

FACULTAD CIENCIAS BÁSICAS Y BIOMÉDICAS

MAESTRÍA EN GENÉTICA

Evaluación del daño oxidativo al ADN mediante ensayo cometa y del perfil metabólico urinario por espectroscopía Raman en pacientes con obesidad de Barranquilla

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Resumen

La obesidad es una enfermedad crónica y multifactorial asociada con alteraciones metabólicas, inflamación y estrés oxidativo, generando daño a macromoléculas como el ADN. Este estudio evaluó el daño oxidativo al ADN mediante el ensayo cometa con enzima FPG y caracterizó el perfil metabólico urinario mediante espectroscopía Raman en pacientes con obesidad tipo I y II en Barranquilla. Se realizó un estudio de casos y controles con 100 participantes (50 obesos, 50 controles), aplicando cuestionarios de estilo de vida y recolectando sangre y orina. El ensayo cometa evidenció aumento significativo de daño al ADN en los obesos, especialmente lesiones oxidativas en purinas. La espectroscopía Raman mostró diferencias en glucógeno, carbohidratos, lípidos, ADN/ARN, triptófano, fenilalanina y porfirinas, reflejando desequilibrios metabólicos asociados a inflamación y disfunción energética. Se observaron correlaciones entre daño genómico y factores del estilo de vida como consumo de alcohol, ultraprocesados, deficiencia de vitaminas, alteraciones del sueño y antecedentes psiquiátricos. La integración de ambos métodos proporciona una visión molecular y metabólica complementaria de la obesidad. Estos hallazgos destacan su utilidad como herramientas no invasivas para detección temprana, monitoreo y prevención de complicaciones. Se abren perspectivas para investigaciones interdisciplinarias y aplicaciones clínicas.

Palabras clave: Obesidad, daño oxidativo, ensayo cometa, espectroscopía Raman, metabolitos urinarios, estilo de vida.

Abstract

Obesity is a chronic and multifactorial disease associated with metabolic alterations, inflammation, and oxidative stress, causing damage to macromolecules such as DNA. This study evaluated oxidative DNA damage using the comet assay with the FPG enzyme and characterized the urinary metabolic profile by Raman spectroscopy in patients with type I and II obesity in Barranquilla. A case-control study was conducted with 100 participants (50 obese, 50 controls), applying lifestyle questionnaires and collecting blood and urine samples. The comet assay showed a significant increase in DNA damage in obese participants, particularly oxidative lesions in purines. Raman spectroscopy revealed differences in glycogen, lipids, DNA/RNA, tryptophan, phenylalanine, and porphyrins, reflecting metabolic imbalances associated with inflammation and energy dysfunction. Correlations were observed between genomic damage and lifestyle factors such as alcohol consumption, ultraprocessed foods, vitamin deficiency, and sleep disturbances. The integration of both methods provides a complementary molecular and metabolic view of obesity. These findings highlight their usefulness as non-invasive tools for early detection, monitoring, and prevention of complications. Perspectives are opened for interdisciplinary research and clinical applications.

Keywords: Obesity, oxidative damage, comet assay, Raman spectroscopy, urinary metabolites, lifestyle.

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