Correlation between age, body size and thyroid volume in an endemic area

S. Semiz*, U. Şenol**, O. Bircan**, S. Gümüşlü***, S. Bilmen***, and İ. Bircan****

*Pediatric Endocrinologist, Department of Health, Culture and Sports; **Division of Radiology, ***Division of Biochemistry, ****Department of Pediatrics, Akdeniz University School of Medicine, Antalya, Turkey

ABSTRACT. Ultrasound is a safe, non-invasive technique that provides a more precise and objective method of determining thyroid volume than inspection and palpation, particularly in areas of mild endemicity, and generally whenever goiters are small. Thyroid volume is also correlated with age, weight, height and body surface area (BSA) in non-iodine-deficient areas. Different authors prefer different parameters to assess thyroid gland volumes. In this study, thyroid volumes were determined using ultrasound in 605 school children aged 6-11 yr who had been living for at least 5 years in Antalya. The correlation between age, BSA, height, weight, BMI and thyroid volume was sought in this mild to moderate iodine-deficient area. Somatic development of our children was in the normal range.

INTRODUCTION

The definition of iodine-deficient goiter endemic is based on the measurement of urinary iodine (UI) excretion and the prevalence of goiter in a population (1). Although thyroid palpation reflects the real prevalence of goiter in severely endemic areas, thyroid volume measurement by ultrasound (US) in children is a reliable method for assessment of goiter in mild to moderate iodine deficiency (ID), where most goitrous subjects have small goiters (2-4). US is a practical and cheap method to assess thyroid size and morphology, and it has already been applied in epidemiological surveys (4-8). Correct interpretation of US also relies on availability of standardized reference criteria from populations whose iodine status is known to be adequate (9).

Thyroid volume was significantly correlated with age \((r=0.41, p<0.001)\), height \((r=0.33, p<0.001)\), weight \((r=0.30, p<0.001)\), BSA \((r=0.33, p<0.001)\), and BMI \((r=0.13, p<0.001)\). The most significant correlation was found to be with age. The application of the International Council for Control of Iodine Deficiency Disorders (ICCIDD) and the World Health Organization (WHO) thyroid volume references to our subjects resulted in prevalence estimates of enlarged thyroid of 31% based on BSA and of 34% based on age. In conclusion, when thyroid volumes are to be compared with reference values, assessment of thyroid volumes based on age is the most reliable method, in the event of normal somatic development.

MATERIALS AND METHODS

Six hundred and five primary school children (301 boys and 304 girls) aged 6-11 yr, who had been living in the Antalya region at least for 5 years were included in the study. To achieve a homogeneous distribution, subjects were selected at random from 6 schools in both rural and urban areas. Physical examination and anthropometric measurements were made. Hs of the subjects were measured by a portable device and Ws using a regularly calibrated scale. Neyzi standards for age and sex were used to assess Hs and Ws of the children (18). H standard deviation score (HSDS), W standard deviation score (WSDS), BMI, and BSA were calculated using the following formulas (19-21):

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\text{HSDS (Z score): } H - \text{Mean normal value for age and sex} - \text{SD according to age and sex}
\]

\[
\text{WSDS (Z score): } W - \text{Mean normal value for age and sex} - \text{SD according to age and sex}
\]

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\text{BMI: } \frac{W}{H} \text{ (m}^2)\]

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\text{BSA (m}^2): W^{0.425} \times H^{0.725} \times 7.84 \times 10^{-4}, \text{ where } W \text{ is expressed in kg and } H \text{ in cm.}
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Thyroid ultrasonic examination was performed by the same person in each subject in the supine position with the neck hyperextended and skin covered by acoustical material. The dimensions of both thyroid lobes were measured with a high-resolution real-time portable ultrasonic scanner (Toshiba SAL 32B) using a 5-MHz linear transducer. The volume was expressed in ml and the sum of both lobes by multiplying the length, width and thickness and a corrective factor (0.479) (13). Reproducibility of thyroid volume measurement by portable US was assessed by a stationary Toshiba SAL 270A real-time scanner using 7.5-MHz linear transducer in 23 randomized subjects. There was a significant correlation \((r=0.96, \ p<0.05)\) between the findings ob-

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**Fig. 1** - The relation between age, body surface area (BSA), BMI, weight, height and thyroid volume (V).