Universidad de Navarra
Facultad de Ciencias

MÁSTER EN INVESTIGACIÓN BIOMÉDICA
Research Project Proposal
Academic year 2026-2027

Project Nº 37

Title: Role of antimicrobial peptides in the modulation of macrophage polarization and inflammatory responses in obesity

Department/ Laboratory Metabolic Research Laboratory, Department of Endocrinology & Nutrition, Clínica Universidad de Navarra

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Summary
Background: Macrophages play a central role in obesity-associated inflammation through their polarization towards either a pro-inflammatory (M1) or an anti-inflammatory (M2) phenotype. An imbalance between these subtypes contributes to insulin resistance, adipose tissue dysfunction, and the progression of metabolic diseases. Antimicrobial peptides (AMPs) are small bioactive molecules involved not only in host defense against pathogens, but also in the regulation of immune responses, inflammation, and tissue homeostasis. Emerging evidence suggests that AMPs may influence macrophage function and polarization; however, their role in adipose tissue macrophage biology during obesity remains poorly understood. **Hypothesis**: Obesity-associated changes in AMP expression modulate macrophage polarization and inflammatory responses in adipose tissue, contributing to immune dysfunction and metabolic alterations. **Objective:** To evaluate the role of AMPs in the regulation of macrophage polarization and inflammatory responses in the context of obesity. **Methodology:** We will evaluate the role of AMPs in macrophage polarization using human monocyte-derived macrophages and THP-1 macrophages. Cells will be exposed to inflammatory and anti-inflammatory stimuli to assess changes in M1/M2 polarization markers, cytokine production, and inflammatory signaling pathways. AMP function will be evaluated by treatment with recombinant proteins and by gene silencing using small interfering RNA (siRNA). In addition, AMP expression and macrophage polarization markers will be analyzed in visceral adipose tissue samples from individuals with normal weight and obesity. The role and functionality of the AMPs will be further investigated in a rat model of bariatric surgery (sleeve gastrectomy and SADI-S).

The following **techniques** will be used:

Sample processing:
- Serum and plasma processing
- Cellular isolation from tissue
- RNA isolation from tissue and cell cultures
- Protein extraction from tissue

Biology molecular techniques:
- Nucleic acid and protein quantification and quality assessment
- Analysis of gene expression by Real-time PCR
- Analysis of protein expression by Western-blot

Analytic techniques:
- ELISAs
- Immunohystochemical analysis

In vitro studies:
- THP-1 and adipocyte cell cultures
- Treatments with recombinant proteins
- Inhibition of gene expression by siRNA

Statistical analysis:
Learn to carry out the statistical analysis and the representation of the data obtained

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yes	
no	X

Does the project include the possibility of supervised animal manipulation to complete the training for animal manipulator?