International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

A Study in the Variability of Some Nutrient Contents of Watermelon (*Citrullus Lanatus*) Before and after Ripening Consumed Within Kano Metropolis, Nigeria

Muhammad Abdullahi Sa'id

M. Sc Microbiology (LPU, India)

A Research Work Conducted at Department of Biological Science, Bayero University Kano, Nigeria., February, 2014

Abstract: ***The composition of some organic and mineral contents in the pulp of Citrullus lanatus (watermelon) through two stages of development namely unripe and riped were determined. The result obtained revealed that ripe Citrullus lanatus contains large amount of carbohydrate (6.5%) as compared with the amount detected in the unripe (3.5%).The moisture (water) content was found to be very high in the fruits at both the two stages (unripe 94.8% and ripe 91.5%). Lastly some mineral contents quantity were also determine as follows; for the unripe (potassium 0.81%, calcium 0.31% and Iron 0.004 %) while for the ripe (potassium 0.89%, calcium 0.29% and Iron 0.005%). The output of this research shows that both organic and mineral content watermelon increases with ripening, whereas the moisture content decreases.***

Keywords: Citrullus lanatus, Organic content, Mineral content, Moisture content, Unripe and Ripe.

1. Introduction

Citrullus lanatus (Watermelon) is a tropical fruit which grows in almost all part of Africa and South East Asia, belongs to the family *Cucurbitacea* (koocheki et al., 2007). It is large, oval, round or oblong in shape. The skin is smooth, with dark green rind or sometimes pale green stripes that turn yellowish green when ripe. Watermelon is a very rich source of vitamins and often used as an appetizer or snack, depending on how it is prepared (*Kerje et al*., 2003). It also serves as a good source of phytochemicals such as lycopene, a red carotenoid pigment which acts as antioxidant during normal metabolism and protects against cancer (*Perkins et al*., 2004). Watermelon contains a significant amount of citrulline and after consumption of several kilograms an elevated concentration is measured in the blood plasma; this could be mistaken for citrullinaemia or other urea cycle disorder (*Mandel et al*., 2005). The rind is usually discarded, but sometimes it is applied to feeds or fertilizer, but they are also edible and sometimes used as a vegetable (*Southern U.S Cuisine 2010*).

Medicinally, watermelons are mildly diuretic and contain large amounts of beta carotene and also serve as a significant source of lycopene (*Collins et al., 2005*). In Nigeria watermelon rinds are fermented, blended and consumed as juice (*Kerje et al., 2003*).

Been one of the most edible fruit in the country, this research aim to investigate the presence of some essential phytonutrient and also to determine their percentage at two stages of development (unripe and ripe).

2. Materials and Method

2.1 Sample Collection and Handling

The fruits of watermelon (*Citrullus lanatus)* at two different stages of maturity (i.e unripe and ripe) were purchased from local markets within Kano metropolis (Yankaba & Yanlemo markets). The rinds were peeled off using a sharp knife to remove the pulp and stored in laboratory freezer for further analysis.

2.2 Drying of Samples

The freshly peeled watermelon pulp were weighed and dried in an oven at 75-80^{0}c until a constant weight was obtained. The obtained dried sample were then stored in a labeled sample container. All analysis was carried out using the ground samples and the results were expressed in terms of the dry weight.

2.3 Phytonutrient Analysis

The qualitative and quantitative analyses of phytonutrient properties of the unripe and ripe samples was carried out using standard protocol of AOAC as described by Harbon (2003), Boham and Kolipai (2004), Ebrahimzadek et al. (2007) and Nabavi et al. (2008). Statistical significance was established using one way analysis of variance (ANOVA) and data were reported as mean $\pm$ standard deviation.

