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HISTOPATHOLOGICAL LESIONS IN SPLEEN OF METANIL YELLOW FED ALBINO RAT *(RATTUS NORVEGICUS)*

Environmental Science

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ABSTRACT

Present study investigated the histopathological changes in the spleen of albino rat (*Rattus norvegicus*) after chronic application of Metanil Yellow at a sublethal dose of 3 g/kg body weight for 30 and 45 days with daily diet. Histopathological changes in the spleen tissue were observed under light microscope after staining with Haematoxylin-Eosin. Studies revealed the degenerative changes in both the white and red pulp regions. Trabeculae and follicular regions were rarely damaged. But at 45 days exposure it was maximum showing distortion and degeneration in both the white pulp and red pulp regions, in particular.

KEYWORDS:

Histopathology, Spleen, Metanil Yellow, Albino rat

INTRODUCTION

Spleen is a kind of soft, dark purplish brown and high vascular organ which is situated on the left side of the abdominal cavity. It is the largest accumulation of lymphoid tissue in the body and plays some vital roles as well as functions *viz.,* acts as an important blood filter, forming antigens and also as defence organ. Some authors (Mebius and Krall, 2005; Loscalzo *et al*., 2008) found that half of the body's monocytes present within the red pulp region of the spleen. Spleen also acts as drainage site for intravenously administered compounds (USFDA, 2001). The genotoxic and carcinogenic effects of azo compounds were reported by some authors (Combes and Haveland-Smith, 1982; Sasaki *et al*., 2002). Metanil Yellow affected the brain at regional levels due to chronic consumption (Nagaraja and Desiraju, 1993). Metabolic and toxicological disorders induced by some specific food colourants/ additives were reported by Tanaka (2005) and Zraly *et al*., (2006). Toxic effects of Metanil Yellow has been investigated by so many authors (Mehrotra *et al*., 1974; Khanna and Das 1991; Gupta *et al*., 2002; Sarkar and Ghosh, 2010, 2012a,b; Sarkar, 2013). Variety of synthetic dyes have found wide applications in textiles, food, cosmetics, lather, paper and other industries (Garrigos *et al*., 2002; Mathur and Bhatnagar, 2007; Pant *et al*., 2008). Singh (1997) reported that the Indian population consumes 220 mg of food colourants per year. Metanil Yellow was found to cause toxic methaemoglobinaemia in adult human males as reported by Sachdeva *et al*., (1992). So, many non-permitted colours in variety of food are used as adulterant (Mathur, 2000). Present study mainly focuses the chronic toxic effects of Metanil Yellow on the spleen tissue of albino rat (*Rattus norvegicus*) after 30 and 45 days treatment to evaluate the nature of toxic damage on comparative basis.

MATERIALS AND METHODS

The experiment was carried out on albino rats (*Rattus norvegicus*) of age group 2-3 months, weighing 250±60 g. After acclimatization under laboratory condition for one week they were divided into three groups containing five animals in each: Group I (control) and Group II & III (treated). The test animals of Group II & III were fed orally with a sublethal dose of Metanil Yellow of 3 g/kg body weight for a period of 30 and 45 days respectively. Rats of both control and experimental groups were sacrificed under chloroform anesthesia and desired spleen tissue was collected from both control and treated groups and fixed in aqueous Bouin's fluid solution and finally paraffin sections of 3-4 micron were stained with Haematoxylin-Eosin stain for histopathological observations.

RESULTS AND DISCUSSION

Two zones of spleen *i.e.*, red pulp and white pulp (Fig.1) are the main functional sites. Red pulp of spleen contains both the lymphocytes and macrophages. The red pulp is made up of splenic cords and venous sinuses. The white pulp, present around the central arteriole and contains lymphoid sheath. White pulp is subdivided into periarteriolar lymphatic sheath. follicular and marginal zones. Marginal zone is present between the white pulp and red pulp and it is very prominent in case of rat and there may be a few megakaryocytes present in the pulp.

