POTENTIAL BIOMARKERS OF BONE AND ADIPOSE INTER-TISSUE CROSSTALK IN OBESE BARIATRIC PATIENTS

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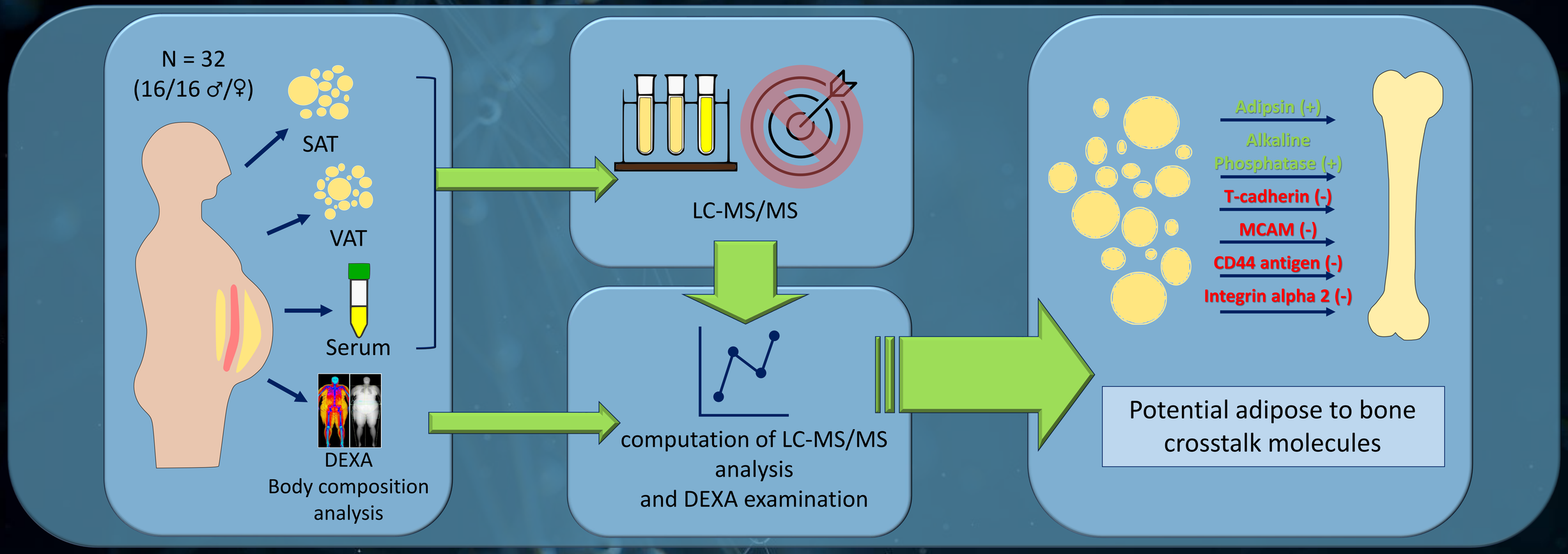
Introduction

Understanding the complex interplay between bone and adipose tissue is essential for grasping overall metabolic health. These tissues, integral to the musculoskeletal system, communicate through intricate signalling pathways. Research into this communication has surged due to its relevance to conditions like obesity, diabetes, and bone disorders. Crosstalk involves the release of signalling molecules influencing each other's function and body homeostasis. Studying this interaction sheds light on bone density, adipose distribution, and systemic metabolism. Deciphering these interactions holds promise for targeted interventions in metabolic and musculoskeletal disorders, advancing overall health and well-being.

