International Journal of Food Science and Biotechnology
2017; 2(3): 97-102
http://www.sciencepublishinggroup.com/j/ijfsb
doi: 10.11648/j.ijfsb.20170203.14

Toxic Effects of Coralene Red XF and Remazol Red RR Textile Dyes on Liver and Kidney in Mice

Mohammad Farhadur Rahman[1], Nargish Jahan Ara[1], Bishnu Pada Dey[2], Mohammad Zakir Sultan[3, *]

[1]Department of Chemistry, Bangladesh University of Textiles, Dhaka, Bangladesh

[2]Department of Pathology, Bangladesh Sheikh Mujib Medical University, Dhaka, Bangladesh

[3]Centre for Advanced Research in Sciences, University of Dhaka, Dhaka, Bangladesh

Email address:

zakir.sultan@du.ac.bd (M. Z. Sultan)

[*]Corresponding author

To cite this article:

Mohammad Farhadur Rahman, Nargish Jahan Ara, Bishnu Pada Dey, Mohammad Zakir Sultan. Toxic Effects of Coralene Red XF and Remazol Red RR Textile Dyes on Liver and Kidney in Mice. *International Journal of Food Science and Biotechnology*. Vol. 2, No. 3, 2017, pp. 97-102. doi: 10.11648/j.ijfsb.20170203.14

Received: June 18, 2017; **Accepted**: June 29, 2017; **Published**: July 31, 2017

Abstract: Adulterated food is a silent killer. Dishonest traders used textile dyes as adulterant in different foods as unethical practices. Moreover, textile industries also throw waste dye as effluent in ground water. In this study, we investigated the toxic effects of two textile dyes Coralene Red XF and Remazol Red RR by *in vivo* experiments in mice. Mice were administered Coralene Red XF and Remazol Red RR textile dyes at a single oral dose of 0.04g/kg daily for 21 days to observe any toxic effect of those dyes in mice. The toxic effects were evaluated by measuring the serum activity of aspartate amino-transferase (AST), glutamate pyruvate transaminase (ALT), serum total bilirubin (STBI), serum creatinine (SCR), serum urea (SUR) and histopathology of liver and kidney. The levels of AST, ALT, STBI, SUR and SCR were found to be increased by both Coralene Red XF and Remazol Red RR. Histopathological examination of liver showed inflammatory atypia of hepatocytes and inflamation also observed in kidney.

Keywords: *In vivo*, Textile Dyes, Coralene Red XF, Remazol Red RR, Toxicity

1. Introduction

Dyes are organic compounds which are widely used in textiles, printing, rubber, cosmetics, plastics, leather industries to color their products. Now-a-days, dishonest traders, importers and manufacturers, restaurant owners, cultivators, processing agencies and so forth are using textile dyes as coloring agent in foods instead of food grade dyes due to cheapness of textile dyes. The problem of adulteration persists at every level of foods from preparation to consumption.

A report by the 'Poribesh Bachao Andolan' disclosed that about 7.9 million (79 lakh) people in South Asia die every year by non-contagious diseases, and food adulteration is marked as one of the most important reasons. The report also warned if this food adulteration cannot be prevented now, it will affect the mental growth in next generation. [1], [2]

The supply of unsafe foods is negatively contributing to the public health seriously with numerous acute and chronic diseases. Yet, little work on the toxicity was published before. [3]

A study in Dhaka city in 2003 found that 96% of sweetmeats, 24% of biscuits, 54% of bread and 59% of ice-creams were seriously adulterated by poisonous chemicals. [4] Use of poisonous chemicals in perishable foods is endangering the lives of people. [5]

Textile dyes use as coloring agents instead of food grades colorant in various kinds of sweets and fast-foods like jilapi (local name of a sweetmeat), piaju (local name of one kind of fast food), chop, beguni (local name of one kind of fast food) in indiscriminate manner in Bangladesh. [6] Besides, in textile industries a large quantity of waste dye is generated as effluent. It has been reported that during the dyeing process 10% of the dye stuffs used remain unfixed from the fibers. [7] Another report

published that up to 30% of the used dyestuff remains in the spent dye-bath after the process. [8] The unused dyes in the effluent mix with water of river, pond or ground, and leading to serious environmental pollution which may ultimately serious health hazard. [7]

Many dyes are carcinogenic and affect the life of aquatic organisms. [9] Olukanni et al. (2005) reported that the serious environmental problems for rapid growth of textile industry leads to harmful causes of agriculture issues, rise of heavy metals in ground water, drastic effects on flora and fauna in the surrounding area. [10]

Therefore, to evaluate the impact of textile dyes on human health, we conducted toxicity studies of some textile dyes in mice model. This paper describes the effects of the two textile dyes on the activity of some organs (liver and kidney) of mice.

