EFFECT OF REHEATED OIL ON SERUM LIPID AND HISTOLOGICAL CHANGES OF THE LIVER OF SPRAGUE-DAWLEY RATS AND POSSIBLE TREATMENT WITH VERNONIA AMYGDALINA

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Abstract –
Background: Vernoniaamygdalina belongs to the family Asterecae. It contain an active components or phytochemicals that can lead to liver regenerations in hepatotoxicity in hepatoxicity.The effect of ingestion of heated and reheated sunflower oil on lipid and histological alterations and the effectiveness treatment with methanolic extract of Vernoniaamygdalina leaves was investigated with Sprague dawley rats.
Method: The rats were divided into 4 groups, the first group fed with fresh sunflower oil, the second group fed with heated sunflower oil, the third group fed with reheated sunflower oil and the fourth group fed with only rat chow for 30 days. The rats were grouped into two, based on the dose of Vernoniaamygdalina administered that is low dose group (50mg/kg) and high dose group (250mg/kg).
Result: There was hyperdyslipedemia in rats feed with heated and reheated sunflower oil with the amount of cholesterol to be 11.7mmol/Land 14.6mmol/L respectively. The amount of cholesterol was significant with p-value of 0.006 compared with the control group. The amount of triglyceride was also high for both heated and reheated oil with the amount of 8.8mmol/L and 9.0mmol/L respectively which was statistically significant compared with the control group (p-value-0.005).The histological study of the liver showed severe degeneration of the hepatocytes, severe accumulation of fats, disruption and constriction of the sinusoids, destruction of kupffer cells and necrosis of the hepatocytes.
Conclusion: After the treatment with the extract, these conditions were still present in the fresh, reheated and heated induced liver treated with the low dose of the extract.

I. INTRODUCTION

Sunflower oil is a non-volatile oil expressed from sunflower seed. It is a mixture of polyunsaturated fats and monounsaturated fats with low unsaturated fat levels of oleic acid and linoleic acid. It is considered as a potent modulator of lipid profile and reduction of cardiovascular disease. The effect of ingestion of heated and reheated sunflower oil on lipid and histological alterations and the effectiveness treatment with methanolic extract ofVernoniaamygdalina leaves was investigated with Sprague dawley rats.

II. METHOD

The rats were divided into 4 groups, the first group fed with fresh sunflower oil, the second group fed with heated sunflower oil, the third group fed with reheated sunflower oil and the fourth group fed with only rat chow for 30 days. After thirty days, some of the rats were dissected and their liver were harvested and blood samples were taken. The remaining rats were grouped into two, based on the dose of Vernoniaamygdalinaadministered that is low dose group (50mg/kg) and high dose group (250mg/kg). After fourteen days of administering the extract, the rats were dissected and their liver were harvested and blood were taken. After this, the histopathological and biochemical analysis were made.

III. RESULTS

PARAMETERS	CONTROL	FRESH OIL	HEATED OIL	REHEATED OIL	P- VALUE
UREA (mg/dl)	20.50±2.5	51.72±1.18	56.33±0.88	63.59±0.86	0.07
CREATININE (mg/dl)	1.07±0.16	1.45±0.05	1.72±0.4	1.81±0.01	1.04
ALT (U/L)	42.87+7.5	63.85+0.35	66.60+0.7	70.05+0.15	0.005
AST (U/L)	49.69+3.33	61.85+1.35	65.65+0.75	70.00+0.30	0.009
TOTAL PROTEIN (g/d)	6.25±0.2	8.36±0.14	8.93±0.02	9.99±0.00	0.98

CHOLESTEROL (mg/dl)	88.69±6.3	200.93+1.0	210.79±1.33	262.06±9.95	0.006
TRIGLYCERIDE (mg/dl)	78.02±5.2	158.48+0.9	161.74±1.48	167.18±2.41	0.0005

Table 1: Biochemical Activity of Sunflower Oils
Values presented as mean + SEM (n=5).

