



## EFFECTS OF MICROCYSTIN-LR ON KIDNEY AND LIVER; A TOXICOLOGICAL RAT MODEL ASSESSMENT

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### Abstract

Naturally derived cyanotoxin, Microcystin-LR (MC-LR) found in freshwater systems poses a threat to human health mainly affecting the functions of the kidney and liver. The present study was aimed to determine the possible effects of MC-LR on mammalian kidneys using male Wistar rats as the animal model. An ethically approved (No. 17/18, ERC, FMS, USJ) experimental protocol was used in the study. Thirty-five rats were divided into five groups (n=7) and were orally treated with different doses of MC-LR (0.105 µg/kg, 0.070 µg/kg, 0.035 µg/kg) and an environmental water sample collected from a well contaminated with MC-LR (0.091 µg/kg) from Padaviya in the district of Anuradhapura, Sri Lanka where high prevalence of Chronic Kidney diseases of Unknown etiology (CKDu) was recorded. The control group was treated with distilled water. The total exposure of the rats to the relevant doses was for 90 days. Blood and urine samples from individual animals were collected at 0, 7, 14, 28, 42, 60, 90 days to analyze serum and urine creatinine and the Kidney Injury Molecule-1 (KIM-1). Concentrations of MC-LR in urine was quantified by an ELISA method. Aspartate Amino Transferase (AST), Aspartate Alanine Transferase (ALT) and Full Blood Count (FBC) were also analyzed. The mean body weight of the treated and control groups of rats gradually decreased until the sixteenth week and a statistically significant difference was found ( $p=0.03$ ) between treated and control groups. The absolute and relative weights of liver and kidneys of the treated groups were less than those of control group. A marked increase in the concentration of serum creatinine from  $0.50\pm 0.01$  to  $0.54\pm 0.05$  mg/dL,  $0.50\pm 0.02$  to  $0.55\pm 0.06$  mg/dL,  $0.50\pm 0.02$  to  $0.57\pm 0.09$  mg/dL,  $0.50\pm 0.02$  to  $0.51\pm 0.06$  mg/dL were detected for 0.105 µg/kg, 0.070 µg/kg, 0.035 µg/kg and 0.091 µg/kg doses of the MC-LR treated groups of rats compared to the control ( $0.50\pm 0.01$  to  $0.59\pm 0.08$  mg/dL) following 90 days of exposure. Reductions in the concentrations of urine creatinine from  $52\pm 1$  to  $43\pm 4$  mg/dL,  $51\pm 1$  to  $43\pm 1$  mg/dL,  $52\pm 2$  to  $45\pm 7$  mg/dL,  $52\pm 2$  to  $44\pm 7$  mg/dL were recorded when MC-LR concentration in urine increased from  $0.4\pm 0.1$  to  $1.2\pm 0.3$  µg/L,  $0.2\pm 0.1$  to  $0.6\pm 0.1$  µg/L,  $0.1$  to  $0.3$  µg/L and  $0.5$  to  $1.0\pm 0.3$  µg/L in MC-LR exposed animal groups. The highest AST, ALT and KIM-1 concentrations were recorded in animals given the treatment dose of 0.105 µg/kg. Thus, the results of the present study confirms that the consumption of Microcystin-LR contaminated water leads to liver and kidney injuries in Wistar rats.

**Keywords:** Microcystin-LR (MC-LR), Wistar Rats, ELISA, AST, ALT, KIM-1