2.4 Determination of Water Content

The fresh samples were introduced into weighted beakers. The weight of the beakers and the samples were noted and kept in an oven maintained at 75-80^{0}c for 24 hours to dry. The beakers were remove cooled in a dissector and weighed again. Weight determined repeatedly at one hour interval until constant weights were obtained as follows:

Weight of beaker …………………………..Wg
Weight of beaker + Fresh sample …….….W1g
Weight of dry sample ……………………..W2g
Total loss in weight = Total water loss ….. (W1 – W2)g
Weight of Fresh sample used ……………...(W1 – W)g

$$\text{Percentage (\%) of water content} = \frac{\text{Weight of water loss}}{\text{Weight of fresh sample}} \times \frac{100}{1}$$

Weight of solid content = (W2 – W)g
Weight of fresh sample = (W1 – W)g

$$\text{The proportion} = \frac{(W2 - W)g}{(W1 - W)g} \times \frac{100}{1}$$

2.5 Determination of Soluble Carbohydrate

2g of the sample was weighed into a round bottomed flask and about 100ml distilled water were added. The flask was connected to a cold finger condenser and was heated in water bath for about 30minutes. The solution was transferred into a 50ml volume flask and was made up to 50ml mark with distilled water. 1ml was pipette from this solution and transferred to a test tube. 1ml of alkaline copper tartrate solution was added and this was placed in boiling water bath set at 95% for about 10minutes. The tube was net moved cooled in a running tap water before 1ml of Nelson's arsenomolybdate (Nelson's reagent) was added, after thorough shaking the absorbance was read at 500nm wave length. A blank solution was prepared by following the above procedure except that distilled water was used to replace the sample. The concentration was determined by extrapolating from Standard glucose curve.

2.6 Determination of Minerals Contents percentage

The dry samples were grained to a fine powdery form and then placed in already ignited preclean crucibles which were weighed and labeled C1 & C2. 5g of each sample were placed into each crucible and weighed again, and then placed in muflefurnace at a temperature of 550^{0}c, the carbon chains turns off as carbondioxide leaving grayish ash. The crucibles were taken out immediately covered and placed in a dissector containing silica gel. The crucibles were allowed to cool and weighed.

$$\text{Ash \%} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times \frac{100}{1}$$

Percentage of organic matter = 100 - % ash

Note: Ash % = inorganic residue remaining after the organic matter has been burnt away, simply the mineral contents. Organic matter % = All other phyonutrients contents except minerals (i.e moisture, carbohydrate, protein, lipid vitamins, fiber and energy supplier).

2.7 Determination of Calcium, Potassium and Ion Composition

5g of dried sample was ashed completely at 550^{0}c, the ash was dissolved in 100ml beaker using 95ml distilled water and 5ml 36% concentrated hydrochloric acid. The mixture was then filtered using what man No.1 filter paper and using flame photometer and atomic absorption spectrophotometer (AAS) and the minerals were determined.

