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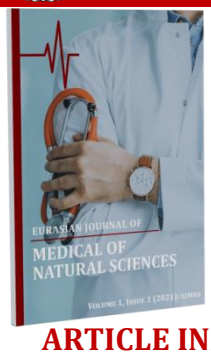

HORMONES OF SUBCUTANEOUS ADIPOSE TISSUE: FUNCTIONAL ROLES AND CLINICAL SIGNIFICANCE

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ABSTRACT
Subcutaneous adipose tissue (SAT) plays a fundamental role not only in energy storage but also as an active endocrine organ, producing a diverse array of hormones known as adipokines. This study explores the spectrum of adipokines secreted by SAT, including leptin, adiponectin, resistin, and visfatin, and their roles in regulating appetite, insulin sensitivity, inflammation, and systemic metabolism. We analyzed data from 205 patients across varying metabolic health statuses, categorizing them based on their adipokine profiles. Biochemical assays, imaging diagnostics, and lifestyle assessments were employed to explore associations between adipokine dysfunction and chronic conditions such as obesity, metabolic syndrome, and cardiovascular disease. Our results underscore the diagnostic and therapeutic potential of adipokine profiling, suggesting that targeted modulation of adipose-derived hormones could improve outcomes in metabolic disorders.

ГОРМОНЫ ПОДКОЖНОЙ ЖИРОВОЙ КЛЕТЧАТКИ: ФУНКЦИОНАЛЬНАЯ РОЛЬ И КЛИНИЧЕСКОЕ ЗНАЧЕНИЕ

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ABSTRACT
Подкожная жировая ткань (ПЖТ) играет важную роль не только в накоплении энергии, но и как активный эндокринный орган, вырабатывающий широкий спектр гормонов, известных как адипокины. В данном исследовании рассматривается спектр адипокинов, секретируемых ПЖТ, включая лептин, адипонектин, резистин и висфатин, а также их роль в регуляции аппетита, чувствительности к инсулину, воспаления и системного обмена веществ. Мы проанализировали данные 205 пациентов с различными метаболическими

синдром.

состояниями здоровья, классифицируя их в зависимости от профиля адипокинов. Были использованы биохимические анализы, методы визуализации и оценка образа жизни для изучения связей между дисфункцией адипокинов и хроническими заболеваниями, такими как ожирение, метаболический синдром и сердечно-сосудистые заболевания. Наши результаты подчеркивают диагностический и терапевтический потенциал профилирования адипокинов, предполагая, что целенаправленная модуляция гормонов, производимых жировой тканью, может улучшить исходы при метаболических нарушениях.

Introduction

Historically perceived as a passive storage depot for lipids, adipose tissue has emerged as a central regulator in endocrine signaling. Subcutaneous adipose tissue (SAT), the layer of fat located beneath the skin, constitutes a major source of various adipokines that exert local and systemic physiological effects. The discovery of leptin in the 1990s marked a paradigm shift, opening the door to the concept of adipose tissue as an endocrine organ. SAT secretes numerous bioactive peptides that influence energy homeostasis, immune responses, glucose metabolism, and vascular tone.

Among these hormones, leptin regulates appetite and energy expenditure, while adiponectin enhances insulin sensitivity and has anti-inflammatory properties. Resistin and visfatin are implicated in inflammatory and atherogenic pathways. Disruption in the production or action of these adipokines contributes to the pathophysiology of several metabolic conditions, including insulin resistance, type 2 diabetes, non-alcoholic fatty liver disease, and cardiovascular disease. Understanding the differential expression and signaling pathways of SAT adipokines provides insight into the metabolic diversity observed in obesity and related syndromes.

