



Effect of Water Melon (*Citrullus Lanatus*) on Serum Glucose Level and Various Protein Parameters in Acetaminophen-Induced Wistar Albino Rats

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Abstract The effect of aqueous extract of *Citrullus lanatus* (F) on acetaminophen-induced wistar albino rats was investigated. 25 male wistar rats were randomly shared into 5 groups of 5 rats per group and aqueous extract of *Citrullus lanatus* was administered orally to rats in groups 2 and 3 at 100 and 200mg/kg/per day respectively for twenty one days while, group4 received 100mg/kg body weight of vitamin C. Acetaminophen (1 mg/kg) was then administered to rat groups 2-5 daily for the same period of study. Blood samples were collected on the 22nd day of study and were used to determine, the glucose level, ALT and albumin concentrations using standard kits. The results showed significant increase in the level of ALT in rat group5 (77.3 ± 5.87) compared to group 1 (58.5 ± 4.5). Meanwhile, ALT levels decreased significantly in *Citrullus lanatus* extract treated groups 2 and 3, (71.6 ± 5.8 and 74.5 ± 4.5) respectively, compared to untreated group5, $p < 0.05$.

Albumin level increased significantly, in rats group 5, (52.1 ± 5.8) when compared to rats in normal control group 1(35.4 ± 3.6). However, these values decreased significantly in extract treated groups 2 and 3; (38.7 ± 3.8 and 42.0 ± 4.9) respectively, when compared to rats in untreated groups, $p < 0.05$. Glucose level significantly increase in rats in group 5, (5.2 ± 5.8) as compared to rats in normal group1, (4.2 ± 2.9). However, it decreased significantly in rats treated with extract groups 2 and 3; (4.3 ± 3.9 and 4.7 ± 5.2) respectively, when compared with rats in untreated groups, $p \leq 0.05$. Rats in group5 showed significant increase in weight (8.0 ± 7.7) when compared to rat group 1 ((7.13 ± 5.87) , $p \leq 0.05$. There was significant decrease in the weights of rats treated with extracts (groups 2 and 3); (6.36 ± 2.5 and 6.78 ± 3.38) respectively, when compared to rats in normal and untreated groups, $p \leq 0.05$. In conclusion, aqueous extract of *Citrullus lanatus* administered orally as low as 100mg/kg reduces glucose, ALT levels and mediate appreciable weight loss, which may be chemically beneficial to individuals at risk of diabetes and hepatocellular diseases.

Keywords Acetaminophen, *Citrullus lanatus*, Hepatocellular, Alanine Amino Transferase.

Introduction

Water melon (*Citrullus lanatus*) is a vine-like flowering plant originated from southern Africa. Their fruit which is also water melon is a special kind referred to by botanist as a pepo [1]. The scientific name of the watermelon is derived from both Greek and Latin roots. The Citrullus part comes from a Greek word “citrus” which is a reference to the fruit. The lanatus part is Latin, and has the meaning of being wooly, referring to the small hairs on the stems and leaves of the plant [2]. It’s a berry which has a thick rind exocarp, fleshy center mesocarp and endocarp. Pepos are derived from an interior ovary, and are characteristics of the cucurbitaceae. The water melon fruit loosely considered a type of melon although not in the genus cucumis. It has a smooth exteriors rind green, yellow or sometime white, and a juicy, sweet interior flesh which are usually deep red to pink, but sometimes orange, yellow or even green if not ripe [3-4]. *Citrullus lanatus* takes about 90 days from planting and harvesting. It is particularly common in West Africa, where it is also called ootanga oil or Kalahari oil. Water melon is a native of the Kalahari desert in South Africa [5]. Water melon is widely grown in Northern part of Nigeria where the suitable agroecology is found and due to average rain fall which falls within the Guinea Savanna zone of North Central Nigeria and it



grows best on soils with a sandy loamy texture [6]. It is commonly used to make a variety of salads, most notably fruit salad [7]. Water melon has been reported to contain about 6% sugar and 92% water by weight which makes it very low in calories [8]. This fruit is rich in vitamin B₁, vitamin B₂, vitamin B₆, vitamin C, folate, niacin and minerals like potassium, iron, calcium, magnesium and phosphorus in traces. *Citrullus lanatus* is rich in antioxidants called carotenoids, such as, vitamin A, lycopene, phytofluene, phytoene, beta carotene, lutein and neurosporene. Its seeds contain a good quality of protein, oil and dietary fibre and minerals like magnesium, calcium, phosphorus, zinc, potassium and iron [9]. The health benefits of watermelon are mainly based on its nutritional value and presence of these components. Antioxidants neutralize the free radical in the body; free radicals are the primary causes of heart attacks and strokes. Vitamin C and beta carotene fight free radicals and reduce the risk of diseases [10]. Antioxidants also reduce cholesterol which apart from causing heart related problems can worsen other diseases and reduces the risk of cancer [11]. It can help the body lose weight due to its low content in fat and calories, as well as boost energy production, since vitamins B complex are essential for energy production in the body [8]. The objective of the study is to determine the protective ability of *Citrullus lanatus* on acetaminophen-induced albino rats based on its reported inherent nutritional benefits.

