

## Physiology

**KEYWORDS:** Capsicum annum, biochemical parameters, blood glucose

## EFFECTS OF METHANOIC EXTRACT OF CAPSICUM ANNUM (CHILLI PEPPER) ON BIOCHEMICAL PARAMETERS AND BLOOD GLUCOSE LEVEL IN WISTAR RATS.



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### ABSTRACT

**Objective:** The current study investigated the effects of methanoic extracts of *capsicum annum* on biochemical parameters and blood glucose levels in male and female wistar rats.

**Materials and Methods:** A total of 33 wistar rats (12 females and 21 males) weighing between 80g and 120g were used in the study. These animals were divided into five groups (six rats each, for groups 1 and 2 and seven rats each for groups 3, 4 and 5). Group 1 served as controls and was only allowed access to grower's mash feed and water *ad libitum*. Groups 2, 3, 4 and 5 served as the test groups and were administered 5mg/kg bw, 10kg/kg bw, 15mg/kg bw and 20mg/kg bw of methanoic extract of *Capsicum annum* fruit respectively (these groups of rats were equally allowed access to grower's mash feed and tap water *ad libitum*). The treatment lasted for four (4) weeks after which the animals were anaesthetized and blood samples harvested from them via cardiac puncture. Serum of each sample obtained after proper centrifuging were subjected to biochemical analysis using biochemical analyzer (Reflotron Plus). Animals in the respective groups from which blood glucose levels were measured had their tails pricked and about 0.6µl of blood obtained and dropped on the oxidase reagent impregnated spot on the ONE-TOUCH® strip inserted in a glucometer.

**Result:** Values from the various laboratory screenings of the present study, were subjected to statistical analyses (using the statistical package for social sciences-SPSS) and the results showed significant increases ( $p < 0.05$ ) in the test groups' levels of aspartate aminotransferase (AST), Alanine aminotransferase, (ALT), Alkaline phosphatase (ALP) as well as significant ( $P < 0.05$ ) decreases in blood glucose levels of all test groups' animals.

**Conclusion:** Considering the outcome of the current study, it implies that that consistent consumption of *capsicum annum* (chilli peppers) may possibly impair liver functions or damage it. This extrapolation is due to the raised levels of AST, ALT, and ALP, however, mild consumption of the same plant, could be of therapeutic benefits, as seen in its blood glucose reduction potentials. The current study therefore, recommends that *Capsicum annum* (chilli pepper), should be consumed mildly (particularly in hyperglycemic conditions), in order to achieve its beneficial properties.

### 1. INTRODUCTION

*Capsicum annum* (chilli pepper) is a genus of flowering plants in the nightshade family Solanaceae, which is a cultivar of capsicum (pepper).<sup>[1]</sup> The generic name is derived from the Greek word kapto, meaning "to bite" or "to swallow".<sup>[2,3]</sup> The fruit of *Capsicum annum* plant have a variety of names depending on place and type. The

piquant (spicy) varieties are commonly called chili peppers or simply "chilies". In Nigeria chilli pepper is held dearly by the Yorubas of south-west Nigeria. The Igbos call it *ose*. The Yorubas call it *atare* while the Hausas call it *borkunu*.<sup>[4]</sup>

Some local studies have linked the high consumption of different types of chili peppers by the Yoruba tribe in Nigeria to their high life expectancy (number of years lived in good health). It is said that the Yorubas use at least five different types of chili pepper in making a stew or soup.<sup>[4]</sup>

Fresh Chilli peppers have been reported to be very rich in vitamin C: 94mg per 74g in comparison to only 37mg of same quantity in oranges. This may be linked to its effective immune system stimulatory and wound healing properties.<sup>[5]</sup> *C. annum* should be avoided by people allergic to it and in this category are pregnant women as the constituents of the pepper can stimulate intense contraction of the uterus, thus endangering their pregnancies.<sup>[5]</sup>

*Capsicum annum* (chilli pepper) is used as a common spice in food recipes across the world. It has therefore being a subject of investigation by researchers in order to ascertain its possible actual biological effects.<sup>[6, 7]</sup> Besides new medicinal applications, the pungency of pepper or hotness have being examined by scientists and researchers over decades in order to know its effects on most systems of the body (reproduction, respiration, immune systems and on some organs of the body such as liver, also in fasting blood glucose on laboratory animals such as rats, mice as the case may be.<sup>[6]</sup>

Mohamed and Saleh,<sup>[7]</sup> reported that, extensive consumption of hot pepper (chilli pepper) induced a significant increase in temperature of rabbits after oral ingestion of each dose. Hepatic tissue damage was recorded through examination of the stained paraffin embedded sections. Inflammatory cellular infiltration and hepatocyticvacuolation were marked in rabbits ingested with the hot red pepper. Histochemical studies reveal a decrease in both of carbohydrates and protein contents in the liver. Increased Serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), cholesterol, triglycerides and glucose was decreased in rabbit due to oral ingestion of hot red pepper. These scientific evidences shown that hot red pepper possesses some chemical and pharmacological properties and if consumed without caution could induce tissue damage.<sup>[7]</sup>