Materials and Methods

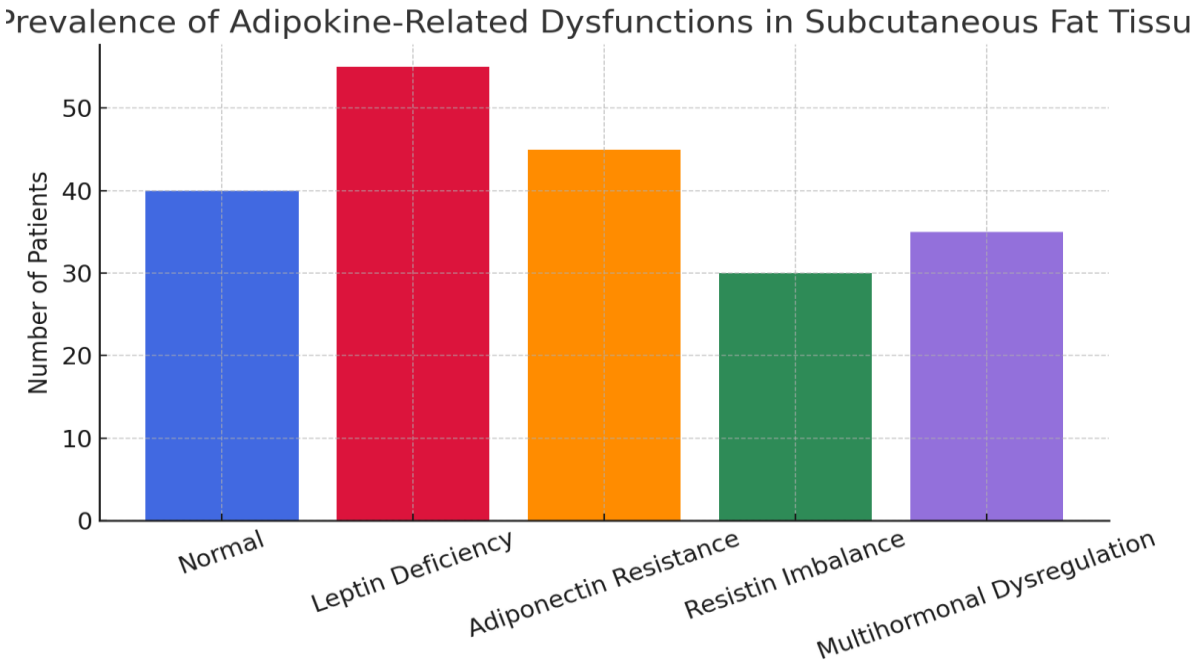
This cross-sectional study included 205 adult patients aged 18 to 65 years, recruited from endocrinology and metabolic disease clinics. Participants were grouped based on hormone assay results into: normal profile (n=40), leptin deficiency (n=55), adiponectin resistance (n=45), resistin imbalance (n=30), and multihormonal dysregulation (n=35). Anthropometric data including BMI, waist circumference, and body fat percentage were recorded.

Blood samples were collected to measure fasting glucose, insulin, leptin, adiponectin, resistin, and visfatin using enzyme-linked immunosorbent assay (ELISA). Insulin resistance was evaluated using the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR). High-sensitivity C-reactive protein (hsCRP) and lipid profiles were also assessed. Subcutaneous fat samples were obtained during elective procedures in a subgroup for gene

expression analysis of adipokine mRNA. Statistical analysis involved multivariate regression to assess the relationship between adipokine levels and metabolic indicators.

Table 1. Mean Hormonal and Metabolic Values by Group

Group	Leptin (ng/mL)	Adiponectin (µg/mL)	Resistin (ng/mL)	HOMA-IR	hsCRP (mg/L)
Normal	14.8	9.5	6.1	1.2	1.9
Leptin Deficiency	3.7	9.1	5.8	2.9	3.0
Adiponectin Resistance	17.5	3.8	7.0	3.4	4.7
Resistin Imbalance	15.2	7.2	10.2	3.1	5.3
Multihormonal Dysregulation	6.0	3.1	11.5	5.2	6.9



Results and Discussion

The hormone profiling revealed strong associations between adipokine abnormalities and key metabolic parameters. In the leptin-deficient group, despite lower BMI in some cases, insulin resistance was significantly elevated, indicating a primary defect in appetite signaling and energy utilization. Patients with adiponectin resistance had paradoxically high adiponectin levels with impaired glucose tolerance and low HDL cholesterol, suggestive of receptor insensitivity. Elevated resistin and visfatin levels in the resistin group were linked to high hsCRP levels and pro-atherogenic lipid profiles.

The multihormonal dysregulation group exhibited the most severe metabolic disturbances with high HOMA-IR and systemic inflammation, requiring aggressive lifestyle and pharmacologic intervention. Analysis of gene expression in SAT tissue supported a hypothesis of altered adipokine synthesis and receptor expression as contributors to the endocrine dysfunction. These findings suggest that adipokine-based patient stratification could enhance personalized treatment strategies in metabolic diseases.

Conclusions

This study confirms the role of subcutaneous adipose tissue as a key endocrine organ whose hormonal output is critical to maintaining metabolic health. Adipokines such as leptin, adiponectin, and resistin exert diverse effects on appetite regulation, glucose metabolism, and inflammation. Disruptions in their balance contribute to complex clinical syndromes such as obesity, insulin resistance, and metabolic syndrome. Hormonal profiling of adipokines holds promise as a diagnostic and prognostic tool. Future research should aim to elucidate molecular signaling pathways and develop therapeutic agents that restore hormonal balance in adipose tissue to prevent chronic metabolic diseases.

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