2. Materials and Methods

2.1. Materials

Dye used: (a). Coralene Red XF and (b). Remazol Red RR

Coralene Red XF is a disperse dye and Remazol Red RR is vinyl sulfone reactive dye, widely used in textile industry. Both textile dyes were supplied by Dye Star Ltd, Dhaka, Bangladesh.

2.2. Instruments

Aspartate aminotransferase (AST) [AST formerly was called serum glutamic oxaloacetic transaminase (SGOT)], alanine aminotransferase (ALT) [ALT used to be called serum glutamic-pyruvic transaminase, or SGPT], serum urea and serum creatinine were determined by biochemical auto analyzer (Dimension Xpand Plus, Siemens, Germany). Histopathological observations were carried out under a light microscope (Olympus BX53, Olympus, Japan).

2.3. Experimentations

Nine adult male mice, weighing 40-50 mg, were used in this experiment. All the rats were acclimatized to the new environment for a period of one week. During the experiment period the rats were kept in a well-ventilated animal house at 25°C. They were supplied with standard pellets and fresh drinking water. All the rats were kept in cage and maintained with natural 12 h light and dark cycle in the animal house of Institute of Nutrition and Food Sciences (INFS), University of Dhaka, Bangladesh. The mice were divided into three groups consisted of three mice each.

Group A and Group B were administered Coralene Red XF dye and Remazol Red RR, respectively at a single oral dose of 0.04g/kg daily (half dose of Mahmoud N. H.) for 21 days to observe any toxic effect of those dyes in mice. [11] 100.0 mL solution for both dyes was prepared at 0.04g/kg concentration. For each mouse oral dose were administered twice per day at 0.5 mL/time for 21 days besides normal foods. Group C was left as control and administered normal foods.

2.4. Histopathological Examinations

At the end of the experiment the control and treated mice were sacrificed. Their livers and kidneys were removed and fixed in 10% formalin solution, processed and embedded in paraffin wax. Sections of 3-6 μm thickness were stained with hematoxylin and eosin.

2.5. Biochemical Analysis

By decapitation of each mouse, blood was collected in centrifuge tube and kept 1 hour at room temperature for coagulation. Then centrifuged at 4000 rpm for 20 minutes and serum was separated by decantation and placed at -20°C until biochemical analyses were done.

AST and ALT were measured according to Wroblewski and LaDue [12] (recommended by IFCC as described by Bergmeyer [13], [14]). Serum TBI and serum urea were measured by the method of Doumas [15] (modification of diazo method described by Jendrassik and Grof[16]). Measurment of serum creatinine was determined by Larsen. [17]

3. Results

3.1. Histopathological Results

3.1.1. Liver

An unremarkable change was observed in liver of control mice (Figure 1 and 2). After treating with Coralene Red XF disperse dye a moderate inflammation of liver was observed in two mice (No. 1 and 3) but there was no significant effect on third one (No. 2) (Figure 3 and 4, respectively). Figure 5 shows unremarkable changes in liver which was obtained from Group B, mice No. 1 treated with Remazol Red RR reactive dye but Figure 6 revealed mild inflammations of livers of mice No. 2 and 3 for the induced effect of the same dye.

