ASSESSMENT OF BODY COMPOSITION IN WOMEN WITH HYPERANDROGENISM USING BIOIMPEDANCE ANALYSIS

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Abstract. *Hyperandrogenism is one of the most common endocrine disorders affecting women of reproductive age and is frequently associated with metabolic disturbances, including obesity, insulin resistance, and altered body composition. Despite advances in hormonal diagnostics, the metabolic component of hyperandrogenism remains insufficiently studied in clinical practice. In particular, the role of body composition changes, especially visceral fat accumulation, is of great importance in understanding the pathogenesis and progression of the disease.*

Bioimpedance analysis is a modern non-invasive method that allows detailed assessment of body composition, including fat mass, muscle mass, and body water distribution. The use of this method makes it possible to identify hidden metabolic disorders even in patients with normal body mass index.

The present study aimed to evaluate body composition parameters in women with hyperandrogenism using bioimpedance analysis and to determine their diagnostic and clinical significance. The results showed that patients with hyperandrogenism demonstrate increased total and visceral fat mass, decreased muscle mass, and disturbances in water balance. These changes were more pronounced in patients with clinically manifested forms of the syndrome.

Thus, bioimpedance analysis can be considered an effective additional diagnostic tool that expands the possibilities of early detection and comprehensive assessment of metabolic disorders in hyperandrogenism.

Keywords: *hyperandrogenism, bioimpedance analysis, body composition, visceral fat, metabolic disorders*

Introduction.

Hyperandrogenism remains one of the leading causes of endocrine and reproductive disorders in women, significantly affecting fertility, menstrual function, and overall quality of life. In recent decades, the prevalence of hyperandrogenism has been steadily increasing, which is associated not only with improved diagnostic capabilities but also with the growing incidence of metabolic disorders, including obesity and insulin resistance. According to modern data, hyperandrogenism is closely linked with polycystic ovary syndrome, which is considered its most common clinical manifestation and is observed in the majority of patients with androgen excess [4,11].

The pathogenesis of hyperandrogenism is complex and multifactorial. It involves dysregulation of the hypothalamic–pituitary–ovarian axis, increased androgen production by the ovaries and adrenal glands, as well as metabolic disturbances that contribute to disease progression. In particular, visceral adipose tissue plays an important role in the development of hyperandrogenism, as it is metabolically active and directly involved in the processes of insulin resistance, inflammation, and steroid hormone metabolism [6,7].

In recent years, increasing attention has been paid to the role of body composition in the development of endocrine disorders. It has been shown that women with hyperandrogenism often have an increased proportion of visceral fat, even in the absence of overt obesity. This type of fat distribution is associated with a higher risk of metabolic complications and contributes to the worsening of hormonal imbalance. At the same time, traditional anthropometric indicators such as

body mass index do not always reflect the true metabolic status of patients and may lead to underestimation of existing disorders [10].

In this regard, the use of modern diagnostic methods capable of assessing internal body composition is of particular importance. Bioimpedance analysis is one such method, which allows the evaluation of fat mass, lean body mass, and body water distribution in a simple and non-invasive manner. This method is widely used in clinical practice and has proven its effectiveness in assessing metabolic status and monitoring treatment outcomes [1,2].

Despite the growing interest in this field, the role of bioimpedance analysis in the diagnosis and management of hyperandrogenism has not yet been sufficiently studied. There is a need for comprehensive research aimed at evaluating the diagnostic value of body composition parameters and their relationship with hormonal and metabolic indicators.

Therefore, the aim of the present study was to assess body composition characteristics in women with hyperandrogenism using bioimpedance analysis and to determine their clinical and diagnostic significance in improving early detection and management of the disease.

Material and methods of research.

This study was conducted based on the clinical experience of the Andijan regional branch of the Republican Specialized Scientific and Practical Medical Center “Mother and Child” of the Ministry of Health of the Republic of Uzbekistan during the period from 2022 to 2025. The results of examination and treatment of 120 women of reproductive age diagnosed with hyperandrogenism were analyzed. The inclusion criteria were clinical and laboratory signs of hyperandrogenism, including menstrual irregularities, clinical manifestations of androgen excess, and confirmed hormonal imbalance.

To perform a comparative analysis, all patients were conditionally divided into two groups depending on the clinical course of the disease: the first group included patients with latent forms of hyperandrogenism, while the second group consisted of patients with manifest forms characterized by pronounced clinical and laboratory changes. The main difference between the groups was the severity of hormonal imbalance and the degree of metabolic disturbances identified during the examination.

