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Reference range of thyroid hormones in healthy school-age children: Country-wide data from India

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Abstract

Objective: This study was planned to obtain normative data of thyroid functions in school-age children from different regions of India.

Design and methods: Students from 36 schools involving 13 states across four geographical zones of India were evaluated for goiter. Subjects who consented, underwent evaluation for serum FT3, FT4, TSH, anti-TPO antibodies and thyroid ultrasound. From this, a "reference population" was obtained by excluding those with personal or family history of thyroid disease, use of thyroid medications, goiter, hypoechogenicity or nodularity on ultrasound or positive anti-thyroid antibodies.

Results: Of 24,685 students clinically evaluated, 8665 formed part of the study. The reference population comprised 5343 subjects. The mean, median, 3rd and 97th percentiles of FT3, FT4 and TSH for each year (6–17 years) were obtained.

Conclusions: This community based study in Indian school-age children provides reference intervals for thyroid hormones and evidence against narrowing the TSH reference range.

Keywords: Thyroid function; Normative data; TSH; Goiter; Urinary iodine excretion

Introduction

There is an ongoing debate on narrowing the thyroid stimulating hormone (TSH) reference range in adults [1]. The evidence provided is mainly from the developed countries [2]. There is no statement as far as thyroid functions of children and adolescents are concerned.

There are scant data on normal thyroid functions from India both in adults and children. The universal salt iodization programme launched in the early 1980s to eradicate iodine deficiency has achieved considerable success with large parts of the country becoming iodine sufficient [3].

Considering the fact that iodine sufficiency is a must for normal thyroid function, the time is now appropriate to assess thyroid function to generate normative data for our population. Keeping in mind the crucial role of thyroid hormones in childhood and adolescence, we recently carried out a study to generate normative data for thyroid function in school-age children in our country, using Delhi as a representative population [4]. India is a diverse country with differences in ethnicity, terrain and iodine nutrition. Hence, this study was planned to obtain normative data of thyroid functions in school-age children from different regions of India.

Abbreviations: FT3, free tri-iodothyronine; FT4, free thyroxine; TSH, thyroid stimulating hormone; TPO, thyroid peroxidase; Abs, antibodies; WHO, World Health Organisation; ICCIDD, International Council for Control of Iodine Deficiency Disorders; CV, coefficient of variation; SD, standard deviation.

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The objective of the present study was to establish reference intervals of thyroid functions (free T3, free T4 and TSH) in school-age children (6–17 years) from different regions of India.

Subjects and methods

This cross sectional study of school children in India was approved by the institutional Ethics Committee of the Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi. The Indian Union consists of 28 states and seven union territories. The study was conducted in various cities of different states from each of the four zones of the country. The school selection in each state depended on permission from the local authorities for examination and testing of all school children. Additional informed consent was taken from the parents/guardians and a verbal assent from the students themselves. Prior to each school visit, proforma were sent home to be filled by the parents. The information sought included personal or family history of thyroid disease, use of thyroid medications in the child and consumption of iodized salt. During the school visit, clinical examination, including anthropometry and assessment of goiter was done by two experienced endocrinologists and graded as per the WHO [5]. Those who consented for blood sampling were included in this study and underwent further evaluation.

Ultrasound assessment of thyroid echogenicity and nodularity was performed in each of these children by a single experienced sonologist using a portable ultrasound machine (Aloka SSD — 500, Tokyo, Japan) with a 7.5 MHz transducer.

Five mL of blood was collected from each subject between 8–10 AM, and serum stored at −20 °C in a central laboratory. Fig. 1 depicts the methodology used in the surveys.

From this entire sample, a disease and risk free or 'reference population' was obtained by using following parameters for exclusion (Fig. 1): history of use of thyroid medications; family or personal history of thyroid disease; presence of goiter;

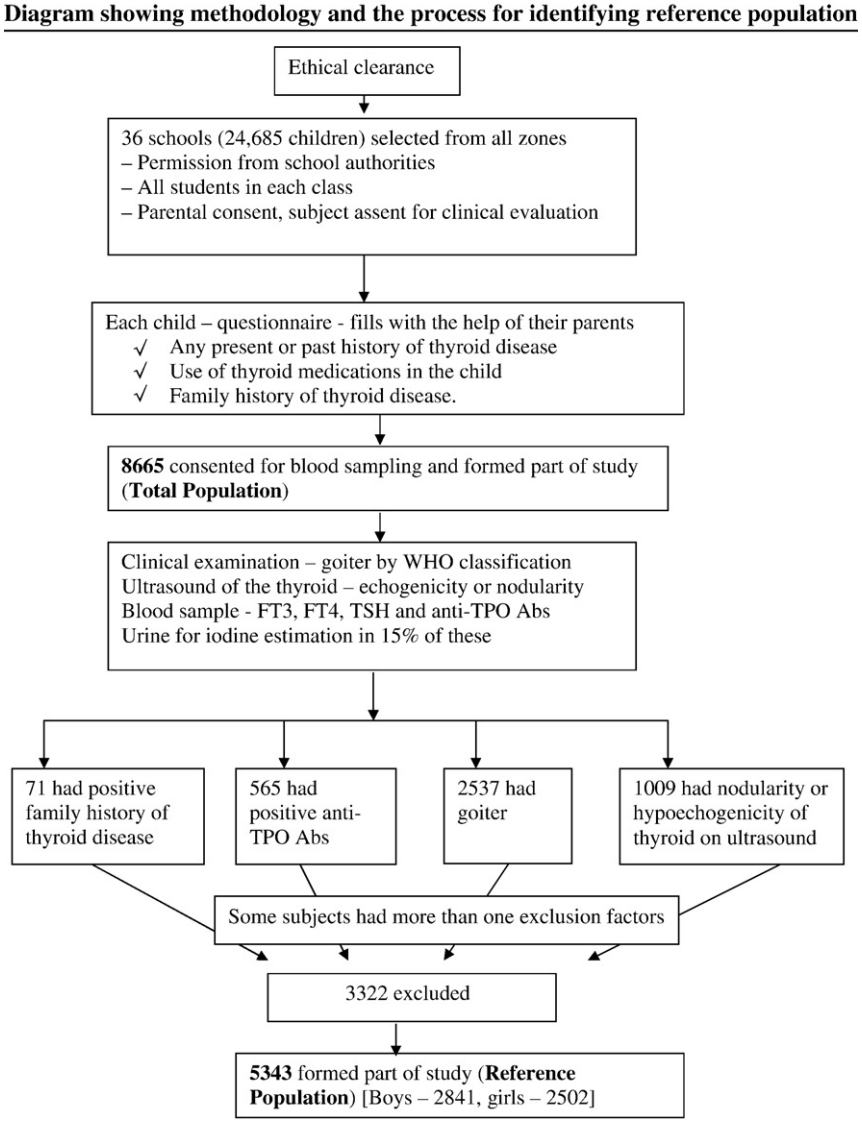

Fig. 1. Diagram showing methodology and the process for identifying reference population.