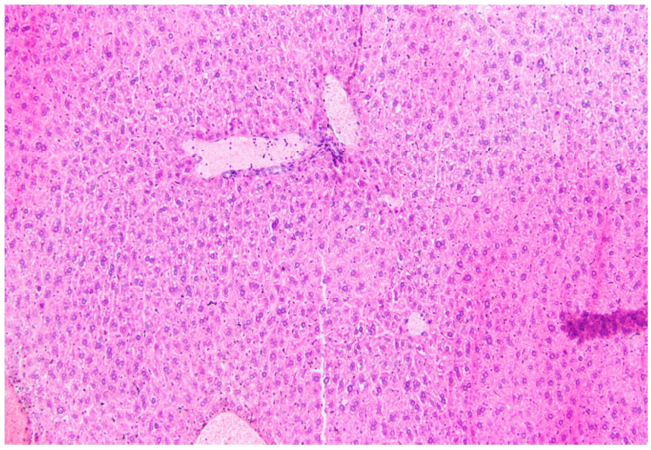

Figure 1. *Liver section of 1st control mice showing unremarkable liver tissue (100X).*

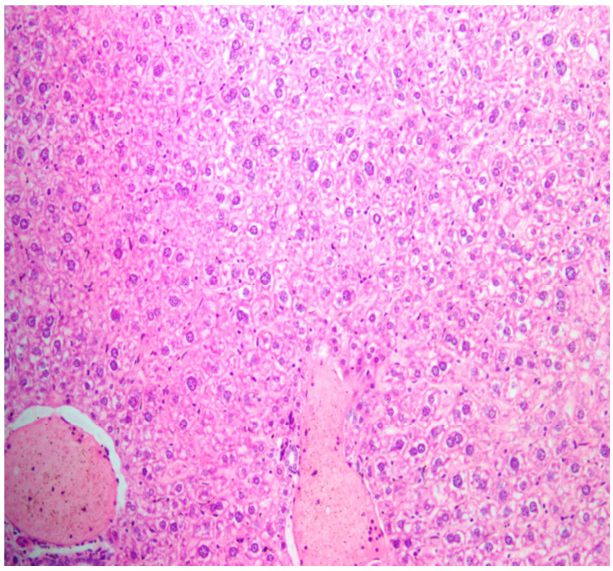

Figure 2. *Liver section of 2nd control mice showing unremarkable liver tissue (200X).*

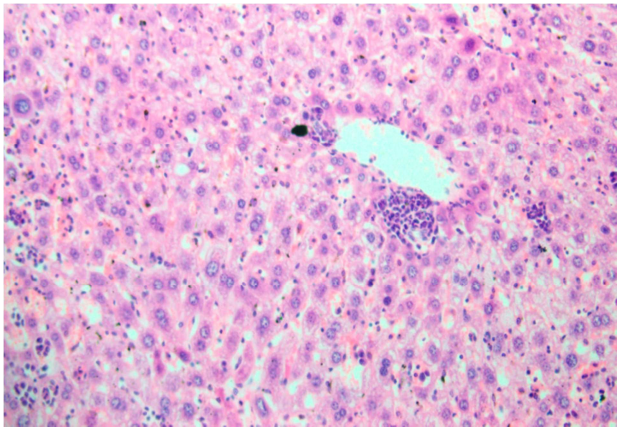

Figure 3. *Liver section of Coralene Red XF groups 1st mice showing moderate inflammation with inflammatory atypia of hepatocytes (200X).*

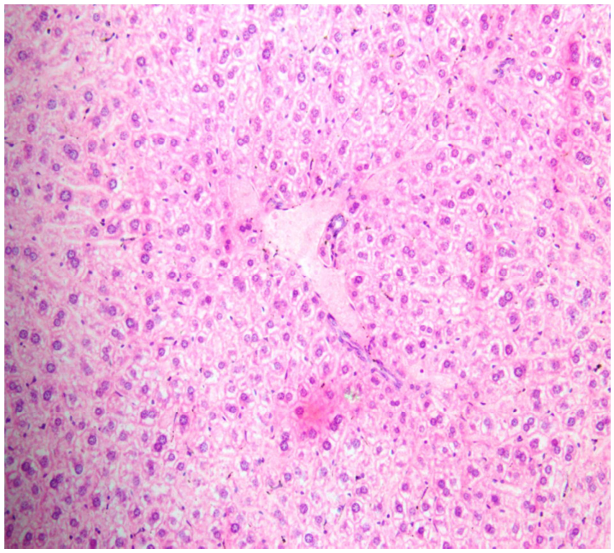

Figure 4. *Liver section of Coralene Red XF groups 2nd mice Showing unremarkable liver tissue (200X).*