Animals

Twenty five (25) male Wistar rats, with average 160g were purchased from the Department of Pharmacology, Animal House and kept in the Department of Biochemistry Animal House in College of Health Sciences, Niger Delta University. They were randomly assigned into five groups: A, B, C, D and E of (n=5) in each group. They were fed with growers' mash obtained from Edo feed and flour mill Limited, Ewu, Edo State and given water liberally. The rats gained maximum acclimatization (2 weeks) before actual commencement of the study.

Materials and Methods

Plant Materials

Fresh fruit of *Citrullus lanatus* were collected from Pharmacognosy herbarium, Faculty of Pharmacy, Niger Delta University, Bayelsa State. The plant was identified and authenticated by a Botanist Prof. K. Ajibeshin of Department of Pharmacognosy, Niger Delta University.

300g of *Citrullus lanatus* (fruit) was thoroughly washed and crushed with mortar and pestle and was extracted in 1L of cold sterile distilled water maintained on a mechanical shaker. The aqueous extract was filtrated with No. 1 Whatman Millipore filter paper (0.45 µm Ref. HAWP04700, Bedford, MA, USA) and concentrated to dryness with a rotary evaporator (Rotavapor, R-210, Buchi Laborotechnik, AG, Flawil, Switzerland) at 50 ± 5 °C and lyophilize. A yielded freeze-dried material of approximately 25g was obtained. The freeze-dried sample was stored in a cool dry place until ready for use.

Experimental Procedures/*Citrullus lanatus* administration

25 male wistar rats were randomly shared into 5 groups of 5 rats per group and aqueous extract of *Citrullus lanatus* administered orally through orogastric tube on daily basis for twenty one days as shown below;

- Group A: Growers' match and saline water (normal control)
- Group B: Growers' match + 100mg/kg of extracts
- Group C: Growers' match+ 200mg/kg extracts
- Group D: Growers' match + vitamin C 100mg/kg
- Group E: Growers' match + saline water (Positive control)

Groups B, C, D and E were administered doses of acetaminophen 1mg/kg body weight/day intra peritoneally for twenty one days. Animals were scarified on the 22nd day and blood collected through cardiac puncture into well labeled universal bottles. The blood was centrifuged at 2500 rpm for 10min. and the serum collected was used for biochemical analysis.

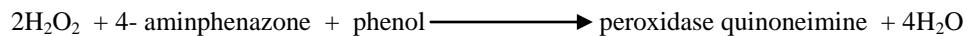
Biochemical Assay

Principle of Glucose Oxidase Test

Glucose oxidase reagent contains glucose oxidase, peroxidase and o-toluidine. The latter reagent is an oxygen reagent acceptor and changes from a colourless reduced form to a blue oxidized form. Glucose is oxidized by glucose oxidase to glucuronic acid. Hydrogen peroxide is also formed in the reaction and is decomposed by peroxidase to water and oxygen. The liberated oxygen is accepted by o-toluidine and therefore a red-violet coloration (quinoneimine) which was measured spectrophotometrically at absorbance of 560 nm.

Principle



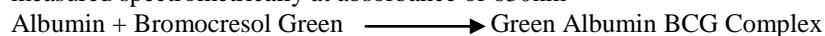


Estimation of Albumin

Albumin Kit was used for the determination of Albumin in serum.

Principle

Albumin binds with the dye Bromocresol Green in a buffered medium to form a green coloured complex. The intensity of the colour formed is directly proportional to the amount of albumin present in the sample which was measured spectrometrically at absorbance of 630nm



Estimation of ALT

ALT kit was used for the determination of ALT in serum using Reitman-Frankel method (Widmann, 1980).

Principle



Alanine aminotransferases is measured by monitoring the concentration of pyruvate hydrazone formed with 2,4,-dinitrophenylhydrazone using spectrophotometer at 540nm.

Statistical Analysis

The results were expressed as mean \pm SD. Data was analyzed by one-way analysis of variance. Sequential differences among means were calculated at the level of $P < 0.05$, using Turkey contrast analysis as needed.