Aims

1. Analysis of inter-tissue communication between adipose and bone tissue
2. Estimation of new potential biomarkers for BMD from blood samples

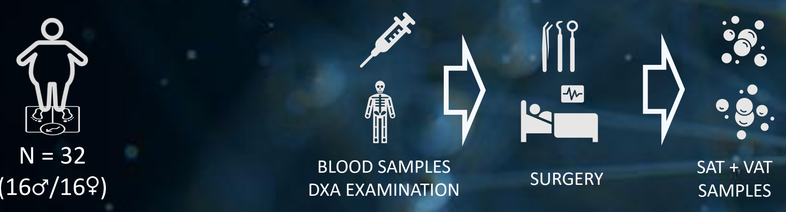
Scheme of experiment



LC-MS/MS = Liquid Chromatography Tandem Mass Spectrometry; VAT = visceral adipose tissue; SAT = subcutaneous adipose tissue; BMD = bone mineral density

Materials

- 32 obese individuals (16 female/16 male) undergoing bariatric
- DEXA examination data and blood samples were collected pre-surgery, tissue biopsies were obtained during surgery from specific areas



Methods

Sample Analysis:
- Serum analysis was performed on a timsTOF Pro mass spectrometer
- Both types of adipose tissue (SAT and VAT) were extracted and analysed by LC-MS/MS

Data Analysis:
- Proteomic data were analysed using multiple proteomic databases and softwares
- A list of exprimed proteins was selected
- R package were used to analyse relationships between proteins from different adipose tissue types, exprimed serum protein, and DEXA examination traits.

Results

Combining proteomic analysis and DEXA examination, we identified 78 proteins correlated with BMD values. Our investigation into adipose-bone tissue communication focused on proteins expressed differentially in adipose tissue and transported in plasma, comparing them with the BMD-related proteins. From this, we pinpointed 6 potential biomarkers:

Adipsin: Positively correlated with BMD, with signaling roles in adipose tissue.
Alkaline Phosphatase, Tissue-Nonspecific Isozyme (AP-TNAP): Positively correlated with BMD, pivotal in bone mineralization.
T-cadherin: Positively correlated with BMD, possibly involved in adiponectin communication.
MCAM: Lower serum expression despite adipose tissue elevation, linked to bone metabolism and regeneration.
CD44 Antigen: Negatively correlated with BMD, implicated in wound healing and immunomodulation.
Integrin Alpha-2 (ITGA2): Lower serum levels despite varied adipose expression, potentially involved in bone material breakdown and treatment targets for bone defects.

Molecules corelated with bone mineral density (BMD)

protein	serum - c	VAT - c	SAT - c	BMD Total - c	p
Adipsin	0,15149	0,15719	0,10313	0,37066	0,04010
T-cadherin	0,29900	0,15590	0,24651	-0,36580	0,04299
Alkaline phosphatase	-0,25399	0,13313	-0,09648	0,43702	0,01396
MCAM	-0,05947	0,09946	0,30702	-0,37050	0,04019
CD44 antigen	0,13163	-0,04493	0,13154	-0,40501	0,02381
Integrin alpha-2	-0,09326	0,02161	-0,20235	-0,37394	0,03824

c = correlation; VAT = visceral adipose tissue; SAT = subcutaneous adipose tissue

Discussion

Studying molecules like Adipsin, Alkaline Phosphatase (AP-TNAP), T-cadherin, MCAM, CD44 Antigen, and Integrin Alpha-2 (ITGA2) in the interplay between bone and adipose tissue is intriguing due to their roles in cellular interactions and signalling. Adipsin influences bone density via metabolic signals, AP-TNAP affects bone mineralization, T-cadherin may impact bone remodelling, MCAM contributes to cell adhesion in both tissues, CD44 Antigen regulates cellular processes, and ITGA2 mediates tissue interactions. Understanding these mechanisms sheds light on how adipose signals influence bone health and vice versa, potentially leading to therapeutic breakthroughs for metabolic disorders and osteoporosis.

Conclusions

We selected 6 proteins with potential for biomarkers of inter-tissue communication of adipose and bone tissue. This study needs verifying experiments to confirm the conclusion.
We hope that our results will help to understand the complex, difficult and dynamic process of inter-tissue communication between bone and adipose tissue in the future.

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