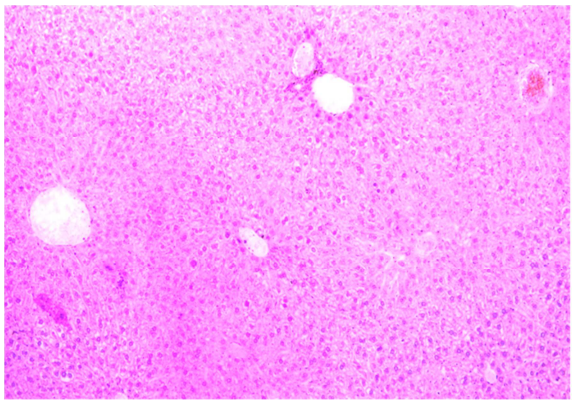

Figure 5. *Liver section of Remazol Red RR groups 1st mice showing unremarkable liver tissue (100X).*

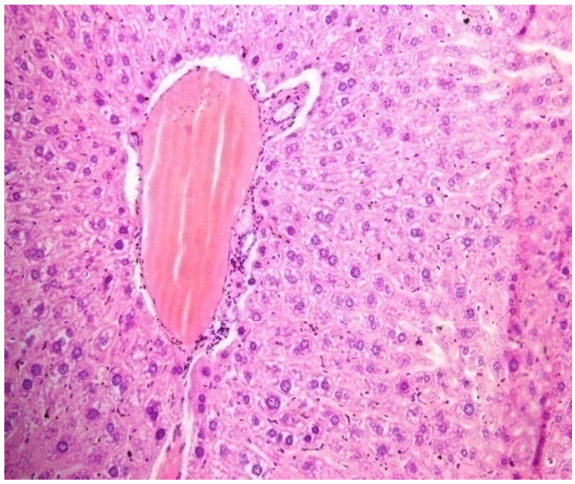

Figure 6. *Liver section of Remazol Red RR groups 2nd mice showing mild inflammation of liver tissue (200X).*

3.1.2. Kidney

Figure 7 and 8 show unremarkable change in kidney for control mice. Figure 9 showed that Coralene Red XF disperses dye produced mild inflammations in kidneys of first and third mice. But for same dye there was no change in kidney of second mouse (Figure 10). A mild inflammation was observed of kidney in mouse No. 1 showed in Figure 11 for Remazol Red RR reactive dye. But Figure 12 revealed moderate inflammations in kidney for same dye.

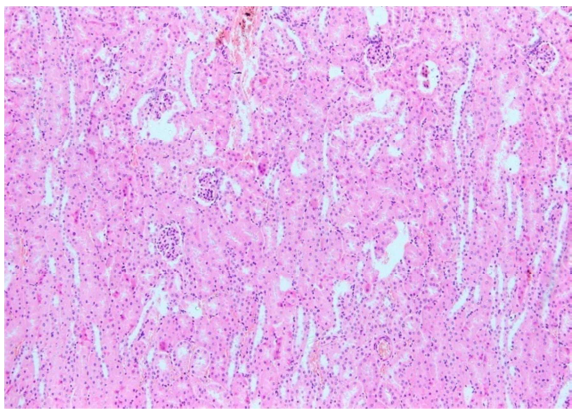

Figure 7. *Section in kidney of 1st control mice showing unremarkable kidney tissue (100X).*

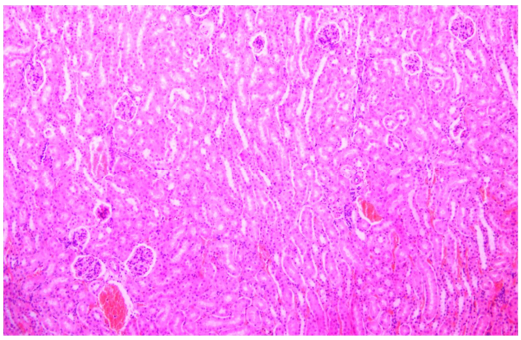

Figure 8. *Section in kidney of 2nd control mice showing unremarkable kidney tissue (100X).*

