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EFFECT OF HYDRO-ETHANOLIC EXTRACT OF *SOLANUM AETHIOPICUM* FRUIT ON THE LIPID PROFILE OF WISTAR RATS.

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ABSTRACT

The rising trend in the prevalence of dylipidemia-associated medical conditions has been linked with poor dietary and lifestyle choices. The present study was aimed at investigating the effects of hydro-ethanolic fruit extract of *Solanum aethiopicum* on the lipid profile of wistar rats. A total of 24 wistar rats weighing about 140–180g were divided into 4 groups of 6 rats each. Group 1 served as control, groups 2, 3 and 4 received 200, 400 and 600 mg/kg body weight of the extract respectively for a period of 14 days. Thereafter, the animals were sacrificed and serum lipid profile determined using standard methods. The findings showed that the administration of the hydro-ethanolic fruit extract of *S. aethiopicum* resulted in a significant reduction in the serum Total Cholesterol, Triglycerides, Low Density Lipoproteins (LDL) and atherogenic index whereas the High Density Lipoproteins was increased. These findings suggest lipid lowering potential and could be beneficial in prevention and management of management dyslipidemia-associated conditions.
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Keywords: *Solanum aethiopicum*, Lipid profile, fruit extract.

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INTRODUCTION

There is an increasing trend in the prevalence of dyslipidemia-associated conditions such as diabetes mellitus and obesity in developing countries [1,2]. This rising trend has been linked mainly with lifestyle choice and low basal metabolic rate [3]. However, because of the high rate of morbidity and mortality that is often associated with dyslipidemia certain synthetic medications have been used in its management. Some of these medications are expensive and also have adverse effects when consumed on the long-term. Therefore appropriate dietary control and improved physical exercise have been widely recognized as probably the most viable and inexpensive approaches in the management of dyslipidemia-associated conditions [4]. Hence the need for more studies towards identifying easily accessible plant materials with proven benefits in mitigating against medical conditions associated with abnormal lipid metabolism [5].

The egg plant (*Solanum aethiopicum* L.) is an edible fruit vegetable crop which belongs to the family Solanaceae [6]. It is grown mainly for the nutritional, medicinal and economic values of its leaves and fruits. The egg plant is consumed globally and studies have shown that it is rich in dietary fibre, vitamins and minerals and low calories [7,8]. The fruit is also laced with a wide range of biologically active compounds such as amino acids, saponins, flavonoids, phenols, oxalic acid, solasodine, solanoflavone, tannins and ascorbic acid [1,9,10]. These substances have been implicated in the analgesic, anti-haemorrhoidal, antispasmodic, anti-oxidant, anti-glaucoma, antibiotic and ant-diabetic effects of the plant as well as its ability to reduce body weight [2,6,11,12,13,].

The aim of the present study was to investigate the effect of *S. Aethiopicum* fruit extract on the lipid profile of wistar rats.

MATERIALS AND METHODS

Collection and Preparation of Plant Extract

Fruits of *S. aethiopicum* used for this study were purchased from the Oil Mill market in Port Harcourt, Nigeria. The fruits were washed with water and chopped into tiny bits before sun-drying for a period of 2 weeks, after which they were ground into powder with a mechanical grinding machine and prepared for extraction at the department of Pharmacognosy, University of Port Harcourt. The extraction process was done using Soxhlet extractor, with hydro-ethanol (80% absolute ethanol and 20% water) as solvent. The solution was filtered with a white handkerchief and re-filtered with Whatman filter paper to get a clear filtrate. The filtrate was then concentrated using a rotary evaporator at an optimum temperature (40–50^0C). The filtrate containing the extract was poured into an evaporating dish and dried on a water bath at a temperature of 45^0C until it dried into a pastry form. The extract was re-suspended in distilled water before administration.

Experimental Animals

24 male wistar rats weighing between 160–200g were used in this study. They were kept in the animal house of Department of Human Physiology, University of Port Harcourt in spacious and well-ventilated cages at room temperature under natural dark and light cycle. The animals were allowed two weeks to acclimatize, during which they were allowed free access to rat feed and water. All animals were treated according to institutional guidelines for care and use of experimental laboratory animals. The present study was approved by the University of Port Harcourt Research Ethics committee with approval number; UPH/CEREMAD/REC/MM68/002.