Results

Table A: Effects of *citrullus lanatus* on acetaminophen-induced rats

| Experimental Group /Treatment | MEAN Weight CHANGE (g) | Albumin (g/L) | ALT (U/L) | Glucose (mMol/L) |
|---|------------------------|------------------|-------------------|------------------|
| Group1(Normal control) | 7.13 ± 5.87^a | 35.4 ± 3.6^a | 58.5 ± 4.5^a | 4.2 ± 2.9^a |
| Saline water | | | | |
| Group2(100mg/kg)Citrullus lanatus + 1mg/kg | 6.36 ± 2.5^b | 38.7 ± 3.8^b | 71.6 ± 5.8^b | 4.3 ± 3.9^a |
| Acetaminophen | | | | |
| Group3(200mg/kg) Citrullus lanatus + 1mg/kg | 6.78 ± 3.38^b | 42.0 ± 4.3^c | 74.5 ± 4.5^c | 4.7 ± 5.2^a |
| Acetaminophen | | | | |
| Group4(100mg/kg) Vit C+1mg/kg Acetaminophen | 7.16 ± 7.4^a | 48.7 ± 4.9^d | 56.4 ± 4.4^a | 4.8 ± 4.6^a |
| Group5 1mg/kg Acetaminophen (Positive control) | 8.0 ± 7.7^e | 52.1 ± 5.8^e | 77.3 ± 5.87^d | 5.2 ± 5.8^b |

Values are means of five determinations \pm SD

Values with different superscript in the column differ significantly ($P < 0.05$)

Effects of *Citrullus Lanatus* on Weight Changes

Result of the present study as presented in Table A, showed that aqueous extract of *Citrullus lanatus* has significant effect ($p < 0.05$) on some serum biochemical parameters in the acetaminophen-induced rats. Values obtained from group5 (positive control) are compared to group1 (normal control) and values of the extract treated groups 2 and 3 are compared to group 5. Rats in group5 showed significant increase in weight (8.0 ± 7.7) when compared to rat group 1 ((7.13 ± 5.87) , $p \leq 0.05$). There was significant decrease in the weights of rats treated with extracts (groups 2 and 3); (6.36 ± 2.5 and 6.78 ± 3.38) respectively, when compared to rats in normal and untreated groups, $p \leq 0.05$.

Effects of *Citrullus Lanatus* on Albumin Level

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Effect of *Citrullus Lanatus* on ALT Level

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Effect of *Citrullus lanatus* on Glucose Level

The results showed a significant increase in rats in group 5, (5.2 ± 5.8) as compared to rats in normal group1, (4.2 ± 2.9). However, the glucose levels decreased significantly in rats treated with extract (groups 2 and 3); (4.3 ± 3.9 and 4.7 ± 5.2) respectively, when compared with rats in untreated groups, $p \leq 0.05$ (Table A).

Discussion

The present study was designed to evaluate the oral effect of aqueous extract of *Citrullus lanatus* on glucose level, serum albumin and ALT on the liver. Liver is an important organ that performs vital function for healthy survival of the body. Liver detoxify harmful substances, secretes bile into intestine, synthesizes and store important molecules [12].

The result of this study revealed that administration of aqueous extract of *Citrullus lanatus* caused significant decrease on glucose level in rats groups treated with extract (100mg/kg and 200mg/kg) compared to the untreated groups. This result is in agreement with the earlier report of Jiyun, et al. (2011) [13] that *Citrullus lanatus* contains low calories about 6% by weight and may improve insulin sensitivity in type 2 diabetic patients. Also, *Citrullus lanatus* has been shown to confer hypoglycemic functions to rats treated with the extract [14].

The serum level of ALT showed significant ($p < 0.05$) reduction at 100mg and 200mg/kg body weight compared to positive control group5. This result is in line with the work reported by Rahman et al. (2013) [15] that the plant *Citrullus lanatus* lowers serum level of transaminase and that the plant has a hepatoprotective function. The rise in levels of ALT is always accompanied by elevation in the level of AST, which play a role in the conversion of amino acid to keto acid. ALT is an excellent marker of liver damage caused by exposure to toxic substances [16]. *Citrullus lanatus* offers various health benefits which include preventing and fighting various diseases including liver diseases [17]. It is rich in antioxidants like vitamin C, vitamin A, carotenoids and lycotene which is beneficial in preventing some forms of cancer, endometrial cancer, breast cancer, prostate cancer, lung cancer and colorectal cancer and various liver diseases [11, 18-19].

Also, findings of this study showed a significant decrease in the mean weight of the animal groups treated with the *Citrullus lanatus* compared to untreated group, which is also in agreement with the earlier report by Jonathan and John, (2005) [8] that *Citrullus lanatus* can help the body lose weight as it is high in water content and low in fat and calories.

