glycine	4.50 ± 0.32	4.01 ± 0.75	3.54 ± 0.59
Histidine	3.40 ± 0.57	3.25 ± 0.91	3.35 ± 0.48
Isoleucine	3.21 ± 0.30	3.29 ± 0.47	3.27 ± 0.35
Leucine	8.23 ± 0.46	6.57 ± 0.77	6.30 ± 0.30
Lysine	6.65 ± 0.43	6.31 ± 0.80	5.75 ± 0.57
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
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
Threonine	3.78 ± 0.16	3.19 ± 0.74	3.51 ± 0.43
Tryosine	2.38 ± 0.17	2.47 ± 0.11	2.43 ± 0.04
Valine	3.80 ± 0.21	4.01 ± 0.34	3.70 ± 0.14

Table 3: Essential amino acid compositions of the different varities watermelon seeds and FAO recommended daily intake (gm/100gm protein).

Amino Acids	**FAO**	***Dan Bunkure***	***Dan Maiduguri***	**D*an Niger***
Arg	2.00	5.74	6.31	5.70
His	2.40	3.40	3.25	3.35
ILe	4.20	3.21	3.29	3.27
Leu	4.80	6.23	6.57	6.30
Lys	4.20	6.65	6.31	5.75
Met	2.20	1.28	1.45	1.17
Phe	2.80	3.80	3.62	3.76
Thr	2.80	3.78	3.19	3.51
Trp	1.40	ND	ND	ND
Val	4.20	3.80	4.01	3.70

Conclusion

Watermelon seeds have their own nutritional makeup, including proteins, fats, iron and other nutrients and a source of calories its seeds are relatively high in calories. Watermelon seeds are composed of 50 percent oil, which explain its relatively high fat content The seeds are composed of protein and are a good source. The protein in watermelon seeds is of reasonably high quality; of the essential amino acids and ranks highly in all but lysine.

Watermelon seeds are a good source of several vitamins and minerals. Regarding minerals, watermelon seeds provide calcium, magnesium phosphorus potassium zinc , copper and manganese and contain fat, carbohydrates, and is a good source of vitamins A and C. It is naturally low in saturated fat and cholesterol, making it a heart-healthy food. Its amino acids help maintain arteries and blood flow through the heart. Watermelon contains about 92 percent water, making it a good thirst quencher and diuretic.

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