Experimental Design

The animals used for this study were divided into 4 groups of 6 animals each. Group 1 served as Control. Groups 2, 3 and 4 received 200, 400 and 600 mg/kg body weight of the fruit extract of *S. aethiopicum* respectively via oral gavage once daily for 14 days.

Sample Collection and Determination of lipid profile

The experiment lasted for a period of 14 days and thereafter, the animals were sacrificed under light chloroform anaesthesia. Blood samples were collected via cardiac puncture for the analysis of lipid profile; Total Cholesterol (TC), Triglycerides (T), Low Density Lipoproteins (LDL) and High Density Lipoproteins (HDL), with the aid of the kinetic methods kits (Randox: United Kingdom) using a double-beam spectrophotometer.

Statistical Analysis

Statistical analysis was done using SPSS vs 23.0 (SPSS incorporated, Chicago, Illinois, USA). Data are expressed as mean ± standard error of mean (SEM) and presented in tables. Significant differences were determined using one-way analysis of variance (ANOVA), while a *p*-value of less than 0.05 ($p<0.05$) was considered statistically significant.

RESULTS AND DISCUSSION

Table 1: *Effect of hydro-ethanol extract of S. aethiopicum fruit on Lipid Profile*

	Parameters				
Groups	**Total cholesterol (mmol/L)**	**Triglycerides (mmol/L)**	**HDL (mmol/L)**	**LDL (mmol/L)**	**Atherogenic Index**
Control	2.38 ± 0.09	0.78 ± 0.10	0.94 ± 0.10	1.27 ± 0.19	-0.09 ± 0.05
200mg/kg	1.90 ± 1.83	0.75 ± 0.06	1.07 ± 0.03	0.76 ± 0.22	-0.16 ± 0.05
400mg/kg	2.05 ± 0.27	0.61 ± 0.04	1.21 ± 0.03*	1.14 ± 0.23	-0.30 ± 0.04*

600mg/kg	1.67 ± 0.27*	0.56 ± 0.10	1.15 ± 0.05	0.77 ± 0.10	-0.33 ± 0.08*

Data are expressed as mean ± SEM, n=6
* significantly different from control group (P<0.05)

A high level of blood cholesterol level, particularly Low Density Lipoprotein (LDL) and Total Cholesterol is a primary risk for cardiovascular diseases like stroke and heart disease, while their reduction could lead to decreased risk of atherosclerosis and coronary heart diseases [2,14]. High Density Lipoprotein (HDL) on the other hand is known as a biochemical entity with cardio-protective effect due to its ability to promote cholesterol transport from arteries to the liver for breakdown [15,16].

The result shown in table 1 showed that the high dose (600mg/kg) of the extract produced a statistically significant ($p<0.05$) reduction in the serum Total Cholesterol (TC) level when compared to the control group, while the lower doses (200 and 400 mg/kg) did not give any significant reduction in TC. For the Triglycerides and Low Density Lipoprotein (LDL) concentrations, there was slight reduction with increasing concentrations of the extract, although not significantly. High Density Lipoproteins (HDL) increased slightly in the extract treated groups but significant increase was only observed in the 400mg/kg group ($p<0.05$) compared to control. The atherogenic index decreased in a dose dependent fashion, although only significantly at the 400mg/kg and 600mg/kg extract treated groups comparison with the control group.

Results of the present study is similar to the findings of Akinwunmi and Ajibola [17] which revealed that S. aethiopicum extract has possible lipid lowering activity in experimental animal models. This activity of the plant can be linked to the impacts of the phytochemical contents embedded in the plant such as saponins, flavonoids, tannins and phenolic compounds [1,12] as well as dietary fibre [18,19,20]. Tannins have been investigated and found to play a role in the reduction of plasma lipids via several means such as; inhibition of hepatic lipid synthesis, lipoprotein secretion, promoting the production of bile and thus lipid digestion and upregulation of LDL receptor expression [1,21,22,23,24,25]. Also, saponins have been reported by Vinarova *et al*., [26] and Yin *et al*., [25] to have the ability to act as cholesterol-lowering agents due to its ability to reduce plasma lipids while Elekofehintimi *et al*., [27] reported that the hypolipidemic impact of saponin could be as a result of its ability to enhance LDL receptors. Also, Chen *et al*., [28] in their study recognized that Saponins inhibited cholesterol absorption from the intestines, by binding to bile acids thereby leading to increased bile acid excretion, with the consequence of this action seen as elevated HDL-cholesterol due to reverse cholesterol transport, just as illustrated in the finding of this study.

