

EFFECT OF TARTRAZINE ORALLY ADMINISTERED ON THE LIPID PROFILE OF ALBINO RATS^{1*}Elekima Ibioku, ²Nwachuku, Edna Ogechi and ³Ben-Chioma Adline Erinma^{1,2,3}Department of Medical Laboratory Science, Rivers State University, Port Harcourt, Nigeria.***Corresponding Author: Elekima Ibioku**

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ABSTRACT

In this study the effect of tartrazine on lipid profile of albino rats were evaluated. Thirty (30) rats weighing approximately 0.14kg were used in this study. The rats were divided into five (5) groups of six (6) rats per group. Lipid parameters such as Total Cholesterol (TC), triglyceride (TG), High Density Lipoprotein-cholesterol (HDL-C) and Low density Lipoprotein-cholesterol (LDL-C) were evaluated. Results obtained were analysed using graphpad prism 5.1 with statistical significance observed at $P < 0.05$. When tartrazine treated rats were analysed, group 1 had 0.994 ± 0.175 , 1.745 ± 0.063 , 1.203 ± 0.065 and 0.0910 ± 0.067 for TG, TC, HDL-C and LDL-C. Group 2 had 1.316 ± 0.078 , 2.791 ± 0.895 , 1.616 ± 0.453 and 0.577 ± 0.583 for TG, TC, HDL-C and LDL-C respectively. Group 3 had 1.113 ± 0.371 , 1.812 ± 0.283 , 1.076 ± 0.078 and 0.230 ± 0.225 for TG, TC, HDL-C and LDL-C respectively. Group 4 had 1.215 ± 0.117 , 1.784 ± 0.152 , 0.979 ± 0.065 and 0.253 ± 0.198 for TG, TC, HDL-C and LDL-C respectively while group 5 had 1.269 ± 0.191 , 1.900 ± 0.111 , 1.092 ± 0.029 and 0.231 ± 0.149 . The comparison of group 1 and group 2 revealed that TC and TG was significantly increased ($p < 0.05$) while there was a non-significant decrease and increase in HDL-C and LDL-C respectively (table 4.1). The comparison of group 1 and group 3 showed a significant decrease in HDL-C levels ($p < 0.05$) while TG, TC and LDL-C were non-significantly increased (table 4.2). Comparison of group 1 and group 4 showed a significant increase and decrease in TG and HDL-C respectively ($p < 0.05$). However, non-significant increases were seen in TC and LDL-C levels. Finally, the comparison of group 1 and 5 indicated a significant increase in TG, TC and a significant decrease in HDL-C ($p < 0.05$). Non-significant increase was observed in LDL-C level as well.

KEYWORDS: Tartrazine, cholesterol, triglycerides, HDL-C, LDL-C.**INTRODUCTION**

Food colorants (dyes) play vital role in the selection of food. They are used in food to improve appearance, enhance attraction, prevent loss of colour when processing or storing foods, and stimulates psychological satisfaction.^[1] Dyes are also used in rubber, plastics, pharmaceutical and cosmetics industries.^[2] Food dyes are divided into natural and synthetic dyes. Examples of natural dyes are the caramel, Annatto, and turmeric while example of synthetic dyes are carmoisine, amaranth, Tartrazine, Allura red and so on.^[1]

Tartrazine is a water soluble synthetic lemon-yellow azo dye used as a food colorant with an acceptable daily intake (ADI) of 0-7.5mg/kg body weight.^{[3][4]} It is seen in food products such as soft drinks, energy drinks, flavored corn chips, cereals, cake mixes, pastries, custard powder, sauces, powdered drink mixes, ice cream, candy, chewing gum, yogurt, noodles, potato chips, biscuits and so on.^{[5][6]} Tartrazine has been reported to induce several side effects such as allergic reactions in specific human populations.^[5] Though the side effect varies based on the route of administration and the dose administered.^[3] It

has been reported that tartrazine induce mammalian cells chromosomal aberration, carcinogenic and mutagenic effects, learning and memory loss and behavioral changes in animals as well as haematological, renal and hepatic derangements.^{[1][3][7][8]} However, in this study, the effect of tartrazine orally administered on lipid profile of albino rats will be considered.

Lipids (e.g. cholesterol and triglycerides) are bio-molecules that are soluble in organic solvent but are insoluble in water and somehow consist of contain charged groups such as phosphoryl, hydroxyl, salic acids, amino group and sulfuryl group which enhance their solubility in aqueous biological surroundings.^{[9][10][11]} Lipids have important role precursor of hormones synthesis, generation of ATPs (energy), aiding in digestion and as structural components of functional biological cells.^{[9][10]} For lipids to be transported properly in aqueous medium they are bound to complex proteins called lipoproteins. Such lipoproteins are chylomicrons, VLDL, IDL, LDL and HDL. Abnormalities in Lipids and lipoproteins metabolism are closely associated cardiovascular,

cerebrovascular and peripheral vascular diseases.^{[10][12]} These disorders are on the increase even in developing countries (Warnick, 2009; Elekima, et al., 2016). Therefore, determination of lipids levels such as cholesterol and triglyceride as well as their lipoprotein levels is vital in establishing the degree of risk for cardiovascular diseases.^{[10][11]} Lipid parameters considered in this study include total cholesterol, triglycerides, High density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C).

