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The Effects of Omega-3 Fatty acids on the kidney after exposure to fine particulate matter

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Objectives: Several epidemiologic studies indicate that ambient particulate matter (PM) is closely associated with CKD and renal function decline. Recent experimental studies have shown that fine particulate matter can affect distant organs other than lungs, via increasing systemic inflammation. Omega-3 polyunsaturated fatty acids (PUFA-3) is an essential nutrients which is known to have anti-inflammatory and anti-oxidative effects. In this study, we examined the effect of PUFA-3 in the kidney of experimental rat model exposed to fine particulate matter.

Methods: 12 week old Sprague Dawley rats were exposed to Carbon Black particles for 5 hours for 6 weeks in an exposure chamber within the fume hood with HEPA-filter. PUFA-3 was supplemented at a dose of 300mg/kg/day 5 day a week by oral gavage before the exposure. Final carbon black concentration measured by Aerosol Mass Monitor was average 202.8±40.2 for PM_{2.5} and 315.5±61.4 for PM₄.

Results: Exposure to PM resulted in lung injury with upregulation of gene expressions such as IL-6, Nox-2 and 4, COX2, Hif-1 α , which were attenuated with PUFA-3 supplementation. In the kidney, exposure to PM resulted in significant tubular injury, with significant increase in KIM-1 gene expressions. PUFA-3 alleviated tubular injury, with a trend to decrease pro-inflammatory gene expressions in the kidney tissue. To exclude ischemic injury by alteration of renal blood flow by hypotension, blood pressure and heart rate were measured. Systolic blood pressure was significantly increased in PM exposure groups compared to normal group, however PUFA-3 had little effect on blood pressure. Diastolic blood pressure and heart rate were not significantly different among the groups.

Conclusions: We conclude that exposure to fine particulate matter can be significant risk factor for renal injury and omega-3 may have a preventive potential.