Measurement of liver enzymes is a common test in basic health check up and has revealed the increasing prevalence of asymptomatic patients with mild elevation in aspartate aminotransferase (AST), alanine aminotransferase (ALT), the National Health and Nutrition centre recorded that elevated liver transaminases levels is up to 8.9% of the survey population.<sup>[8]</sup> Although, there are several published guidelines for the workup of

symptomatic transaminases level elevation<sup>[9, 10]</sup> however, prospective studies are sparse.<sup>[11]</sup> The present study thus seeks to investigate the effects of methanolic extract of *capsicum annuum* pepper (chilli pepper) on biochemical parameters and fasting blood glucose level in wistar rats.

## 2. MATERIALS AND METHODS

### a. Design

This study was an experimental based one and used 33 wistar rats (12 females and 21 males) weighing between 80g and 120g were used in the study. These animals were grouped into five (six rats each for group 1 and 2 and seven rats each for group 3, 4 and 5). Group 1 served as controls and were only allowed access to grower's mash feed and water *ad libitum*. Groups 2, 3, 4 and 5 served as the test groups and were administered 5mg/kg bw, 10kg/kg bw, 15mg/kg bw and 20mg/kg bw respectively of methanolic extract of *Capsicum annuum* fruit diluted in 50ml of normal saline for oral administration using the gavage method. These groups of rats were equally allowed access to grower's mash feed and tap water *ad libitum*. The treatment lasted for four (4) weeks after which the animals were anaesthetized and blood samples harvested from them.

### b. Plant Materials

*Capsicum annuum* (chilli pepper) basket was obtained from a model market within Port Harcourt City and was identified and authenticated by a specialist in the herbarium of the department of Plant Science and Biotechnology, University of Port Harcourt. The chilli pepper was washed and air-dried for one week and were reduced to coarse powdery form for methanolic soxhlet extraction.

### c. Preparation of the Plant Methanol Extract

The powder sample of capsicum (chilli pepper) was soaked in distilled water for 48- hrs (2 days), after which it was sieved. The extracts obtained were kept in a refrigerator at a temperature of 4°C after every administration, to avoid enzyme activity.

### d. Experimental Animals

A total of 33 wistar rats (12 females and 21 males) weighing between 80g and 120g were used in the study. All the animals were treated according to the National Institute of Health Guidelines for the care and use of laboratory animals (NIH, department of health and Human services, publication n0.85-23 revised 1985). They were acclimatized for two weeks at the end of which they were divided into five groups (six rats each for group 1 and 2 and seven rats each for group 3, 4 and 5). Group 1 served as controls and were only allowed access to grower's mash feed and water *ad libitum*. Groups 2, 3, 4 and 5 served as the test groups and were administered 5mg/kg bw, 10kg/kg bw, 15mg/kg bw and 20mg/kg bw respectively of methanolic extract of *Capsicum annuum* fruit diluted in 50ml of normal saline for oral administration using the gavage method. The treatment lasted for four (4) weeks after which the animals were anaesthetized and blood samples harvested from them. Administrations were by oral route to the animals, required doses were drawn according to weight of the rats

### e. Laboratory Screening

After 28 days (four weeks) of administration, blood samples were taken from the anaesthetized animals through cardiac puncture for the determination of biochemical parameters (liver enzyme test). The blood sugar level was determined by using the tails of the rats which were pricked and the blood (0.6µl) was put on the oxidase reagent impregnated spot on the ONE-TOUCH® strip. The strip was inserted into the glucometer for about 10-15 seconds and the resulting intensity changes of blue colour from the oxidation reaction correlates with the concentration of glucose in the blood, which is displayed in the glucometer small window (screen).

## 3. RESULTS AND DISCUSSION

It is seen in table 1 that aspartate aminotransferase (AST) levels significantly ( $P<0.05$ ) increased in the test groups (2, 3, 4 and 5)

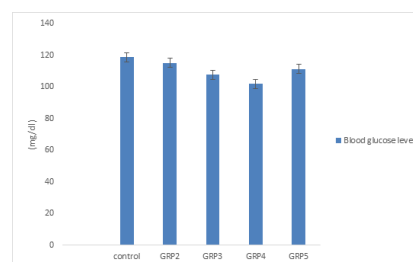
when compared to the control. The extent of the increment was that group 2 (5mg/kg) was increased by 52.0 U/L, group 3 (10mg/kg) was increased by 48.75 U/L, group 4 (15mg/kg) was increased by 42.0 U/L and group 5 (20mg/kg) was increased by 63.25 U/L respectively, when extracts was administered orally as compared to the control. From table 1 also, in the test groups 2(5mg/kg), and 5(20mg/kg) ALT levels were significantly ( $P<0.05$ ) decreased (9.0 U/L, and 11.25 U/L respectively) but increased significantly ( $P<0.05$ ) in test group 4 (10mg/kg) at 47.75 U/L when extracts was administered.

