URGANCH DAVLAT TIBBIYOT INSTITUTI
JANUBIY OROLBO‘YI TIBBIYOT JURNALI
2 - TOM, 4 - SON. 2026
14.00.00 - TIBBIYOT FANLARI ISSN: 3093-8740

УДК 616.441-073.43:796.83

ULTRASOUND EVALUATION OF THYROID GLAND MORPHOLOGY IN COMPETITIVE WRESTLERS: A CROSS-SECTIONAL STUDY OF STRUCTURAL CHARACTERISTICS AND BENIGN THYROID ABNORMALITIES

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Abstract

Background: The thyroid gland plays a crucial role in regulating metabolic processes, energy balance, and physiological adaptation to intensive physical activity. Athletes involved in combat sports experience prolonged physical and psychological stress that may influence endocrine function. Although functional thyroid changes have been extensively investigated, structural characteristics of the thyroid gland in wrestlers remain insufficiently studied.

Objective: To assess the ultrasonographic characteristics of the thyroid gland and determine the prevalence of structural thyroid abnormalities among competitive wrestlers.

Materials and Methods: A cross-sectional ultrasound examination was performed in 21 male wrestlers who had been participating in regular intensive training. Thyroid ultrasonography was conducted using high-frequency linear transducers in B-mode, with Color Doppler Imaging when clinically indicated. The following parameters were evaluated: thyroid volume, gland contours, capsule integrity, echogenicity, echotexture, diffuse abnormalities, focal lesions, and TI-RADS classification.

Results: Most athletes demonstrated normal thyroid morphology characterized by homogeneous echotexture, regular contours, preserved capsule, and normal echogenicity. Thyroid pathology was detected in a limited number of participants. Thyroiditis was diagnosed in three athletes (14.3%), simple thyroid cysts in four athletes (19.0%), and autoimmune thyroiditis in one athlete (4.8%). Benign thyroid nodules were identified in two athletes, including one TI-RADS II lesion and one TI-RADS III lesion (4.8% each). No ultrasonographic signs suggestive of thyroid malignancy were observed. Thyroid volume remained within normal limits in the majority of participants.

Conclusion: Competitive wrestlers generally demonstrate normal ultrasonographic characteristics of the thyroid gland. The detected abnormalities are predominantly benign and require routine follow-up rather than aggressive intervention. Larger prospective studies are warranted to clarify the potential influence of long-term intensive athletic training on thyroid morphology.

Keywords: thyroid gland, ultrasonography, wrestlers, sports medicine, TI-RADS, thyroiditis, thyroid cyst, endocrine adaptation.

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Introduction

Regular intensive physical exercise induces numerous physiological adaptations involving the cardiovascular, musculoskeletal, immune, and endocrine systems. Among endocrine organs, the thyroid gland occupies a central position because thyroid hormones regulate oxygen consumption, protein synthesis, thermogenesis, and energy metabolism. Optimal thyroid function is therefore essential for maintaining athletic performance, recovery, and adaptation to prolonged physical stress.

Combat sports such as wrestling require high levels of endurance, strength, anaerobic capacity, rapid weight fluctuations, and repeated exposure to intensive training sessions. These physiological demands may alter endocrine homeostasis and potentially influence thyroid morphology and function. Previous investigations have mainly focused on circulating thyroid hormones, whereas structural thyroid alterations in athletes remain less frequently evaluated.

High-resolution ultrasonography represents the first-line imaging modality for thyroid assessment because it is non-invasive, highly sensitive, inexpensive, and capable of detecting both diffuse and focal thyroid abnormalities. Modern ultrasound examination combined with the Thyroid Imaging Reporting and Data System (TI-RADS) allows standardized characterization of thyroid nodules and assists clinicians in determining appropriate follow-up strategies.

Despite growing interest in sports endocrinology, data regarding thyroid ultrasonographic findings in competitive wrestlers remain limited. Better understanding of thyroid morphology in this population may contribute to early diagnosis of endocrine disorders and optimization of medical surveillance programs for elite athletes.

Study Population

Twenty-one male wrestlers were included in the study. All athletes were actively involved in competitive wrestling and had undergone regular professional training for at least three consecutive years. Training frequency ranged from five to six sessions per week, with an average duration of approximately two hours per session.

The inclusion criteria were:

- male athletes aged 18–30 years;
- active participation in wrestling competitions;
- regular intensive training for at least three years;
- absence of previously diagnosed thyroid malignancy;
- written informed consent.

The exclusion criteria included:

- previous thyroid surgery;
- acute infectious diseases at the time of examination;
- severe systemic illnesses;
- current treatment with thyroid hormones or antithyroid medications;
- refusal to participate.

Ultrasound Examination

Ultrasound examinations were performed using a high-resolution diagnostic ultrasound system equipped with a 7–15 MHz linear-array transducer. All examinations were carried out by an experienced radiologist following a standardized examination protocol.

Each participant was examined in the supine position with slight neck extension to obtain optimal visualization of both thyroid lobes and the isthmus.

The following ultrasonographic parameters were evaluated:

- thyroid gland volume;
- dimensions of both lobes;
- isthmus thickness;
- gland contour;

- capsule integrity;
- echogenicity;
- echotexture;
- vascularization using Color Doppler Imaging (when indicated);
- presence of diffuse thyroid abnormalities;
- presence, size, number, and characteristics of focal lesions;
- TI-RADS classification for thyroid nodules.

Thyroid volume was calculated using the standard ellipsoid formula:

Volume = Length × Width × Thickness × 0.479

The total thyroid volume was obtained by summing the volumes of both lobes. Measurements were compared with internationally accepted reference values.

Evaluation of Diffuse Thyroid Changes

Diffuse thyroid abnormalities were diagnosed according to accepted ultrasonographic criteria, including:

- decreased echogenicity;
- heterogeneous parenchymal structure;
- increased vascularity;
- irregular internal architecture;
- diffuse enlargement of the gland.

Autoimmune thyroiditis was suspected when diffuse hypoechogenicity, heterogeneous echotexture, and increased vascularity were simultaneously observed.

Evaluation of Focal Thyroid Lesions

Detected thyroid nodules were classified according to the American College of Radiology Thyroid Imaging Reporting and Data System (ACR TI-RADS). The following ultrasonographic characteristics were analyzed:

- composition;
- echogenicity;
- shape;
- margin characteristics;
- echogenic foci.

Each lesion received a TI-RADS category based on the total score. Nodules classified as TI-RADS II and TI-RADS III were regarded as benign or probably benign lesions requiring only routine follow-up according to current clinical recommendations.

Statistical Analysis

Collected data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics software (Version 26.0).

Continuous variables are presented as mean ± standard deviation (SD), while categorical variables are expressed as absolute numbers and percentages.

Descriptive statistical methods were applied to summarize the ultrasonographic findings. Due to the relatively small sample size, no complex inferential statistical analyses were performed. The prevalence of thyroid abnormalities was calculated as percentages of the total study population.

The results are presented in tables and descriptive form to facilitate interpretation and comparison with previously published studies.

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