PARAMETERS	CONTROL	FRESH OIL TREATMENT	VA TREATENT		P –VALUE
			50mg/kg	250mg/kg	
UREA (mg/dl)	20.50±2.50	51.72±1.18	44.39±1.68	38.06±0.00	0.008
CREATININE (mg/dl)	1.07±0.16	1.45±0.05	1.18±0.08	1.10±0.12	0.87
ALT (U/L)	42.87±7.75	63.85±0.35	58.50 ±0.80	51.30±0.40	0.006
AST (U/L)	49.69±3.33	61.85±1.35	60.10±0.20	44.35±0.55	0.009
TOTAL PROTEIN (g/d)	6.25±0.25	8.36±0.14	6.55±0.28	5.68±0.10	0.98
CHOLESTEROL (mg/dl)	88.69±6.36	200.93±1.00	112.41 ±2.99	96.78±0.23	0.0008
TRIGLYCERIDE (mg/ dl)	78.02±5.21	158.48±0.99	81.82±0.60	76.72±1.49	0.0007

Table 2: Effect of Fresh Sunflower Oil
Values presented as mean + SEM (n=5).

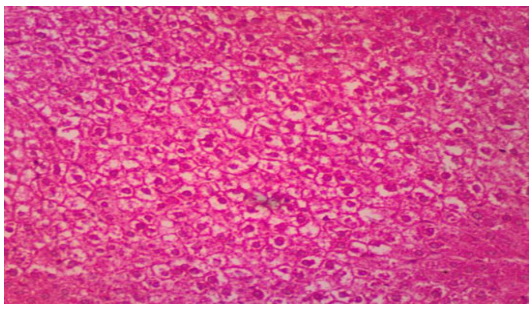


Fig1.1

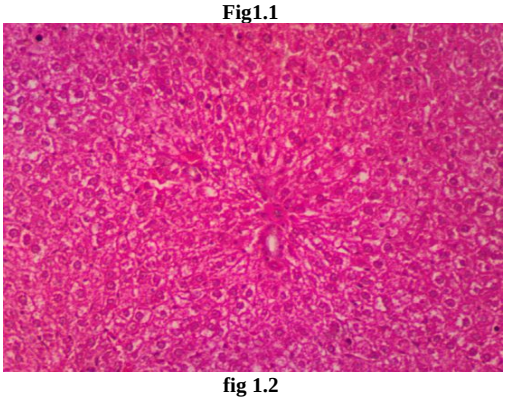


fig 1.2

These two figures depict the liver of rat fed with fresh oil for four weeks. It could be observed that the liver is undergoing morphological changes such as fatty changes as a result of the accumulation of lipid and constricted sinusoids.The liver cells are seen to be normalchanges as a result of the accummulation of lipids and constricted sinusoids.

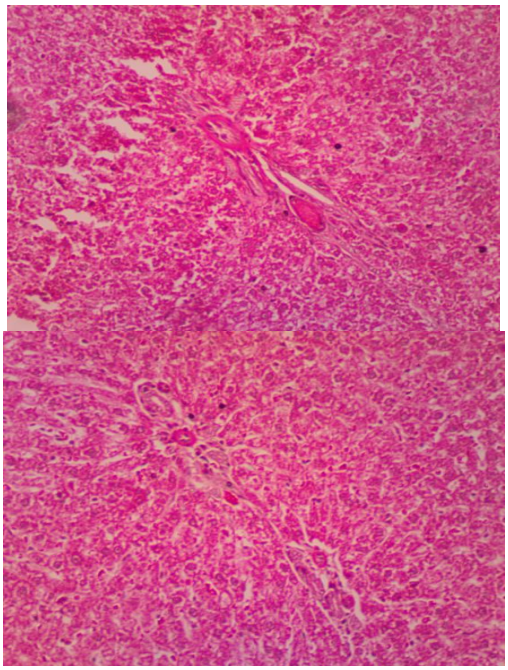


Diagram of the liver of rats fed with heated oil. Here fatty change is more prominent than inthose fed with fresh oil as there is accumulation of lipid.There are sinusoidal constrictions.