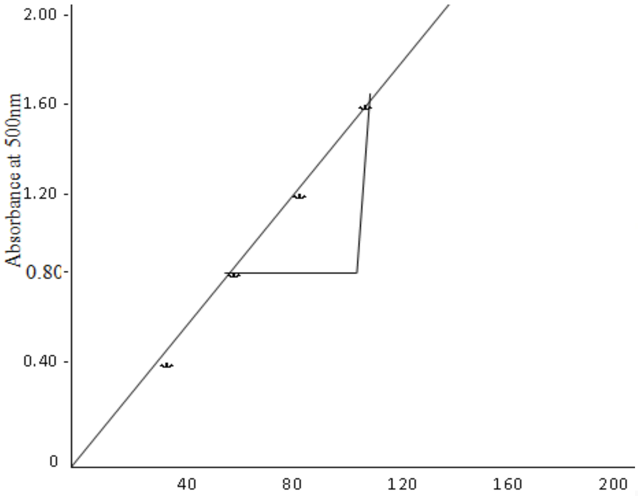
3. Results

The proximate of some phytonutrient composition of *Citrullus lanatus* (watermelon) before and after ripening were determine and the results obtained revealed that the pulp of unripe fruit contained approximately (94.8%) of water, (5.2%) dry mass of which (3.5%) is total soluble carbohydrate and about (1.8%) minerals and vitamins. The mineral contents estimated in this research are; K^+ 0.81% (25.50mg/l), Ca^{2+} 0.29% (6.50mg/l) and Fe^{2+} 0.004% (0.28mg/l). The pulp of ripe fruit contained approximately (91.5%) of water, (8.5%) dry mass of which (6.5%) is total soluble carbohydrate and about (2.2%) minerals and vitamins. The mineral contents as explained above are; K^+ 0.89% (27.9mg/l), Ca^{2+} 0.31% (7.1mg/l) and Fe^{2+} 0.005% (0.33mg/l). The statistical significance of the result was established using one-way Analysis of variance (ANOVA) and data were reported as mean ± standard deviation as shown in table1.

Table1: Result of some phytonutrient composition of Citrullus lanatus (watermelon) fruit before and after ripening.

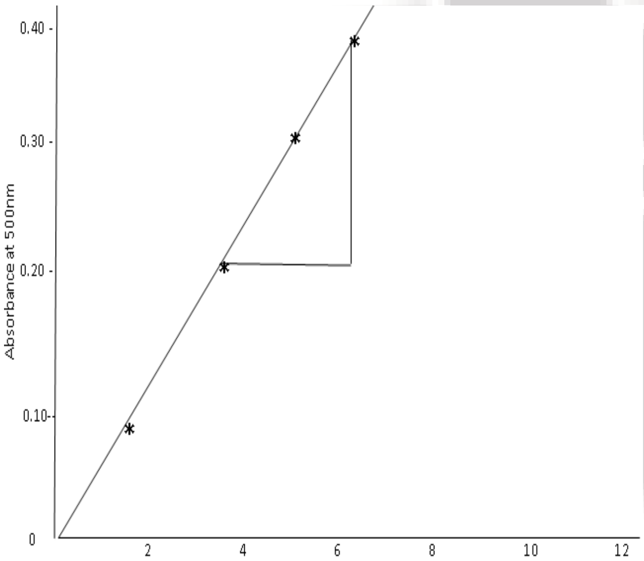
Sample	Moisture contents ($H_20\%$)	Dry matter of sample (%)	Soluble CHO content (%)1	Mineral content (%)	Calcium ion content (%)	Potassium ion content (%)	Iron content (%)	CHO conc (mg/l)	Ca conc (mg/l)	K conc (mg/l)	Fe conc (mg/l)
Unripe	94.8±0.65	5.2.±0.65	3.5±0.10	1.8±0.06	0.29±0.01	0.81±0.04	0.004±0.01	7.78±0.10	6.5±0.01	25.50±0.04	0.28±0.01
Ripe	91.5±0.65	8.5±0.65	6.5±0.10	2.2±0.06	0.31±0.01	0.89±0.04	0.005±0.01	13.10±0.10	7.1±0.01	27.90±0.04	0.33±0.01

Key: CHO = carbohydrate, H20= water, Ca= calcium, K=potassium, Fe= ron, %= percentage, Conc=concentration, ±= standard error, mg/l= milligram per liter



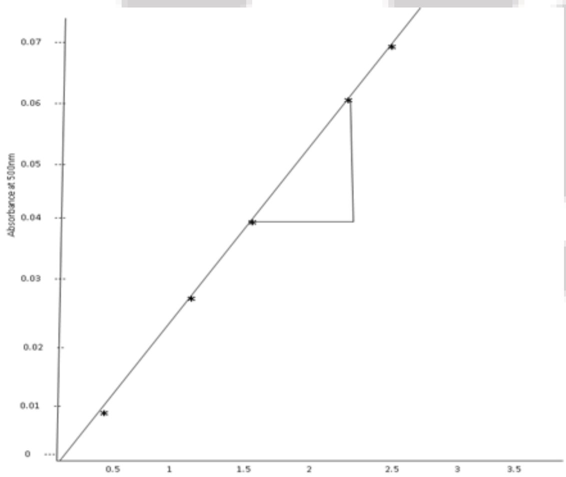
Concentration in milligrams

Figure 1: Glucose standard curve for the estimation of carbohydrate concentration



Concentration in milligrams per liter

Figure 2: Calibration curve for standard potassium and calcium metals concentration estimation.