In conclusion, aqueous extract of *Citrullus lanatus* administered orally as low as 100mg/kg reduces glucose, ALT levels and mediate appreciable weight loss, which may be chemically beneficial to individuals at risk of diabetes and hepatocellular diseases.

References

1. Tarek Z and Khaled S, (2001): "Acetaminophen". The American society of health-system pharmacists. *J. chem. eng.* **44(6)**:1351-1365.
2. Baker T. P., Corwin B, and Jett L.W. (2002). Watermelon Bacterial Fruit Blotch. University of Missouri Extension.<<http://extension.missouri.edu/p/IPM1011>> Accessed 18.
3. Laghetti, G. and Hammer, K. (2007).The Corsican citron melon [*Citrullus lanatus* (Thunb.)Matsumura & Nakai subsp. *lanatus* var. *citroides* (Bailey) Mansf. Ex Greb.] a traditional and neglected crop. *Genetic Resources and Crop Evolution*. **54**: 913–916.
4. Mabberley, D.J. (2008). Mabberley's Plant-Book: a portable dictionary of plants, their classification and uses. Cambridge University Press.
5. Blomberg, M. (2004). In season: savory summer fruits. The Gainesvillesun. pp. 456-460.
6. Parsons and Jerry, (2002): "Gardening column: watermelons". Texas cooperative extension of the texas A & M University system.**42 (6)** 1164-1194.
7. Wind, D. (2008).Watermelon, *Citrullus lanatus*- Nutrition & Growing Tips.Dave's Garden, El Segundo, California, USA.<<http://davesgarden.com/guides/articles/vi ew/1517/>>.
8. Jonathan and John (2005): watch your garden Grow: watermelon" Cochrane system 2254-65.
9. Mandel, H., Levy, N., Izkovitch, S. and Korman, S.H. (2005)."Elevated plasma citrulline and arginine due to consumption of *Citrullus vulgaris* (watermelon)". *Berichte der deutschen chemischen Gesellschaft*, **28 (4)**: 467–472.
10. Madhavi, P, Kamala V., Habibur, R (2012). Hepatoprotective Activity of *Citrullus lanatus* Seed Oil on CCl₄ Induced Liver Damage in Rats (2012). *Scholars Academic Journal of Pharmacy* (SAJP), volume- 1, Issue-1.pg 30-33.



11. Gill, N.S., Bansal, R.K., Garg, M., Sood., S. Muthuraman, A., and Bali., M. (2010). Evaluation of antioxidant, anti-inflammatory and analgesic potential of *Citrullus lanatus* seed extract in rodent model. *The Internet Journal of Nutrition and Wellness*. Volume 9, Number 2.
12. Patrick, R.S and McGee, J.O. (1988). Biopsy pathology of the liver , Chapman and Hall, London, 163.
13. Jiyun, A. ,Wonhee, C. Suna, K. and Taeyoul H. (2011). Anti-diabetic effect of watermelon (*Citrullus vulgaris* Schrad) on Streptozotocin-induced diabetic mice Food Science and Biotechnology Volume 20, Issue 1 , pp 251-254.
14. Varghese, S andNarmadha, R. (2013). Evaluation of hypoglycemic effect of ethanolic seed extracts of *Citrullus lanatus*.*J of Phytopharmacol* 2(6): 31-40.
15. Rahman H, Manjula K and Anoosha, T. (2013). In-vitro antioxidant activity of *Citrullus lanatus* seed extracts, *Asian J Pharm Clin Res* 2013; 6 (3):152-157.
16. Ranjna, C., 1999. Practical Clinical Biochemistry. Methods and Interpretation. 2nd Edn., pp: 117
17. Gill. NS and Sood, S. (2011). Evaluation of antioxidant and anti-ulcerative potential of *Citrullus lanatus* seed extract in rats, *Lat. Am. J. Pharm.*, 30 (3): 429-434.
18. Alok, BRK., Vivek, D., and Niyaz, A. (2012). Evaluation of anti-ulcer activity of *Citrullus lanatus* seed extract in Wistar rats. *Journal of Pharmacy and Pharmaceutical Sciences* ISSN- 0975- 1491.Vol 4, Suppl 5.
19. Madhavi, P., Maruthi, Rao, Kamala Vakati, Habibur Rahman, M. and Chinna Eswaraiah (2012). Evaluation of Anti- Inflammatory Activity of *Citrullus lanatus* Seed Oil by *In-vivo* and *In-vitro* Models. *Int. Res J Pharm. App Sci.*, 2(4): 104-10.

