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The biomechanistic aspects of renal cortical injury induced by diesel exhaust particles in rats and the renoprotective contribution of quercetin pretreatment: histological and biochemical study

Ahmed A. Morsi^{1*}, **Hanan Fouad**², **Wardah Abdullah Alasmari**³, **Eman Mohamed Faruk**^{4,3}

¹ Department of Histology and Cell Biology, Faculty of Medicine, Fayoum University, Fayoum, Egypt, ² Medical Biochemistry and Molecular Biology Department, Faculty of Medicine, Cairo University, Cairo, Egypt, ³ Department of Anatomy, Faculty of Medicine, Umm Al Qura University, Saudi Arabia, ⁴ Department of Histology and Cytology, Faculty of Medicine, Benha University, Benha, Egypt

Abstract:

Although several studies have reported a toxic effect of diesel exhaust particles (DEP) exposure on the kidney tissues, the involvement of autophagy/NF- κ B signaling as encountered mechanisms and the protective effects of a natural flavonoid, quercetin on DEP remains unclear. Thirty-two albino rats were divided as control, quercetin treated (60 mg/kg, oral), DEP-exposed (0.5 mg/kg, intra-tracheal), and quercetin/DEP exposed groups. Specimens of the renal cortex were subjected to histo-biochemical study and immunohistochemical analysis using anti-NF- κ B, and anti-LC3 β antibodies followed by morphometric and statistical analyses. The expression level of autophagy genes was quantitatively evaluated using RT-PCR, as well. The DEP-exposed rats showed an elevation in the renal tissue levels of MDA and a decrease in the catalase and superoxide dismutase ($p < 0.05$). Histologically, there were cytoplasmic vacuolar changes in the lining cells of the renal tubules, glomerular atrophy, and vascular congestion. In addition, renal inflammation was evident as confirmed by the increased NF- κ B immunoexpression. Moreover, the gene expression of *Becn1*, *ATG5*, and *LC3 β* increased ($p < 0.05$) due to DEP exposure. Conversely, quercetin pretreatment improved these renal histo-biochemical alterations ($p < 0.05$) and regulated autophagy/NF- κ B pathways. Overall, the study proved the renal toxicity mediated by DEP exposure via precipitating renal inflammation, autophagy activation, and oxidative stress. Quercetin pretreatment could antagonize such machinery to protect the kidney against DEP.

Keywords: air pollution, autophagy, immunohistochemistry, NF- κ B, oxidative stress, rat kidney