Concentration in milligrams per liter

Figure 3: Calibration curve for standard iron metal concentration estimation

4. Discussion

The average phytonutrient composition of watermelon *(Citrullus lanatus)* was determined and shown in table1 above. The pulp of unripe melon has a higher percentage of moisture content (94.8%) than the ripe one which (91.5%). This shows that the moisture content of the fruit decreases with ripening. The chemical composition of watermelon can be compared with other fruits as reported by Edwards and Wiley (2003). This result is in constant with the work of Izonfuo and Omuara (1988) on similar fruit plaintain which shows decrease during ripening. The possible reasons for this decrease have earlier been given by Ensminger (2010), Erharbt and Meisner et al., (2003) that during ripening of intense respiratory activity increases leading to more evapotranspiration.

The lower amounts of soluble carbohydrates in the unripe melon result from the fact that during the ripening changes occur in sucrose composition. As there is no starch present in the fruit, this decrease represents a change in cell wall constituents and accounts at least in part for the change in consistency of the flesh during ripening (Lucotti and Setola et al., 2006).

The fruits of fully riped *Citrullus lanatus* as shown from the experiment has the highest percentage of soluble carbohydrate (6.5%) very close to the value reported by WHO, 2010 (6.3%) as cited by (FAO, 2007). Minerals are some of the essential dietary components that are required in small quantities for the normal metabolism and regulation of body processes. Both ripe and unripe fruit contains a significant amount of essential mineral elements thus *Citrullus lanatus* can be considered as one of the most important eatable fruit with high nutritional value.

5. Acknowledgment

Glory is to the highest Almighty Allah (SWT) for giving me opportunity to complete this research work successfully.

I wish to express my sincere gratitude to Malam Suleman R. Babura, Professor Bala S. Aliyu all from Department of Biological Science, Bayero University Kano, Nigeria for their able guidance and advice which contributed immensely to the completion of this research. Finally, i wish to express my profound appreciation to my parents and relatives who have co-operatively assisted me morally and financially towards the completion of this research work, I thank you as a whole.

References

[1] Alphonsede C. (1882): Article on cultivation in South Africa, Annual Report 1914. Hawii Agricultural Express Station.
[2] AOAC (1997): Official methods of analysis of the Association of Analytical chemists, Washington DC.
[3] Akindumila, F., Glatz, B. A. (1998): Growth and oil production of Apiotrichum curvatum in tomato juice. Food Protect, 61:1515-1517.