All patients underwent a comprehensive examination that included clinical, laboratory, and instrumental methods of assessment. Clinical evaluation consisted of anthropometric measurements, assessment of menstrual function, and identification of clinical signs of hyperandrogenism. Laboratory investigations included determination of hormonal parameters such as total testosterone, dehydroepiandrosterone sulfate (DHEA-S), luteinizing hormone (LH), follicle-stimulating hormone (FSH), prolactin, and thyroid hormones, performed according to standard protocols.

In addition to routine diagnostic methods, all patients underwent bioimpedance analysis using a standardized procedure. The study evaluated key body composition parameters, including total body fat percentage, visceral fat level, skeletal muscle mass, total body water, and phase angle. Measurements were carried out under standardized conditions, including fasting state and controlled hydration status, to ensure the accuracy and reproducibility of the results.

When assessing the clinical and metabolic characteristics of patients, special attention was paid to the relationship between body composition indicators and hormonal parameters. Patients were further categorized based on the degree of deviation of bioimpedance indicators from normal reference values, allowing the identification of early metabolic disturbances even in the absence of overt clinical symptoms.

Statistical processing of the obtained data was carried out using the Statistica 6.0 software package. The analysis included descriptive statistics, comparative analysis between groups, and correlation analysis to determine the relationship between hormonal and bioimpedance indicators. Differences were considered statistically significant at $p<0.05$.

Results and discussion.

Among the examined women with hyperandrogenism, the majority of patients were of reproductive age, with an average age ranging from 18 to 30 years. Clinical analysis showed that the syndrome manifested with varying degrees of severity, including both latent and clinically expressed forms. According to the obtained data, metabolic disturbances were observed in a significant proportion of patients, even in cases where anthropometric indicators such as body mass index remained within normal limits.

One of the key findings of the study was the presence of significant alterations in body composition parameters identified using bioimpedance analysis. An increase in total body fat percentage was observed in the majority of patients, with particularly pronounced changes in visceral fat accumulation. It is important to note that elevated visceral fat levels were detected even in patients without obvious obesity, which indicates the presence of hidden metabolic disorders and confirms the limited diagnostic value of traditional anthropometric indicators alone.

Among the concomitant conditions, signs of insulin resistance, menstrual dysfunction, and endocrine imbalance were frequently identified. A considerable proportion of patients demonstrated a combination of hormonal and metabolic abnormalities, indicating a close relationship between endocrine dysfunction and body composition changes. In particular, patients with manifest forms of hyperandrogenism exhibited more pronounced metabolic disturbances compared to those with latent forms.

The analysis of bioimpedance indicators revealed that increased visceral fat plays a central role in the pathogenesis of hyperandrogenism. Visceral adipose tissue is metabolically active and contributes to the development of insulin resistance, which in turn stimulates androgen overproduction. This creates a feedback mechanism that aggravates hormonal imbalance and contributes to disease progression. In addition, a decrease in skeletal muscle mass was observed in a number of patients, which further reflects unfavorable metabolic changes and reduced adaptive capacity of the organism.



Figure 1. Segmental distribution of skeletal muscle mass across body regions (arms, legs, and trunk) based on bioimpedance analysis

A detailed evaluation of body composition demonstrated that disturbances in total body water distribution were also present. These changes may be associated with alterations in cellular metabolism and membrane permeability, reflecting systemic metabolic dysfunction. The phase angle

parameter, which is considered an indicator of cellular health and integrity, was reduced in patients with more severe forms of hyperandrogenism, suggesting impaired cellular function.

When analyzing the relationship between hormonal and bioimpedance indicators, a positive correlation was identified between androgen levels and visceral fat content. This confirms that increased adiposity contributes to endocrine imbalance. Conversely, lean body mass showed a negative correlation with androgen levels, indicating its protective role in maintaining metabolic stability.