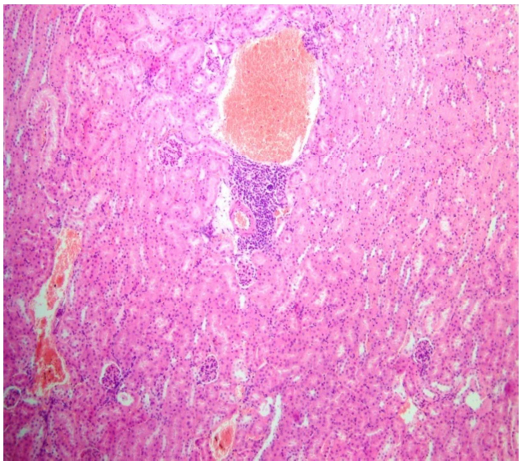

Figure 9. *Section in kidney of Coralene Red XF groups 1st mice showing mild inflammation of kidney tissue (100X).*

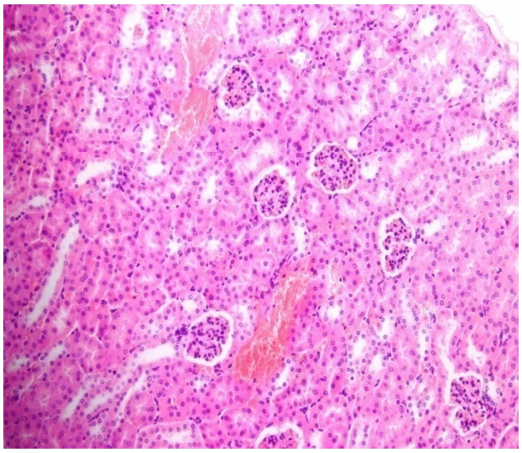

Figure 10. *Section in kidney of Coralene Red XF groups 2nd mice showing unremarkable kidney tissue (200X).*

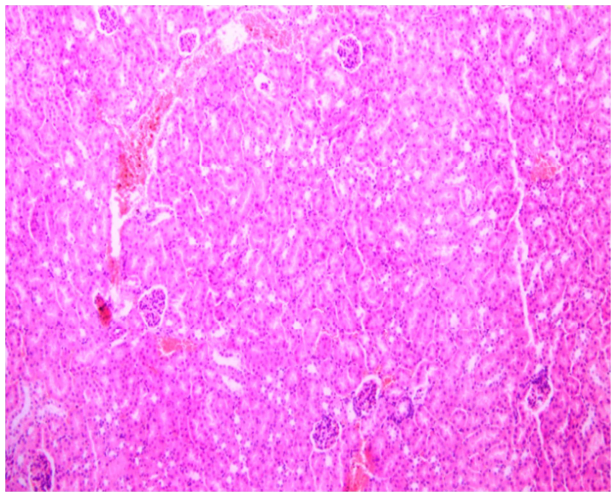

Figure 11. *Section in kidney of Remazol Red RR groups 1st mice showing mild inflammation kidney tissue (100X).*

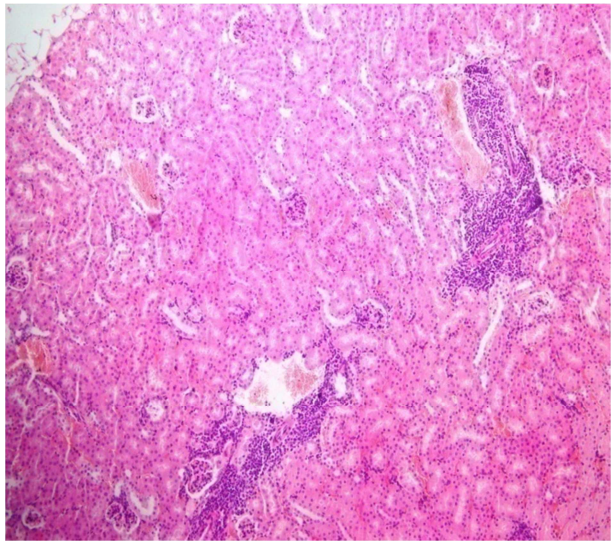

Figure 12. *Section in kidney of Remazol Red RR groups 2nd mice showing moderate inflammation of kidney tissue (100X).*

3.2. Biochemical Results

3.2.1. Liver Function Study

Table 1 shows AST, ALT and TBI level of serum obtained from Group A (Coralene Red XF), Group B (Remazol Red RR) and Group C (control). The values of AST, ALT and TBI level were changed significantly after the administration of Coralene Red XF and Remazol Red RR dyes (Figure 13).