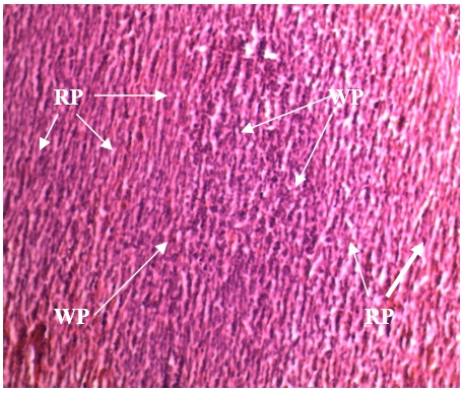
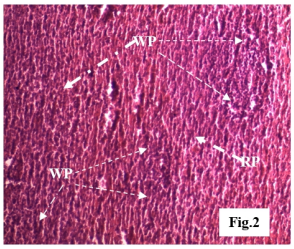


Fig.1

Fig.1. Photomicrographs of transverse sections of spleen tissue of control (C) *R. norvegicus* (H-E) which showing normal appearance of white pulp (WP) and red pulp (RP) (arrows). (C) [10 X 20]

Owing to 30 days of toxicity of Metanil Yellow very minute changes were found in the white pulp and red pulp of spleen of *R. norvegicus* (Fig.2). Trabeculae showed some changes after treatment. But significant changes were found in the white pulp and red pulp regions after 45 days treatment (Fig.3).



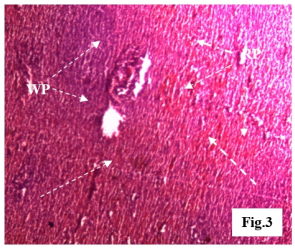


Fig.2. Photomicrographs of transverse sections of spleen tissue of

Metanil Yellow (MY) treated *R. norvegicus* (H-E) which showing degeneration in white pulp (WP) and red pulp (RP) region (broken arrows). (MY, 30 d) [10 X 20]

Fig.3. Photomicrographs of transverse sections of spleen tissue of Metanil Yellow (MY) treated *R. norvegicus* (H-E) which showing degeneration and damages in white pulp (WP) and red pulp (RP) region (broken arrows). (MY, 45 d) [10 X 10]

Different pathologiccal lesions *viz*., depopulation of follicles and distention of the red pulp regions and severe necrosis were found in this prolonged exposure. Some authors (Singh and Khanna, 1988; Ramachandani *et al*., 1992, 1997) recorded the acute and short-term toxicity of popular blend with Metanil Yellow and Orange-II in albino rats. Toxic effects of Metanil Yellow and Derma Orange on freshwater fish, *Channa punctatus* was reported by Goel and Basu (1989) and only Metanil Yellow on teleostean catfish, *Heteropneustes fossilis* was reported by Sarkar and Ghosh (2010). Histopathological as well as microanatomical changes of stomach, intestine, liver and kidney of albino rat have been found due to chronic consumption of Metanil Yellow (Sarkar and Ghosh, 2012b). Some testicular damage also found when fed with Metanil Yellow as reported by Sarkar and Ghosh (2012a). Granular and Purkinje cell layers of the brain of albino rat (*Rattus norvegicus*) were also found to be damaged after treatment with Metanil Yellow (Sarkar, 2013). Direct action of Metanil Yellow or its active metabolites on germ cells has also been recorded by Venkateshwarlu *et al.* (1997). Lymphoid necrosis as well as apoptosis of spleen of albino mice induced by Ethidium Bromide (Mathur and Bhagwat, 2012). Swirski *et al.* (2009) reported that half of the body's monocytes were stored in spleen of mice. Histopathogical changes of rat spleen affected by the dose of sodium fluoride which adversely affected the structure and function of the spleen and caused degeneration of red pulp region of rat spleen (Kumar and Kumari, 2013). Many authors (Kuper *et al*., 2002; Nolte *et al*., 2002; Balogh *et al*., 2004) reported that the spleen is the largest secondary lymphoid organ which contained about one-fourth of the body's lymphocytes and initiated immune response to blood-borne antigens. The entrance of blood in spleen is occurred at the hilus *via* the splenic artery. From trabecular arteries the small arteriole branches enter into the red pulp. In red pulp these small arterioles become central arterioles which are surrounded by lymphoid tissue. Their termination in the white pulp and red pulp regions were observed by some authors (Schmidt *et al*., 1985a; Satodate *et al*., 1986; Dijkstra and Veerman, 1990; Valli *et al*., 2002). Red pulp is made up of splenic cords and venous sinouses. Satio *et al*., (1988) reported that the splenic cords are composed of reticular fibres, reticular cells, and associated macrophages. Metanil Yellow has shown significant pathological changes not only in the white pulp and red pulp regions of spleen tissue of albino rat (*R. norvegicus*) but also in the follicles and trabeculae. The damage in the spleen tissue due to Metanil Yellow toxicity varies with both concentration and exposure periods (30 and 45 days).

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