The necessity of reduced levels of these lipids in managing dyslipidemia, especially in atherogenic conditions is well known [20]. The atherogenic index gives a measure of the risk of cardiovascular disease. According to the findings, the atherogenic index was reduced in a dose-dependent manner. This is similar to the findings of Akinwunmi and Ajibola [17]. Therefore, it is suggested that *S. aethiopicum* fruit may be beneficial in the dietary management of dyslipidemia.

CONCLUSION

The present study has shown that administration of hydro-ethanolic fruit extract of *S. aethiopicum* caused a significant lowering effect on total cholesterol, LDL and atherogenic index, no significant effect on triglycerides while increasing the HDL concentrations. These findings could suggest cardio-protective potential of the fruit extract and could be beneficial in prevention and management of dyslipidemia-associated conditions.

REFERENCES

1. Nwodo, S. C, Okwuchukwu, K. E., & Solomon, O. R. (2013). Effects of *Solanum aethiopicum*Fruit onPlasma Lipid Profile in rats. *Advances in Bioresearch*, *4*(4), 79 – 84.

2. Ogunka-Nnoka, C. U., Onyegeme-Okerenta, B. M., & Omeje, H. C. (2018). Effects of Ethanol Extracts of S. aethiopicum Stalks on LipidProfile and Haematological Parameters of Wistar Albino Rats. *International journal of science and research methodology, 10*(3), 215 – 229

3. Ogden, C., Carrol, M., Curtin L., McDowell, M., Tabak, C., & Flegal, K. (2006). Prevalence of overweight and obesity in the United States. *Journal of the American Medical Association, 295*(13), 1549 – 1555.

4. Keithley, J., & Swanson, B. (2005). Glucomannan and obesity: a critical review. *Alternative Therapies in Health and Medicine, 11*(6), 3034.

5. Kapiga, S. (2011) Commentary: Non-communicable diseases in sub-Saharan Africa: a new global health priority and opportunity. *Int J Epidemiol 40*, 902 – 903.

6. Nwanna, E. E., Ibukun, E. O., & Oboh, G. (2016). Effect of some tropical eggplant fruits (Solanum Spp) supplemented diet on diabetic neuropathy in male Wistar rats in-vivo. *Functional Foods in Health and Disease, 6*(10), 661 – 676.

7. Raigon, M. D., Prohens, J., Munoz-Falcon, J. E., & Nuez, F. (2008). Comparison of eggplant landraces and commercial varieties for fruit content of phenolics, minerals, dry matter and protein. *J Food Compos Anal., 21*(5), 370 – 376.

8. USDA ARS (United States Department of Agriculture Agricultural Research Service), National Nutrient Database for Standard Reference Release 28. Available at: https://ndb.nal.usda.gov/ndb/. Accessed on 21 May, 2021

9. Shen, G., Van Kiem, P., Cai, X. F., Li, G., Dat, N. T., & Choi, Y. A. (2005). Solanoflavone, a new biflavonal glycoside from *Solanum macrocarpon*: Seeking for anti-inflammatory components. *Arch Pharm Res., 28*, 657 - 659.

10. Das, M., & Barua, N. (2013). Pharmacological activities of *Solanum macrocarpon* Linn. (Brinjal plant). *Int J Green Pharm, 7*, 274 – 277.

11. Obia, O., Chuemere, A. N., Chike, C. P. R., & Nyeche, S. (2017). Effect of supplementation of natural honey on serum albumin and total protein of alloxan-induced diabetic wistar rats. *Am J Phytomed Clin Ther* 5 (3): 21.

12. Obia, O., & Asuquo, E. A. (2018). Endogenous antioxidant responses to dietary honey supplementation in alloxan-induced diabetic wistar rats. *Journal of Nursing and Health Science*, 7 (6): 37-40.

13. Ossamulu, I. F., Akanya, H. O., Jigam, A.A., Egwim, E. C., & Adeyemi, H. Y. (2014). Hypolipidemic Properties of Four Varieties of Eggplants (*Solanum melongena*L.). *International Journal of Pharmaceutical Science Invention*, 3(8), 47 – 54.

14. Auta, R., & Ali, I. (2011). Nutritional and Chemical Evaluation of *Solanum incanum* (Bitter garden egg). *International Journal of Tropical Medicine and Public Health*, 1, 96 – 107.