3. MATERIALS AND METHODS

3.1 Materials

Materials used include centrifuge, spectrophotometer as well as cholesterol, triglyceride, high density lipoprotein reagent purchased from Randox Diagnostics, United Kingdom.

3.2 Animals

A total of thirty (30) rats of average weight of 0.14kg were used for this study. The rats were randomly separated into five (5) groups namely group 1, 2, 3, 4 and 5. Each group had a total of six (6) rats. The rats were purchased from the animal farm of University of Portharcourt and were transported to the animal house, Department of Medical Laboratory science, University of Science and Technology, Portharcourt. The rats were acclimatized for 10 days (alternate day and night) at normal room temperature and were fed with chicken growers mash and water.

3.4 Administration

The rats were treated with varying concentration of tartrazine for four (4) weeks orally using gavage technique. Group 1, 2, 3, 4 and 5 were treated daily with 1.0ml of 0.0% (normal saline) (0.0g/kg bodyweight), 1.0% (0.07g/kg bodyweight), 1.5% (0.11g/kg bodyweight), 2.0% (0.14g/kg bodyweight) and 2.5% (0.18g/kg bodyweight) of tartrazine respectively.

3.5 Specimen collection

Cardiac puncture was used aseptically to collect 5mls of fasting samples into lithium heparin bottle. The whole

blood was spun at 3,500rpm for ten (10) minutes to obtain plasma for the analysis of total cholesterol (TC), triglyceride (TG) and High Density Lipoprotein (HDL). Low Density Lipoprotein (LDL) was calculated using the Friedwald equation [13]: $LDL - \text{cholesterol concentration (mmol/l)} = TC - (TG/2.2 + HDL)$.

3.6 Statistical Analysis

Graphpad prism 5.03 was the statistical software used. Mean, standard deviation and inferential statistics using the statistical t-test were the statistical parameters considered with statistical significance seen at $p < 0.05$.

4. RESULTS

When tartrazine treated rats were analysed, group 1 had 0.994 ± 0.175 , 1.745 ± 0.063 , 1.203 ± 0.065 and 0.0910 ± 0.067 for TG, TC, HDL-C and LDL-C. Group 2 had 1.316 ± 0.078 , 2.791 ± 0.895 , 1.616 ± 0.453 and 0.577 ± 0.583 for TG, TC, HDL-C and LDL-C respectively. Group 3 had 1.113 ± 0.371 , 1.812 ± 0.283 , 1.076 ± 0.078 and 0.230 ± 0.225 for TG, TC, HDL-C and LDL-C respectively. Group 4 had 1.215 ± 0.117 , 1.784 ± 0.152 , 0.979 ± 0.065 and 0.253 ± 0.198 for TG, TC, HDL-C and LDL-C respectively while group 5 had 1.269 ± 0.191 , 1.900 ± 0.111 , 1.092 ± 0.029 and 0.231 ± 0.149 . The comparison of group 1 and 2 revealed that TC and TG was significantly increased ($p < 0.05$) while there was a non-significant decrease and increase in HDL-C and LDL-C respectively (table 4.1). The comparison of group 1 and p 3 showed a significant decrease in HDL-C levels ($p < 0.05$) while TG, TC and LDL-C were non-significantly increased (table 4.2). Comparison of group 1 and group 4 showed a significant increase and decrease in TG and HDL-C respectively ($p < 0.05$). However, non-significant increases were seen in TC and LDL-C levels (table 4.3). Finally, the comparison of group 1 and 5 indicated a significant increase in TG, TC and a significant decrease in HDL-C ($p < 0.05$). Non-significant increase was observed in LDL-C level (table 4.4).

Table 4.1: Comparison of group 1 and 2 for Tartrazine treated rats.

Parameter	TG (mmol/L)	TC (mmol/L)	HDL (mmol/L)	LDL (mmol/L)
GROUP 1 (0.00g/kg)	0.994 ± 0.175	1.745 ± 0.063	1.203 ± 0.065	0.0910 ± 0.067
GROUP2 (0.07g/kg)	1.316 ± 0.078	2.791 ± 0.895	1.616 ± 0.453	0.577 ± 0.583
p VALUE	0.0012	0.0171	0.0514	0.0695
t VALUE	4.490	2.855	2.212	2.031
REMARKS	S**	S*	NS	NS

Table 4.2: Comparison of group 1 and 3 of tartrazine treated rats.