Table 1. *Effects of textile dyes on serum activity on liver function in male mice.*

Parameters	AST (µ/dL)		ALT (µ/dL)		TBI (mg/dL)	
	Individual	Average	Individual	Average	Individual	Average
Control	85.0 96.0 87.0	89.3	20.0 18.0 21.0	19.7	0.50 0.30	0.40
Coralene Red XF	320.0 105.0 90.0	212.5	45.0 25.0 20.0	35.0	0.50 0.50 0.50	0.50
Remazol Red RR	378.0 110.0	192.7	63.0 45.0	42.7	0.70	0.60

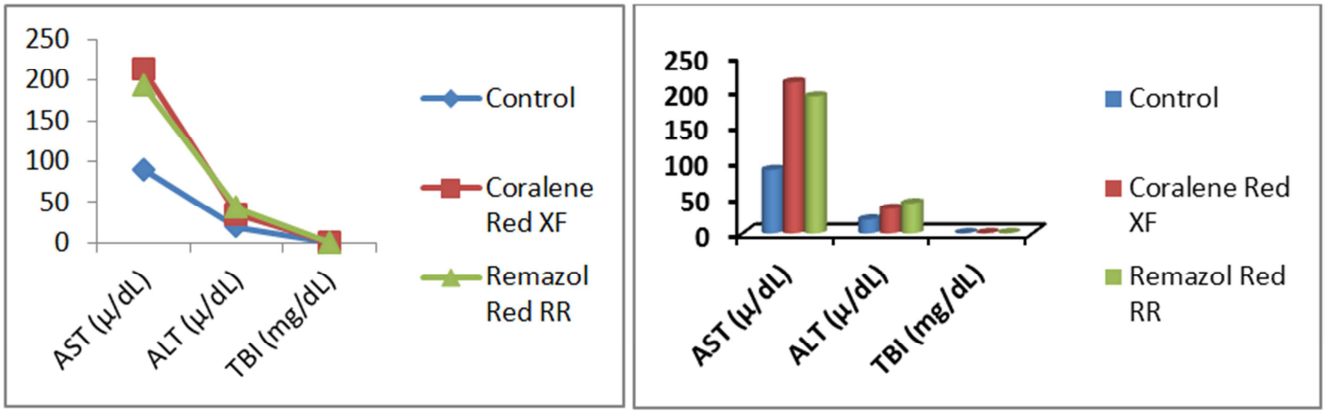

Figure 13. *Comparison the effect of textile dyes on serum activity on liver function in male mice.*

