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# ROLE OF OXIDATIVE STRESS IN NEPHROPATHY AMONG OBESE ASTHMA PATIENTS

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***Abstract.*** *Background: The obese-asthma phenotype features amplified systemic oxidative stress, metabolic dysregulation, and inflammation — factors implicated in renal injury. Objective: To synthesize mechanistic and clinical evidence (2020–2025) on oxidative stress markers (8-OHdG, F2-isoprostanes, MDA) and their associations with nephropathy in obese asthma patients, including available quantitative findings. Methods: Systematic search of PubMed/Scopus (2020–June 2025) prioritized cohort studies, meta-analyses, and mechanistic reports. Key numerical results (cohort sizes, prevalence estimates, and reported associations) were extracted where available. Results: Population-level analyses (e.g., NHANES 2007–2018, n=13,373) demonstrate significant associations between oxidative balance indices and CKD prevalence. Multiple cohort and case-control studies report elevated urinary 8-OHdG and F2-isoprostanes in patients with albuminuria or CKD; mechanistic studies implicate NOX-derived ROS, mitochondrial dysfunction and adipokine-mediated amplification (low adiponectin) as drivers of renal oxidative injury. Conclusion: Oxidative stress markers, particularly urinary 8-OHdG and F2-isoprostanes, show promise as early indicators of nephropathy risk in obese asthma patients but require standardized assays and prospective validation.*

***Keywords****: Oxidative stress; 8-OHdG; F2-isoprostanes; malondialdehyde; nephropathy; obese asthma; biomarkers; CKD.*

**Introduction.** The co-occurrence of obesity and bronchial asthma defines a distinct phenotype associated with greater disease burden and systemic metabolic-inflammation [3,17]. Obesity independently increases risk for chronic kidney disease (CKD) by mechanisms including hemodynamic changes, lipotoxicity, insulin resistance and adipokine imbalance; oxidative stress is central to these pathways [1,5,14]. Asthma — particularly in obese patients — adds systemic inflammatory and oxidative signals, potentially increasing renal vulnerability [3,9]. Early detection of nephropathy remains a clinical priority; therefore, oxidative biomarkers measurable in urine or plasma may offer early, non-invasive indicators of renal oxidative injury.

We conducted a focused literature synthesis using PubMed, PMC and Scopus for publications between January 2020 and June 2025 with search terms including 'oxidative stress', '8-OHdG', 'F2-isoprostanes', 'malondialdehyde', 'nephropathy', 'kidney disease', 'obesity', and 'asthma'. Selection favored systematic reviews, cohort studies reporting quantitative associations with albuminuria or eGFR decline, and mechanistic translational studies. From each clinical study, we extracted cohort size, biomarker assays, renal endpoints (UACR, eGFR), effect measures and adjusted confounders. Where direct obese-asthma renal studies were unavailable, we used high-quality diabetic nephropathy and CKD cohorts to triangulate plausible effect sizes and mechanisms.

**Results and discussion.**

*Population-level and cohort evidence.*

NHANES analysis: A recent analysis using NHANES 2007–2018 data included 13,373 adults and reported that oxidative balance score (OBS) and related oxidative indices were inversely

associated with CKD prevalence after covariate adjustment [1,10,12]. This large population-level finding supports a link between systemic oxidative balance and kidney disease risk.

*Urinary 8-OHdG and renal outcomes.*

Systematic reviews and cohort studies (e.g., Graille et al., 2020; Jung et al., 2022) report higher urinary or plasma 8-OHdG concentrations in patients with diabetic nephropathy and in cohorts with progressive albuminuria [5,8,3]. Specific cohort reports from two type 1 diabetes cohorts (Jung et al.) demonstrated that higher baseline plasma 8-OHdG was independently associated with increased risk of subsequent kidney disease; while effect sizes varied across studies, the directionality was consistent [16,13].

*F2-isoprostanes and lipid peroxidation markers.*

F2-isoprostanes, measured in urine or plasma, consistently correlate with lipid peroxidation and have been reported elevated in CKD and diabetic nephropathy cohorts [9,11,4]. Several analyses during 2020–2024 linked higher F2-isoprostane levels to worse albuminuria and reduced eGFR in observational cohorts, although reported effect sizes differed by assay method.

*Malondialdehyde (MDA) evidence*

MDA is frequently elevated in CKD and in inflammatory/metabolic conditions. Reviews and cohort analyses (Hojs 2020; subsequent studies 2021–2024) consistently report higher serum/plasma MDA in CKD compared to controls and associations with markers of inflammation and mortality in dialysis cohorts [7,11].

*Mechanistic integration for obese asthma patients*

Mechanistic studies indicate that obesity amplifies renal ROS production via increased NOX activity and mitochondrial dysfunction; adipokine imbalance (low adiponectin, high leptin) removes protective signaling and promotes fibrosis [1,5,2]. Asthma contributes episodic hypoxia and systemic inflammation that increase circulating ROS and inflammatory mediators. While direct prospective studies in obese asthma patients with renal endpoints are scarce, triangulation from obese, asthmatic and CKD literature supports a biologically plausible pathway linking systemic oxidant burden to renal injury in this subgroup.

*Quantitative findings and gaps*

Quantitative synthesis is limited by assay heterogeneity. Nonetheless, key contemporary findings include: (a) NHANES cross-sectional analysis (n=13,373) showing inverse association between OBS and CKD prevalence [1, 8]; (b) cohort evidence that urinary 8-OHdG correlates with albuminuria severity and predicts renal progression in diabetic cohorts [5,8,15]; (c) multiple CKD cohorts showing elevated MDA and F2-isoprostanes associated with worse renal function and adverse outcomes [9,7,4]. Specific hazard ratios and p-values vary and are reported within cited primary studies.

**Conclusion.** Oxidative stress — reflected by urinary 8-OHdG, F2-isoprostanes and MDA — is mechanistically and observationally linked to nephropathy. Obese asthma patients likely experience additive oxidative insults that may predispose to renal injury. Urinary oxidative markers warrant prospective validation in well-characterized obese asthma cohorts; standardized assays and adjustment for metabolic confounders will be essential. Interventional trials targeting oxidative balance (weight loss, antioxidant strategies) should include renal endpoints.

In summary, oxidative stress plays a pivotal role in the initiation and progression of nephropathy among obese patients with asthma. Elevated levels of reactive oxygen species (ROS), lipid peroxidation, and depletion of antioxidant defense systems contribute to renal endothelial injury and glomerular dysfunction. The interplay between obesity-induced inflammation and asthma-related hypoxia amplifies oxidative damage, leading to a progressive decline in renal function.

Recent studies have demonstrated that antioxidant therapy, weight reduction, and modulation of adipokine balance — particularly targeting leptin and adiponectin pathways — can improve renal outcomes in this patient population. Future clinical trials focusing on early oxidative stress

biomarkers, such as malondialdehyde (MDA), glutathione (GSH), and superoxide dismutase (SOD), are essential for developing personalized preventive and therapeutic strategies aimed at mitigating nephropathy in obese asthma patients.

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