



Global Conference on Medical and Health Sciences

Hosted Online from Madrid, Spain

Date: 14th June, 2026

Website: <https://econferencia.com>

CHANGES IN THE OXIDATIVE AND ANTIOXIDANT SYSTEMS OF THE KIDNEYS IN METABOLIC SYNDROME

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Background

Metabolic syndrome (MetS) is one of the major challenges in modern medicine. Abdominal obesity, hyperglycemia, dyslipidemia, and arterial hypertension are key factors contributing to the development of kidney injury [1].

Experimental studies have demonstrated significant structural and functional alterations in renal cell membranes during the development of glomerular injury associated with enhanced lipid peroxidation (LPO) [2]. An experimental study by T.L. Pallone [3] showed that oxidative stress may be induced independently or simultaneously in both the renal cortex and medulla. Moreover, the superoxide anion initiates oxidative stress throughout all regions of the kidney, whereas hydrogen peroxide predominantly affects the renal medulla.

Objective

To investigate changes in the oxidative and antioxidant systems of the kidneys in experimental metabolic syndrome.

Materials and Methods

The study was performed on 24 Chinchilla rabbits weighing 2.2–2.4 kg. Metabolic syndrome was induced according to the method of Saidov S.A. (2006) by daily oral administration of cholesterol at a dose of 250 mg/kg body weight



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under fasting conditions, combined with a 5% sucrose solution instead of drinking water for two months. In addition, insulin was administered subcutaneously into the lumbar region every other day at a dose of 0.1 U/100 g body weight.

The animals were divided into two groups: Group I consisted of intact rabbits without any interventions, while Group II included rabbits with experimentally induced MetS receiving 2 mL of purified water.

Kidney tissue malondialdehyde (MDA) levels were determined according to Ohkawa et al. (1979), catalase activity according to Aebi (1984), and superoxide dismutase (SOD) activity according to Misra and Fridovich (1972). All experimental procedures were performed in accordance with the principles of the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes (Strasbourg, 1986).

Results

Rabbits with metabolic syndrome demonstrated a 74.12% increase in renal MDA levels compared with the intact group, indicating enhanced lipid peroxidation. Catalase and SOD activities were significantly reduced by 17.94% and 17.6%, respectively. An increase in total protein content in kidney tissue was also observed. These findings indicate the development of pronounced oxidative stress accompanied by impaired antioxidant defense.

Conclusion

Metabolic syndrome is associated with a marked imbalance between excessive generation of reactive oxygen species and a reduced capacity of antioxidant enzymes to neutralize them, resulting in oxidative damage to renal tissue.



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