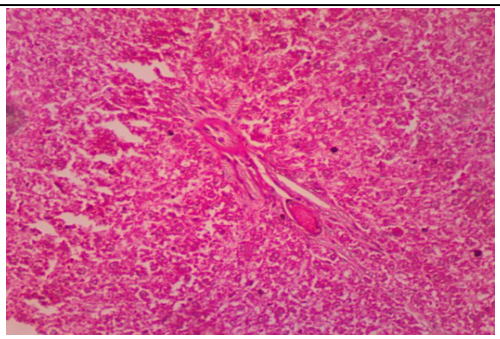


FIG 3.1

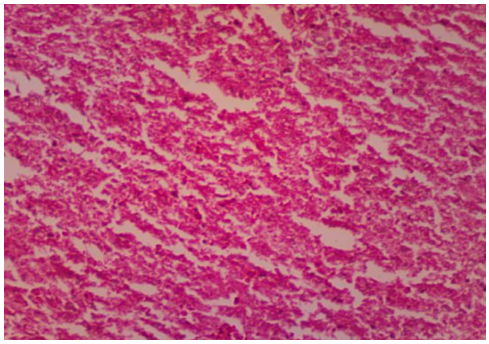


fig 3.2

The liver of rats fed with reheated oil. There is microvesicular fatty changes. Steatosis is very prominent here and the hepatocytes are few. There is lost of sinusoidal demacations. There is focal necrosis of the hepatocytes.

TREATED GROUP LOW DOSE

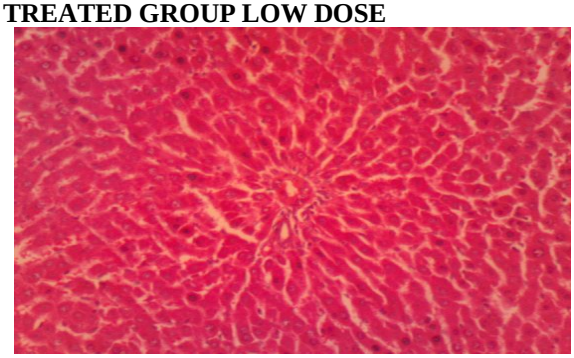


Fig4.0

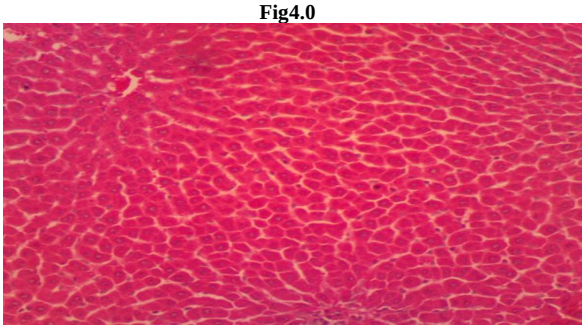


Fig 4.1

These diagrams depict the liver of rats fed with fresh oil and later given the extract. there are fatty changes but it's not very prominent. The hepatocytes seem to be normal.Sinusoidal demarcations are also clear.

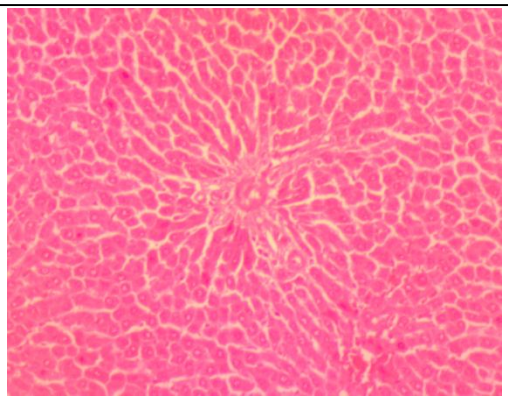


Fig5.0

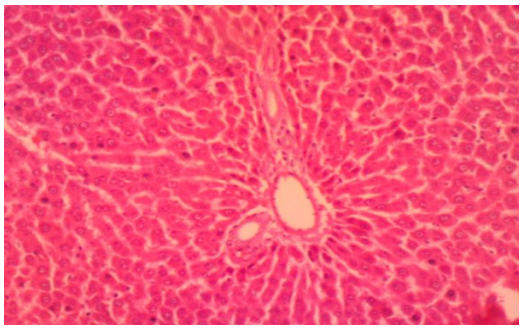


Fig 5.1

These diagrams depict the liver of rats fed with heated oil and later given a low dose of the extract. The hepatocytes look normal with their portal triad present. The accumulation of fat is seen to have drastically reduced.