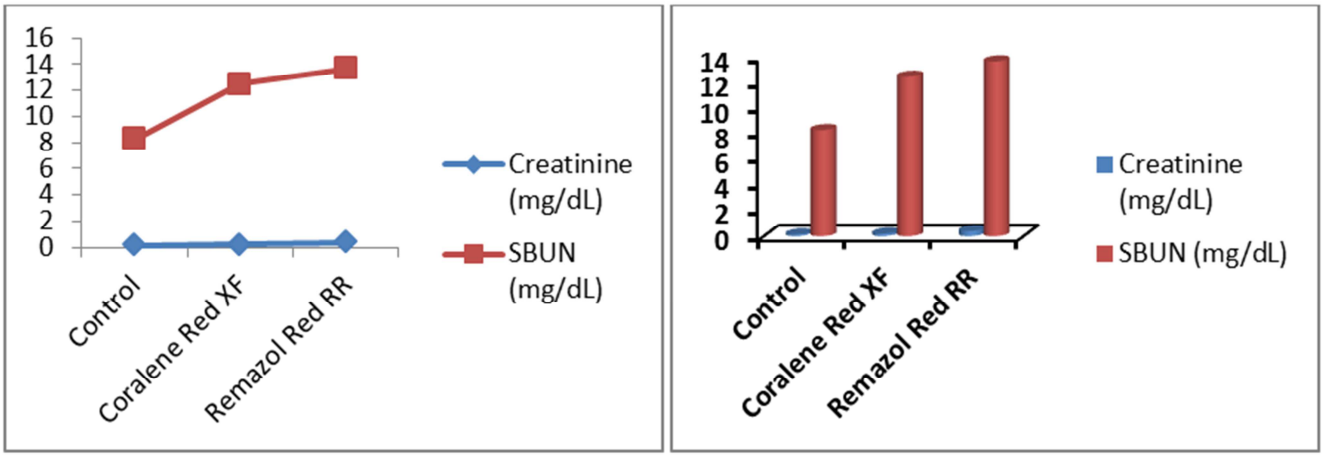

Figure 14. *Comparison the effect of textile dyes on serum activity on kidney function in male mice.*

3.2.2. Kidney Function Study

Table 2 shows creatinine and SBUN level of serum obtained from Group A (Coralene Red XF), Group B (Remazol Red RR) and Group C (control). The values of creatinine and SBUN level were changed less significantly after the administration of Coralene Red XF and Remazol Red RR dyes (Figure 14).

Table 2. *Effects of textile dyes on serum activity on kidney function in male mice.*

Parameters	Creatinine (mg/dL)		SBUN (mg/dL)	
	Individual	Average	Individual	Average
Control	0.15 0.24 0.03	0.14	10.0 6.0 9.0	8.3
Coralene Red XF	0.15 0.25	0.20	15.0 10.0	12.5
Remazol Red RR	0.40 0.56 0.25	0.40	10.0 21.0 10.0	13.7

3.3. Discussion

Consumption of adulterated food items severely affects the human health by producing many acute and chronic diseases. This research was measuring the toxic effect of daily supply foods adulterated with textile dyes. For that purpose, mice were fed Coralene Red XF and Remazol Red RR daily at oral dose for 21 days.

Results obtained in the present work indicated that treating mice with Coralene Red XF and Remazol Red RR caused significant increase of AST, ALT levels in mice serum. Previous study suggested that damaged organs showed increase in enzyme activity and chronic intoxication was accompanied by continuous increase in serum levels in both AST and ALT activitie. [11] It seems that the changes of AST and ALT activities are due to cellular degradation by Coralene Red XF and Remazol Red RR.

Treating mice with Coralene Red XF and Remazol Red RR induced significant increase in serum TBI which may be due to the defect in liver function produced from hepato cellular damage. [18]

This study also found less significant changes in serum creatinine and serum urea for administering Coralene Red XF disperse dye. But treating with Remazol Red RR reactive dye showed significant increase in serum creatinine and serum urea. Mackenzie et al. (1992) found that the significant elevation in creatinine and urea levels related to impairment of renal or post renal function.[19]

Histopathological examination of both liver and kidney revealed inflammation on mice and some times unremarkable after treating with Coralene Red XF and Remazol Red RR. Coralene Red XF disperse dye showed moderate changs in liver but mild inflammation in kidney and some cases

unchanged in both liver and kidney. Remazol Red RR reactive dye showed mild impact in liver but moderately in kidney. There was also a unremarkable changes of liver and kidney for this dye. This might be due to the body immunity of mice. The protection capability varies mouse to mouse. The duration of study time also needs to extend for more accurate observation.

Through this work, the changes on serum activity of blood and histopathological impact on liver and kidney for textile dyes show the alarming about textile dyes for human health. Study at cellular and molecular level with this dye is necessary to get more insight about mechanism of those dyes.

4. Conclusion

The profound impacts on blood, liver and kidneys observed from our study revealed that the textile dyes are not out of harm's way for health. So textile dyes should not use in foods to increase attraction. The government should take necessary steps to stop illegal use of textile dyes. This study will aware the people about the toxic impacts of using dyes.

Acknowledgements

The authors would to thanks Md. Bayejid Hosen, Divisional Forensic DNA Screening Laboratory, Khulna, Bangladesh and Md. Mesbah Uddin, Department of Clinical Pathology, Dhaka Medical College, Bangladesh, for kind cooperation during research work. The authors also pay special thanks to Syeda Saba-E-Zannat, Mymensing Agriculture University, Bangladesh, for helping throughout the research period.