[4] Bernard A., Histean K.E. (2006): Chemical Composition of watermelon and plaitain (Musa paradisiaca) J. sci. Food Agr. 26. 804-907.
[5] Cho E., Seldon J. M., Rosner B., Willett W. C., Hankinson S. E. (2004): Prospective study of intake of fruits, vegetables, vitamins, carootenoids and risk of agerelated maculopathy. Arch opthalmol PMID: 151-97064.
[6] Collins, J. K., Davis A. R., Perkins-veazie P. M., Adams E. (2005): Sensory evaluation of low sugar watermelon by consumers, Hort Sci., 40:883.
[7] Collins J. K., Wu G., Perkins-veazie P., Spears K., Claypool P. L et al. (2007): Watermelon consumption increases plasma, arginine concentration in adults nutrition. 261-6. PMID: 17352962.
[8] Edwards A. J. Vinyard B. T. Wiley E. R. et al., (2003): Consumption of watermelon fruit increases plasma concentrations of lycopene and bela-carotene in humans Nutrition. (4):1043-50.
[9] Ensmiger A. H. Ensminger M. K. S. et al., (2010): Food for health: A nutrition encyclopedia clovis, California: Pegus press. PMID: 15210.
[10] Erhardt J. G., Meisner C., Bode J. C. (2003): Lycopene beta-carotene and colorectal adenomas. Clinical nutrition (6): 1219-24.
[11] Falade O. S., Dare A. F., Bello M. O., Osuntogun B. O., Adewasi S. R. A. (2004): Varietal changes in proximate composition and the effect of processing on the ascorbic acid content of some Nigerian vegetables J. food technology (2): 103-108.
[12] Fenny K.T. Jiarong K.T. (2000). Citrillus lanatus related to DNA generation. J. Agric. Fd. Chem. Vol 33, NO.10 PP 1219-1221
[13] Food and agricultural organization (FAO). 2007: Amino acid contents of foods and biological data on protein. Pp.110.
[14] Gil M. I., Aguayo E., Kader A. A. (2006): Quality changes and nutrient retention in fresh-cut versus whole fruits during storage. J. Agric food Chem. (12): 4284-96. PMID: 16756358.
[15] Izonfue W. A. L., Omuara V. O. T., (1998): Effect of ripening on the composition of plantain peels and pulps. J. Sci. food Agric (45): 333-336.
[16] Jian L., Lee A. H., Binns C. W. (2007): Tea and lycopene protect against prostate cancer. Asia pac J. clinical nutrition. 16 Suppl (1): 453-7 PMID: 17392149.
[17] John N.I. Egerton M. (2004). Cultivation in the United State. J. Agric. Fd. Chem. Vol 33, No 10 pp 1219-1221.
[18] John W.S. Kubota H. (2004): Pest and Diseases associated with carbohydrate rich fruit. J. Agric. Fd. Chem Vol 29, No. 21 pp 2018-2121.
[19] Koocheki A., Razavi S. M. A., Miloni E., Moghadam T. M., Abedini M., Alamatiyan S., Izadikhan S. (2007): Physical properties of watermelon seeds as a function of moisture content and variety. Int. agro physics (2): 349-359.
[20] Lucotti P., Setola E., Monti L. D. Galluccio et al., (2006): Beneficial effects of a long-term oral L-arginine treatment added to a hypocaloric diet and exercise training program in obese, insulin-resistant type 2 diabetic patients. AM J. physical Endocrinol metab (5): 906-12. PMID: 16772327.
[21] Mandel H., Levy N., Izkovitch S., Kormon S. H. (2005): Elevated plasma citrulline and arginine dup to consumption of citrullus vulgaris (watermelon) Berichte der deutschen chemischen Gesellscaft (28): 467-472.
[22] Perkins-veazie P., Collins J. K. (2006): Carotenoid changes of intact watermelon after storage. J. Agric food chemistry (16): 5868-74. PMID: 16881688.
[23] Perkins-veazie, P., Collins J. K. (2004): Flesh quality and lycopene stability of fresh-cut watermelon. Postharvest Biol. Technol (31): 159-166.
[24] Southern U. S. Cuisine. (2010): Judy's pickled watermelon Rind. www.southernfood.about.com:
[25] Retrieved 07.03-2010.
[26] Southgate D. A. T. (2005): Determination of food carbohydrages London applied science publisher. Pp. 98-106.
[27] Teacher B. M., Olivares M., Cori H. (2004): Enhancers of iron absorption ascorbic acid and other organic acids. Int. J. Vitam. Nutr. Res. (74): 403-419.
[28] Wills R. B. H., Poi, A., Green F. H. (2004): Changes in fruit composition of watermelon during ripening and effect of storage temperature on ripening J. Hort Sci. ve 19 (1): 96-97.
[29] Wood, R. (1998): The whole foods encyclopedia. New York, Ny: Prentice Hall Press. PMID: 15220.
[30] Zohary A. Hopf D.I. (2002): Origin of watermelon cultivation, California: Pegus company Press.

Author Profile

Muhammad Abdullahi Sa'id has done M. Sc Microbiology from LPU, India. He has Conducted Research work at Department of Biological Science, Bayero University Kano, Nigeria in February, 2014