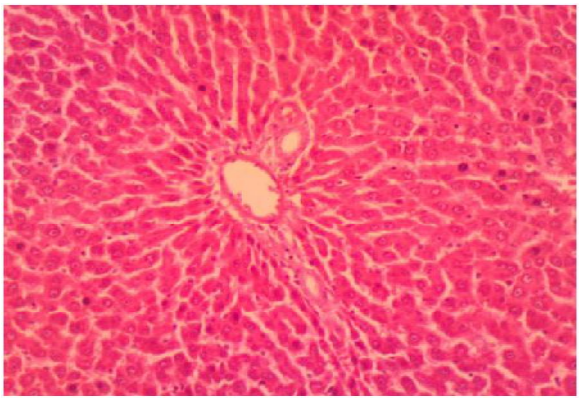


Fig 6.0

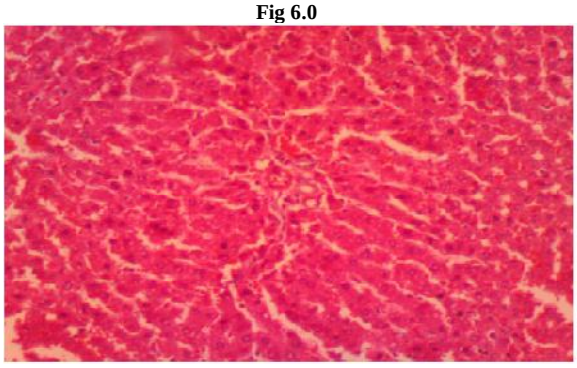


Fig 6.1

These diagrams depict the liver of the rat fed with re-heated sunflower oil and later given a low dose of the

extract. The central vein is very prominent here. There is low kupffer cell activation. Cytoplasm is less eosinophilic which means regeneration isn't complete.

HIGH DOSE GROUP

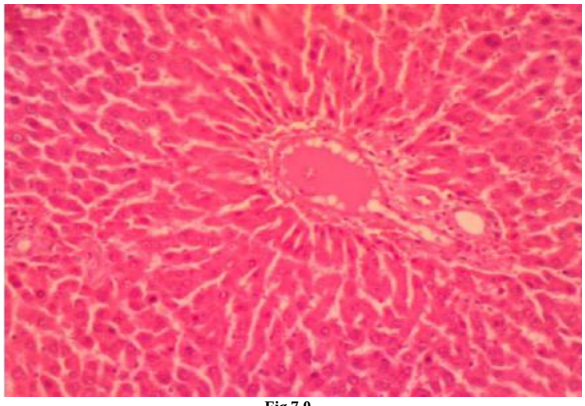


Fig 7.0

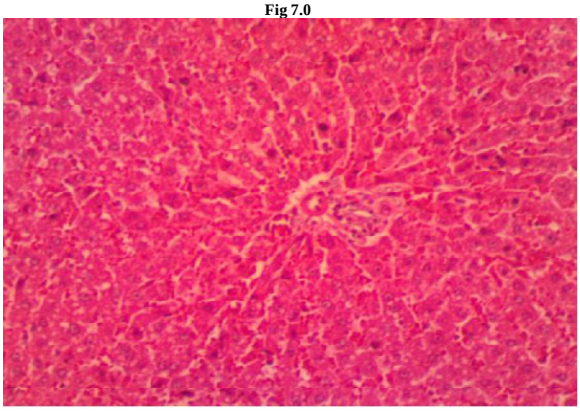


Fig 7.1

These diagrams depict the liver of rats fed with heated oil and given a high dose of the extract. There Is regeneration occurring. Cytoplasms are filled and vacoules are absent. sinusoids are back. constriction of sinusoid is zero. Fatty change is being reversed .mild activation ofkupffer cells and regeneration.