15. Kosmas, C. E., Sourlas, A., Mallarkey, G., Silverio, D., Ynoa, D. Y., Montan, P. D., Guzman, E., & Garcia, M. J. (2019). Therapeutic management of hyperlipoproteinemia (a). *Drugs context*. 8: 212609.

16. Tanaka, S., Couret, D., Tran-Dinh, A., Duranteau, J., Montravers, P., Schwendeman, A., & Meilhac, O. (2020). High-density lipoproteins during sepsis: from bench to bedside. *Crit Care*. 24: 134.

17. Akinwunmi, K. F., & Ajibola, I. O. (2018). Evaluation of Anti-obesity Potentials of Phenolic-Rich Fraction of Solanum aethiopicum L. and Solanum macrocarpon L on Diet-induced Obesity in Wistar Rats. European Journal of Medicinal Plants, 26 (1): 1 – 10.

18. Chinedu, S. N., Eboji, O. K., & Rotimi, S. O. (2013). Effects of Solanum aethiopicum fruit on plasma lipid profile in rats. *Advances in Bioresearch, 4*(4), 79 – 84.

19. Edijala, J. K., Asagba, S. O., Eriyamremu, G. E., & Atomatofa, U. (2005). Comparative Effect of Garden Egg Fruit, Oat and Apple on Serum Lipid Profile in Rats Fed a High Cholesterol Diet. *Pakistan Journal of Nutrtion, 4*(4), 245 – 249.

20. Rotimi, O. A., Olayiwola, I. O., Ademuyiwa, O., & Balogun, E. A. (2012). Effects of fiber-enriched diets on tissue lipid profiles of MSG obese rats. *Food Chemistry and Toxicology*, 50 (11): 4062 – 4067.

21. Adeli, K., Taghibiglou, C., & Van Iderstine, S. C. (2001). Mechanisms of hepatic very low-density lipoprotein overproduction in insulin resistance. *Trends in Cardiovascular Medicine*, 11 (5): 170 – 176.

22. Borradaile, N. M., de Dreu, L. E., Barrett, P. H., Behrsin, C. D., & Huff, M. W. (2003). Hepatocyte apoB containing lipoprotein secretion is decreased by the grapefruit flavonoid, naringenin, via inhibition of MTP-mediated microsomal triglyceride accumulation. *Biochemistry, 42,* (5), 1283 – 91.

23. Del Bas, J. M., Fernandez-Larrea, J., Blay, M., Ardevol, A., Salvado, M. J., Arola, L., & Blade, C. (2005). Grape seed procyanidins improve atherosclerotic risk index and induce live CYP7A1 and SHP expression in healthy rats. *FASEB J*, 19 (3): 479 – 81.

24. Okafor, H. K., Odugbemi, A. I., Okezie, C. B., & Achebe, M. K. (2016). Antidiabetic and Hypolipidaemic Effects of Garden Egg (Solanum aethiopicum) Leaf Extract in Beta-cells of Streptozotocin Induced Diabetic Male Wistar Rats. *Annual Research & Review in Biology*, 10 (6): 1 – 11.

25. Yin, M., Zhang, P., Yu, F., Zhang, Z., Cai, Q., Lu, W., Li, B., Qin, W., Cheng, M., Wang, H., & Gao, H. (2017). Grape seed procyanidin B2 ameliorates hepatic lipid metabolism disorders in db/db mice. *Mol Med Rep.* 16 (3): 2844 – 2850.

26. Vinarova, L., Vinarov, Z., Atanasov, V., Pantcheva, I., Tcholakova, S., Dencov, N., & Stoyanov, S. (2015). Lowering of cholesterol bioaccessibility and serum concentrations by saponins: in vitro and in vivo studies. *Food Funct*, 6 (2): 501 – 12.

27. Elekofehinti, O. O., Adanlawo, I. G., Saliu, J. A., & Sodehinde, S. A. (2012). Saponins from Solanum anguivi fruits exhibit hypolipidemic potential in Rattus novergicus. *Der Pharmacia Lettre. 4*(3), 811 – 814.

28. Chen, Z., Lei, Y. L., Wang, W. P., Lei, Y. Y., Liu, Y. H., Hei, J., Hu, J., & Sui, H. (2017). Effects of saponins from Trigonella Foenum-Graecum seeds on Dyslipidemia. *Iran J Med Sci.* 42 (6): 577 – 585.