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**DOCTORAL SCHOOL OF MEDICINE AND PHARMACY**

PhD THESIS SUMMARY

# **CHANGES IN MARKERS OF SYSTEMIC INFLAMMATION AND OXIDATIVE STRESS IN PATIENTS WITH MORBID OBESITY**

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## INTRODUCTION

The doctoral thesis entitled “**Changes in Markers of Systemic Inflammation and Oxidative Stress in Patients with Morbid Obesity**” investigates the complex relationship between severe obesity, chronic low-grade inflammation, and redox imbalance, with particular emphasis on the impact of weight-loss treatment, especially bariatric surgery, on these biological pathways.

Morbid obesity represents a major global public health challenge, being strongly associated with type 2 diabetes mellitus, cardiovascular disease, non-alcoholic fatty liver disease, and increased mortality. Beyond excessive adiposity, obesity is currently recognized as a chronic inflammatory condition characterized by adipose tissue dysfunction, immune activation, and systemic oxidative stress. Adipose tissue acts as an endocrine organ producing adipokines and cytokines that contribute to metabolic and cardiovascular complications. Oxidative stress, defined as an imbalance between reactive oxygen and nitrogen species and antioxidant defense systems, plays a crucial role in the pathophysiology of obesity and insulin resistance. Persistent inflammation promotes mitochondrial dysfunction, endothelial damage, and lipid peroxidation, creating a vicious cycle that accelerates cardiometabolic disease progression.

## METHODOLOGY

The original research component of this thesis consisted of two prospective controlled cohort studies conducted between 2021 and 2023, designed to evaluate both inflammatory and oxidative stress dynamics in morbidly obese patients undergoing bariatric surgery. A total of 100 obese subjects were assessed preoperatively and at 12 months postoperatively and compared with normoweight control groups. The inflammatory panel included TNF- $\alpha$ , IL-6, and adiponectin, while the redox profile comprised malondialdehyde (MDA), reduced and oxidized glutathione (GSH, GSSG), the GSH/GSSG ratio, total glutathione, and nitric oxide metabolites (nitrite and nitrate).

Standardized biochemical assays were employed, and statistical analyses included group comparisons, longitudinal assessments, and correlation testing with anthropometric and metabolic parameters. This integrated design enabled simultaneous evaluation of cytokine modulation and redox homeostasis following substantial surgical weight loss, providing a structured framework for analyzing the biological impact of bariatric intervention on systemic inflammation and oxidative stress.

Strong correlations were identified between inflammatory markers, oxidative stress parameters, and indices of insulin resistance and dyslipidemia, supporting the hypothesis that inflammation and redox imbalance act synergistically in obesity-related metabolic dysfunction.

## RESULTS

Following bariatric surgery, substantial metabolic improvement was observed. Weight loss was associated with:

- significant reduction of systemic inflammation
- decrease in oxidative stress biomarkers

- partial restoration of antioxidant capacity
- improvement of insulin sensitivity and lipid profile

The integrative analysis of both studies confirms that morbid obesity is characterized by a pro-inflammatory and pro-oxidative systemic environment. Bariatric surgery exerts a dual biological effect: it significantly reduces inflammatory cytokine activity and improves antioxidant defense mechanisms. The increase in adiponectin, reduction in IL-6, decrease in lipid peroxidation, and partial restoration of glutathione levels collectively indicate that surgical weight loss modulates key pathophysiological pathways underlying metabolic syndrome.

Morbid obesity is associated with a systemic pro-inflammatory and pro-oxidative state that contributes to metabolic and cardiovascular complications. Bariatric surgery leads to significant improvement in inflammatory status, restoration of redox balance, and overall metabolic recovery.

## CONCLUSIONS

These findings support the role of weight-loss interventions as essential therapeutic strategies in the management of severe obesity and highlight the importance of inflammatory and oxidative stress markers as tools for clinical monitoring and risk assessment.