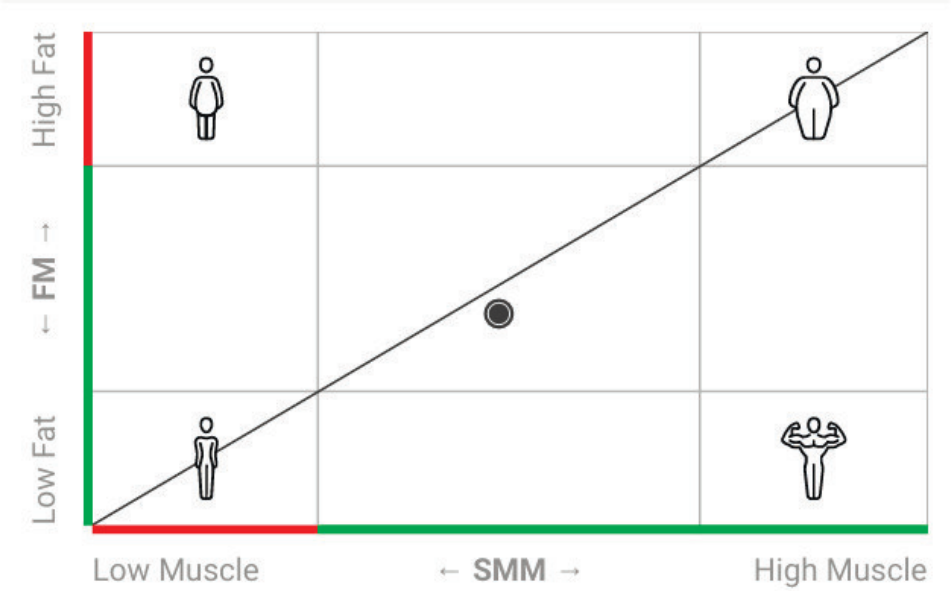


Figure 2. Distribution of body composition according to fat mass (FM) and skeletal muscle mass (SMM) in patients with hyperandrogenism

An important observation of the study is that patients with latent hyperandrogenism often demonstrated only minor deviations in hormonal parameters, while significant changes in body composition were already present. This finding emphasizes the importance of using bioimpedance analysis as an additional diagnostic tool for early detection of metabolic disturbances that may not be identified through routine laboratory testing.

From a clinical perspective, the results indicate that bioimpedance analysis provides valuable information that complements standard diagnostic methods. It allows not only the identification of metabolic abnormalities but also the stratification of patients according to the severity of metabolic risk. This is particularly important for the development of individualized treatment strategies aimed at correcting both hormonal and metabolic components of the disease.

Table 1.

Body Composition Parameters in Patients with Hyperandrogenism

Parameter	Latent HA	Manifest HA
Body fat (%)	28±3	36±4
Visceral fat	Moderate	High
Muscle mass	Normal	Decreased
Body water	Slight ↓	Significant ↓

The results confirm that visceral adiposity plays a central role in the pathogenesis of hyperandrogenism. Increased fat accumulation contributes to insulin resistance and enhances androgen production, forming a pathological cycle that worsens disease progression [6,7].

Importantly, patients with latent hyperandrogenism already demonstrated early metabolic changes, highlighting the importance of bioimpedance analysis for early diagnosis.

Furthermore, the use of bioimpedance analysis makes it possible to monitor changes in body composition during treatment. Dynamic assessment of fat mass, muscle mass, and body water allows evaluation of the effectiveness of therapeutic interventions and adjustment of treatment approaches when necessary. This significantly enhances the overall management of patients with hyperandrogenism.

In general, the obtained results confirm that hyperandrogenism should be considered a systemic disorder involving both endocrine and metabolic components. The integration of bioimpedance analysis into clinical practice expands diagnostic capabilities and contributes to a more comprehensive understanding of the disease.

Conclusion.

The results of the present study indicate that metabolic disturbances associated with hyperandrogenism are observed in a significant proportion of patients and are closely related to alterations in body composition. Increased visceral fat accumulation was identified as one of the most important factors contributing to the progression of hormonal imbalance. It was found that even in patients with normal body mass index, hidden metabolic abnormalities were present, which cannot be detected using standard anthropometric methods alone.

The obtained data demonstrate that changes in body composition, including increased fat mass, decreased muscle mass, and altered body water distribution, play a key role in the pathogenesis of hyperandrogenism. These changes contribute to the development of insulin resistance and endocrine dysfunction, thereby forming a self-sustaining pathological cycle that aggravates the clinical course of the disease.

A significant relationship was established between bioimpedance indicators and hormonal parameters, confirming that visceral adiposity directly influences androgen levels. Patients with more pronounced metabolic disturbances exhibited more severe clinical manifestations of hyperandrogenism, which indicates the importance of early identification of such changes.

The use of bioimpedance analysis made it possible to detect early metabolic alterations that are not identified by routine diagnostic methods. This method provides additional clinically significant information and allows a more accurate assessment of the patient’s condition. The integration of bioimpedance analysis into clinical practice improves diagnostic accuracy and contributes to the development of personalized treatment strategies.

Thus, bioimpedance analysis can be considered an effective non-invasive method for comprehensive evaluation of patients with hyperandrogenism. Its use expands diagnostic capabilities, allows early detection of metabolic disorders, and improves the effectiveness of therapeutic interventions.

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