References

[1] Rahman, M. A, Sultan M. Z, Rahman M. S, and Rashid M. A, 2014. Food Adulteration: A Serious Public Health Concern in Bangladesh. *Bangladesh Pharm J.* 18 (1): 1-7.

[2] The Daily Observer, 22 June 2014. Enforce existing laws against food adulteration. http://observerbd.com/details.php?id=27183.

[3] Borzelleca J. F. and Hallogen J. B, 1987. Life time toxicity/Carcinogenicity Study of FD & C Red No. 3 in mice. *J FD Chem Toxicol.* 25: 735.

[4] Rahman S. M, Hoque M. A. and Talukder M. R. A, 19-20 October 2005), 2005. Food security in Bangladesh: utilization, nutrition and food adulteration (paper presented at the National Workshop on Food security, Dhaka, Bangladesh. pp. 45-46.

[5] Derek, L, Date of access: January 29, 2015. Eight toxic foods: a little chemical education.http://pipeline.corante.com/archives/2013/06/21/eight_toxic_foods_a_little_chemical_education.php.

[6] Bahari ifterer somahar. *The Daily Amader Somoy,* (A daily newspaper of Bangladesh), 1 July, 2014.

[7] Pearce C. I, Lloyd J. R, Guthrie J. T, 2003. The removal of colour from textile wastewater using whole bacterial cells: a review. *Dyes Pigments.* 58: 179-196.

[8] Ozacar M. and Singel A, 2005. Adsorption of metal complex dyes from aqueous solutions by pine sawdust. *Bioresour. Technol.* 96: 791-795.

[9] Baughman G. L. and Perenich T. A, 988. Fate of dyes in aquatic systems: I. Solubility and partitioning of some hydrophobic dyes and related compounds. *Environ. Toxico. Chem.* 1 7: 183 199.

[10] Olukanni O. D, Osuntoki A. A, Gbenle G. D, 2005. Textile effluent biodegradation potentials of textile effluent-adopted and nonadopted bacteria. *Appl Environ Microbiol*. 5(20): 837-844.

[11] Mahmoud N. H, 2006. Toxic effects of the synthetic food dye brilliant blue on liver, kidney and tests functions in rats. *J Egypt Soc Toxicol.* 34: 77-84.

[12] Wroblewski F. and LaDue J. S, 1956. Serum glutamic-pyruvic transminase in cardiac and hepatic disease. *Proc Soc Exp Biol Med.* 91: 569-571

[13] Bergmeyer H. U, Bowers G. N. Jr, Horder M, Moss D. W, 1976. Provisional recommendations on IFCC methods for the measurement of catalytic concentrations of enzymes. Part 2. IFCC method for aspartate aminotransferase. *Clin Chim Acta.* 70(2): F19-29.

[14] Bergmeyer H. U, Horder M, 1980. IFCC methods for the measurement of catalytic concentration of enzymes. Part 3 IFCC method for alanine aminotransferase. *J Clin Chem Clin Biochem.* 18: 521-534.

[15] Doumas B. T, Kwok-Cheung P. P, Perry B. W, Jendrzejczak B, McComb R. B, Schaffer R, Hause L. L, 1985. Candidate reference method for determination of total bilirubin in serum: development and validation. *Clin Chem*. 31(11): 1779-1789.

[16] Jendrassik L, Grof P, 1938. Vereinfachte photometrische method zur bestimmung des bilirubins. *Biochem Z.* 297: 81-89.

[17] Larsen K, 1972. Creatinine assay by a reaction-kinetic principle. *Clin Chim Acta.* 41: 209-217.

[18] Ibrahim N. Y, El-Desoky G. E, Ramadan M. E. and El-Gendi S. H, 1988. Comparative studies on the effect of some natural and synthetic food colorants on blood glucose and liver glycogen as well as glutamic aminotransferase in rats. *Menia J Agric Res Rev.* 10: 16-59.

[19] Mackenzie K. M, Boysea B. G, Field W. E, Petsel S. R, Chappel C. L, Emerson J. L. and Stanley J, 1992. Toxicity of carcinogenicity studies of caramel color in F344 rats and B6 C3 F-1 mice. *Food Chem Toxicol.* 30 (5): 431-443.