Parameter	TG (mmol/L)	TC (mmol/L)	HDL (mmol/L)	LDL (mmol/L)
GROUP1(0.00mg/kg)	0.994 ± 0.175	1.745 ± 0.063	1.203 ± 0.065	0.0910 ± 0.067
GROUP3(0.11mg/kg)	1.113 ± 0.371	1.812 ± 0.283	1.076 ± 0.078	0.230 ± 0.225
p VALUE	0.4939	0.5838	0.0122	0.1781
t VALUE	0.7101	0.56661	3.053	1.4490
REMARKS	NS	NS	S*	NS

Table 4.3: Comparison of group 1 and group 4 of tartrazine treated rats.

Parameter	TG (mmol/L)	TC (mmol/L)	HDL (mmol/L)	LDL (mmol/L)
GROUP1(0.00g/kg)	0.994± 0.175	1.745±0.063	1.203±0.065	0.0910±0.067
GROUP4(0.14g/kg)	1.215±0.117	1.784±0.152	0.979±0.065	0.253±0.198
p VALUE	0.0277	0.576	0.0001	0.0874
t VALUE	2.574	0.5770	5.962	1.8950
REMARKS	S*	NS	S***	NS

Table 4.4: Comparison of group 1 and 5 of tartrazine treated rats

Parameter	TG (mmol/L)	TC (mmol/L)	HDL (mmol/L)	LDL (mmol/L)
Group 1 (0.00g/Kg)	0.994± 0.175	1.745±0.063	1.356 ±0.068	0.0910±0.067
Group 5 (0.18g/Kg)	1.269±0.191	1.900±0.111	1.092±0.029	0.231±0.149
p value	0.0265	0.014	0.0035	0.0613
tvalue	2.599	2.961	3.793	1.001
Remarks	S*	S*	S**	NS

*significant, **Moderate significant, ***Highly significant, NS=Not Significant; S=Significant.

5. DISCUSSION

From the result when group 1 was compared with group 2 of tartrazine treated rats, there was a significant increase in TG and TC alongside a non-significant increase and decrease in LDL-C and HDL-C respectively. The significant increase in TG is in accordance with the reports of^{[1][2][4][14][15]} The significant increase in TG and TC is in line with reports of^{[4][8][14]} but contrary to the findings of^{[1][2]} who report a significant decrease in total cholesterol levels. The non-significant increase and decrease in LDL-C and HDL-C respectively observed in this study is in line with reports of^[15], especially that of HL-C in humans exposed to azo dyes but contrary to the finding of^{[1][4][14]} who reported a significant increase in all lipid parameters. The comparison of group 1 and 2 revealed a significant decrease in HDL-C. This finding is in line with the reports of^{[1][4][14]} However, the non-significant increases in TG, TC and LDL-C observed is contrary to the findings of^{[1][4][8]} The comparison of group 1 and group 4 had TG and HDL-C been significantly increased and reduced respectively. The significant increase in TG and reduction in HDL-C is in line with the work of^{[1][4][8]} TC and LDL-C were also increased non-significantly. Finally, the comparison of group 1 and 5 showed a significant increase and decrease in TG, TC and HDL-C respectively. However, LDL-C was also increased non-significantly. The significant differences seen in TG, TC and HDL-C is in line with the works of^{[1][4][8][14]} The significant increase in TC, TG and LDL-C as well as the decrease seen in HDL-C seen across the various groups may be due to activities of reactive oxygen species and free radicals generated from the microbial transformation of tartrazine which in turn precipitated hepatocellular derangements with a resultant effect on hepatic enzymes such as lecithin cholesterol transferases and hepatic lipoprotein lipase which are needed for the catalysis of cholesterol and triglycerides respectively.^{[1][8][16][17]} Deficiency of these enzymes on a larger scale upset normal lipid metabolism affecting even their lipoproteins.^[16] The risks of developing cardiovascular disorder such as atherosclerosis, hypertension, coronary

heart disease and so on which are usually connected with increase in the plasma levels of lipid parameters such as TG, TC and LDL-C and decrease level of HDL-C concentration.^{[11][12]}

6. CONCLUSION

The result indicated that tartrazine orally administered at varying concentration induced increased levels of TG, TC and LDL-C and decreased HDL-C levels which are usually linked to cardiovascular disorders. Therefore, the use of tartrazine azo dye in food especially in excess of it should be avoided.

7. FUTURE WORK

Further research should be considered done perhaps using other routes of administration and also in a longer duration to ascertain the effects of this dye on lipid parameters and other biochemical parameters at doses within the acceptable daily intake of 0 – 7.5mg/kg bodyweight.

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