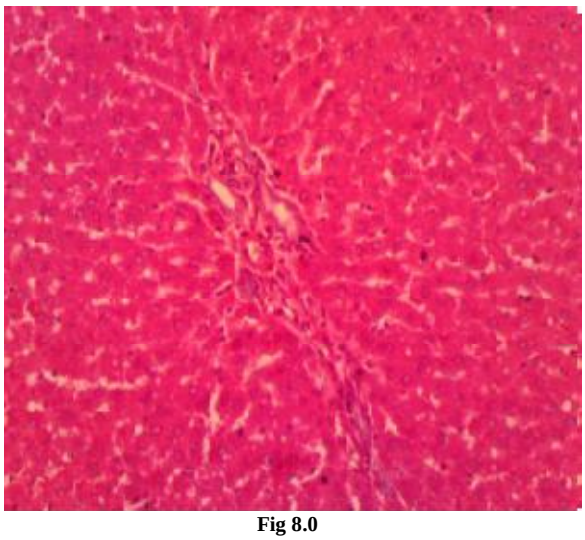


Fig 8.0

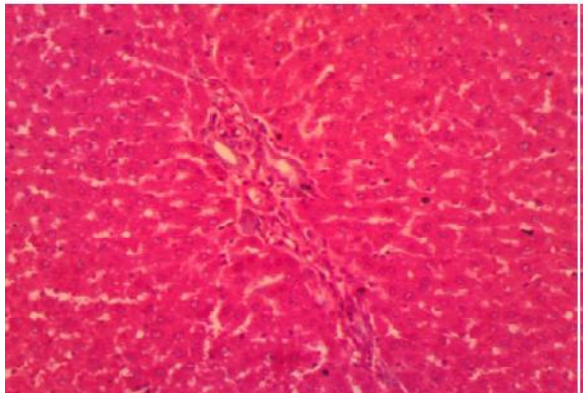


Fig 8.1

These depict the liver of rats fed with re-heated sunflower oil and given a high dose of the extract Extracts seem to increase the rate of necrotic cells from the prignotic to the chauretic state so they will totally go off. Regeneration is occurring. There are fatty change is being reversed and sinusoids are back.

DISCUSSION

It is concluded that use of repeatedly heated cooking oil causes a deteroriation in the histopathology of the liver and this effect can be reversed with methanolic extracts of V. amygdalina. Sunflower oil is widely used for cooking in Ghana and known to be a good and healthier choice compared to other vegetable oils because of it low monounsaturated mixture of oleic and linoleic. However, thermally oxidized sunflower oil generates free radicals and enhance oxidative stress[1].Oxidative stress deregulates cell function, resulting in several pathologies such as diabetes, atherosclerosis, cardiovascular dysfunction, liver damage, kidney damage among many others. In the present study, there was a significant increase in body weight of all groups compared to their respective initial weight after treatment with oil. The body weight increment was more in the reheated oil (RHSO), and heated oil (HSO) groups compared to the control and fresh oil (FSO) groups. Increment in body weight was as a result of free radicals interacting with serum lipids and depositing in adipose tissues [2]. After treatment with V. amygdalinaextract, the increased weight was found reducing close to normal because of the antioxidant properties of the extract [3][4]. Histopathological examination of the liver sections, showed different degrees of reparative effects which was dose-dependent. This work concurs with current previous studies where both young and old leaf extracts of VA caused total regeneration of STZ-induced hepatotoxicity[5].

CONCLUSION

It is concluded that use of repeatedly heated cooking oil causes a deteroriation in the histopathology of the

liver and this effect can be reversed with methanolic extracts of Vernoniaamygdalina.

REFERENCES

[1] Kamsiah J, Mohd R. M, Xin-Fang L, (2011). "The effects of heated vegetable oils on blood pressure in rats."Clinics (Sao Paulo). 66: 2125–2132.doi: 10.1590/S1807-59322011001200020

[2] Maritim, R.A. Sanders, J.B, (2003). "Watkins Diabetes, oxidative stress, and antioxidants". A review J.Biochem. Mol. Toxicol., 17 (1) pp. 24–38.

[3] Erasto P, Grierson DS, Afolayan AJ, (2007)." Evaluation of Anti-oxidant activity and fatty acid profile of the leaves of V. amygdalina growing in South Africa". J. Food Chemistry. 104:636-842.

[4] Iwalewa EO, Adewunmi CO, Omisore NOA, Adebanji OA, Azike CK, Adigun AO, Adesina OA, Olowoyo OG, (2005)." Pro- and anti-oxidant effects and cytoprotective potentials of nine edible vegetables in South West Nigeria". J. Med. Foods. 8:539–544.

[5] Asante DB, Effah-Yeboah E, Barnes P, et al. (2016). "Antidiabetic Effect of Young and Old Ethanolic Leaf Extracts of Vernoniaamygdalina: A Comparative Study". J. Diabetes Res., 2016 (19): 1-13. http://dx.doi.org/10.1155/2016/8252741

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