MORPHOMETRIC ASSOCIATION BETWEEN ZINC HOMEOSTASIS AND GLOMERULAR MESANGIAL EXPANSION IN EARLY EXPERIMENTAL DIABETIC KIDNEY DISEASE

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Annotation. *Diabetic kidney disease is a major microvascular complication of diabetes mellitus. Early renal injury may include structural changes of the glomerulus, particularly expansion of the mesangial matrix. Zinc is an essential trace element involved in redox homeostasis, metallothionein synthesis, and enzymatic processes. This thesis examines the potential relationship between zinc homeostasis and glomerular mesangial expansion in experimental diabetic kidney disease. Simultaneous assessment of zinc in serum, urine, and kidney tissue together with glomerular morphometry, albuminuria, and metallothionein expression may clarify the association between altered zinc status and early renal structural injury.*

Keywords*: diabetic kidney disease; zinc; zinc homeostasis; glomerulus; mesangial expansion; morphometry; metallothionein; oxidative stress*

Introduction. Persistent hyperglycemia is associated with metabolic and morphological changes in the renal microvasculature and nephron. Oxidative stress, inflammation, non-enzymatic glycosylation, and disturbed extracellular-matrix turnover participate in diabetic kidney injury. The glomerulus is particularly sensitive, and increased mesangial activity with excessive matrix accumulation may produce mesangial expansion. The source article also summarizes experimental evidence suggesting that altered zinc status is associated with oxidative injury, while zinc supplementation may reduce some pathological renal changes.

Aim. To assess the potential morphometric relationship between zinc homeostasis and glomerular mesangial expansion during the early stage of experimental diabetic kidney disease.

Materials and Methods. The proposed experimental design includes control, diabetic, and diabetic-plus-zinc-correction groups. Glycemia, body mass, albuminuria, and selected renal biochemical indicators would be assessed. Zinc concentrations would be measured in serum, urine, and kidney tissue. Histological sections would be examined for glomerular area, relative mesangial matrix fraction, and capillary structures. Metallothionein expression could be assessed by immunohistochemical or

molecular methods. Correlation analysis would be used to examine associations among zinc status, morphometric parameters, and functional indicators.

Results and Discussion. Experimental diabetes is expected to be associated with altered zinc homeostasis, increased oxidative stress, and glomerular structural changes. An increase in glomerular area and mesangial matrix fraction may occur. In the zinc-corrected group, reduced oxidative injury, stronger metallothionein expression, and less pronounced morphological damage may be observed. Serum zinc, urinary zinc, and tissue zinc should be interpreted together because they describe different aspects of zinc metabolism. Importantly, correlation alone cannot establish causality.

Conclusion. Changes in zinc homeostasis may be associated with early glomerular structural injury, especially mesangial matrix expansion. Combined evaluation of serum, urinary and renal-tissue zinc, glomerular morphometry, albuminuria, and metallothionein provides a promising framework for studying early diabetic renal injury. Real laboratory measurements and statistical analysis are required before quantitative conclusions can be made.

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