Again in table 1 below, the effects of capsicum annum extract on ALP (alkaline phosphatase) was shown, there was a significant ( $p<0.05$ ) increase in the test group 4 (15mg/kg: 75.0 U/L) and 5 (20mg/kg: 91.50 U/L).

In figure 1, it is seen that the blood sugar levels of all test groups (2, 3, 4 and 5) were All values are presented in mean  $\pm$  SEM,  $n=6$   $P \leq 0.05$ . \* means values are statistically significant to the control. AST= Aspartate aminotransferase, ALT =Alanine aminotransferase, ALP= Alkaline phosphatase.

**Table 1: Effects of Capsicum on biochemical parameters for the period of six (6) week**

S/No	Groups	AST (IU/L $\pm$ sem)	ALT (IU/L $\pm$ sem)	ALP (IU/L $\pm$ sem)
1	Group 1 (control)	13.75 $\pm$ 2.56	31.75 $\pm$ 20.86	52.50 $\pm$ 12.99
2	Group 2 (5mg/kg)	52.0 $\pm$ 21.61*	9.0 $\pm$ 1.92*	41.25 $\pm$ 11.25
3	Group 3 (10mg/kg)	48.75 $\pm$ 17.53*	26.25 $\pm$ 16.94	45.0 $\pm$ 10.61
4	Group 4 (15mg/kg)	42.0 $\pm$ 17.21*	47.75 $\pm$ 22.09*	75.0 $\pm$ 12.25*
5	Group 5 (20mg/kg)	63.25 $\pm$ 11.49*	11.25 $\pm$ 4.68*	91.50 $\pm$ 38.45*



**Figure 1: Bar chart showing the effect of oral administration of capsicum extract on blood glucose level of male and female albino wistar rats.**

Elevated levels of liver enzymes may indicate inflammation or damage to cells in the liver.[17] Inflamed or injured liver cells leak higher than the normal amount of certain chemicals including liver enzymes which results in elevated liver enzyme in blood test. In most cases liver enzymes level are only mildly and temporarily elevated with common causes ranging from Non-alcoholic fatty liver diseases, Hepatistatois and non-alcoholic steatohepatitis . [18]

The outcome of this study has revealed that oral administration of methanolic extract of capsicum annum increased aspartate aminotransferases (AST) of liver significantly ( $p< 0.05$ ) in the test groups 2 (5mg1kg), 3(10mg1kg) group 4 (15mg1kg) and group 5(20mg1kg) which were treated with methanolic extracts of capsicum annum. The significant increase in the AST of the test group agrees with the study carried out by Dkhil, and Al-Quraishy [7] who stated that increase in AST may have resulted from damage to liver cells which can in turn impair liver functions. It also agrees with

the work carried out by Ojeh et al., [13] on the regulated effect of capsicum frutescens supplement diet (CFSD) on fasting blood glucose level, biochemical parameters & body weight of alloxan induced diabetic wistar rat where it was concluded that, there was increase in serum AST and ALT, uric acid & total cholesterol.

For the ALT (alanine aminotransferase) comparing the test group with the control, results in the present study showed also that there was insignificant increase ( $P < 0.05$ ) in the control compared to Test group 2, 3 and 5). A significant increase ( $P < 0.05$ ) was recorded in the test group 4 where the increase was about 50%, making test group 4 likely to suffer impaired liver function. ALP also showed significant increase ( $< 0.05$ ) in test group 4 and 5.<sup>[14]</sup>

Results from ALP (alanine phosphatase), showed a significant increase ( $< 0.05$ ) in test group 4 and 5 compared to the control group. However, there was an insignificant increase ( $> 0.05$ ) in the control but not statistically significant compared to the test group 4 and 5. The primary importance of measuring ALP is to check the possibility of bone or liver diseases. [15] This increase in ALP can possibly lead to some serious liver diseases.

For the blood glucose, results showed that serum blood glucose levels were decreased in the test groups as compared to the control that were not administered capsicum extract. This shows that capsicum annum extract decreased the serum blood glucose level in the test group which agrees with [14, 16] that decrease in serum glucose is due to red pepper administration) and [13] that administration of the extracts red pepper are capable of decreasing the level of Serum blood glucose.

#### 4. CONCLUSION

The current study has revealed that a four week's administration of various doses of methanolic extracts of capsicum annum in wistar rats showed the tendencies of causing a level of hepatocellular damage. This could be due to the type of active compound found in it. [16] Thus, the excessive consumption of capsicum annum (Chilli pepper) has the potential of inducing liver damage. [7, 13.] It was also discovered that the extract was able to decrease the levels of serum blood glucose. Generally, the result have revealed that continuous or excessive consumption of capsicum annum (chilli peppers) may impair liver functions as seen in the triggered release of AST, ALT, and ALP, but could be beneficial when taken in mild form (as the extract was able reduce serum blood glucose levels of the test animals).

Therefore, Capsicum annum (chilli pepper) should be consumed even though regular but in mild concentrations in their recipes especially in people with pathologically high blood sugar levels (diabetes mellitus) in order to reduce serum blood glucose level and hence prevent.

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#### REFERENCES

1. Wells, John C., (Longman Pronunciation Dictionary) (3rd ed.), Longman, 2008: 123, ISBN 9781405881180
2. Quattrocchi, Umberto. CRC World Dictionary of Plant Names. 1 A-C. CRC Press. 2000: 431. ISBN 978-0-8493-2675-2.
3. Walsh, B.M.; Hoot, S.B. "Phylogenetic Relationships of Capsicum (Solanaceae) Using DNA Sequences from Two Noncoding Regions: The Chloroplast atpB-rbcL Spacer Region and Nuclear waxy Introns" (- Scholar search). International Journal of Plant Sciences 2001; 162 (6): 1409-1418. doi:10.1086/323273.
4. Mecum, V. Fighting Breast Cancer, Obesity with Red Hot Pepper. 2010 [http://nigeriavillagesquare.com/forum/threads/fighting-breast-cancer-obesity-with-hot-pepper.56364/]
5. Ryoo, H, Sanchez,R., Guzman,M, Prieto,E. The Effect of Spiciness (Hot Peppers) on Heart Rate and Blood Pressure. 2011;4(3): 2-4
6. Bosland, P.W. An effective plant field-cage to increase the production of genetically pure chile (Capsicum spp.) seed. HortScience 1993;28:1053.
7. Dkhil, M.A. and Al-Quraishy, S. Effects of extensive consumption of hot red pepper fruit on liver of rabbit. Journal of Medicinal Plants Research. 2010; Vol. 4(23): 2533-2538, 4 December, 2010

8. Ioannou GIV, Boyko EJ, Lee SP. The prevalence and predictors of elevated serum amino transferase activity in the united states, in 1999-2003. AmjGastroenterol 2006; 101(1) 76-82.
9. Green RM, Flamm S. AGA technical review on the elevator of liver, chemistry tests. Gastroenterology 2002; 123(4): 1367-1384.
10. Pratt DS, Kaplan MM. evaluation of abnormal liver-enzymes results in asymptomatic patients NEngland J medical 2000, 342 (17): 1266-1271
11. Morisco F, Pagliaro L, Caporaso N, University of naplesfederio 2 Italy. For managing asymptomatic persistent non-viuous, non-alcohol released elevation of aminotransferase levels. 2008. 4(2):7-15.
12. Yakhak Hoe Chi. Journals of pharmaceutical society. (Taeken Yakkakhoe, c/o Pharmacy Seoul National Univ, Seoul 151,5 Korea) 1981. Vol 25 (3) 101.
13. Ojeh, E. A; Ese, A.C. and Lawrence, E.O. Regulated Effects of Capsicum frutescens Supplemented Diet (C.F.S.D) on Fasting Blood Glucose Level, Biochemical Parameters and Body Weight in Alloxan Induced Diabetic Wistar Rats. British Journal of Pharmaceutical Research 2013 3(3): 496-507.
14. Monsereenusorn Y (1983). Sub-chronic toxicity studies of capsaicin and capsicum in rats. Res. Commun. Chem. Pathol. Pharmacol., 1983:41:95-110.
15. Jeremy E. Kaslow, MD, FACP, FACAAI Physician and Surgeon Board Certified Internal Medicine 2015. A Guide for enzyme alternation.
16. Chaiyasit K, Khovidhunkit W, Wittayalerpanya S. Pharmacokinetic and the effect of capsaicin in Capsicum frutescens on decreasing plasma glucose level. J. Med. Assoc. Thai., 2009; 92:108-113.
17. Materska, M. and Perucka, I. . Antioxidant Activity of the Main Phenolic Compounds Isolated from Hot Pepper Fruit (Capsicum annum L.) J. Agric. Food Chem. 2005. 53, 1750-1756.
18. Rhoades, R. A. and Bells, D.R. Medical Physiology: Principles for Clinical. 4th edition. Lippincott Williams & Wilkins, Philadelphia. 2013. 536-548.