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CURRENT STATE OF ENDEMIC GOITER PREVALENCE AMONG THE FEMALE POPULATION

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Abstract:
Endemic goiter in women represents a significant public health challenge, particularly in regions with iodine deficiency, as it is associated with a high risk of development and specific clinical and physiological features. This article examines the main factors contributing to the development of endemic goiter in women, including iodine deficiency, pregnancy-related physiological changes, nutritional habits, and insufficient awareness of iodine prophylaxis. Particular attention is paid to the role of increased iodine requirements during pregnancy, inadequate use of iodized salt, and limitations of risk-based screening approaches in primary health care. The analysis of these factors highlights the importance of improving preventive strategies and ensuring early detection of endemic goiter among women at the primary care level.

Keywords: Endemic goiter; iodine deficiency; women; pregnancy; iodine prophylaxis; early detection; primary health care

Introduction

Assessment of population iodine status is a key component of monitoring iodine deficiency disorders and preventing endemic goiter. In a systematic review by Molla Mesele Wassie et al. (2019), the agreement between the main population-

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https://eurekaoa.com/index.php/5

based indicators used to classify iodine status was analyzed. The authors relied on established criteria according to which iodine deficiency in a population is defined by the presence of neonatal thyroid-stimulating hormone (TSH) levels >5 mIU/L in more than 3% of newborns, a median urinary iodine concentration (MUIC) <100 µg/L, or a goiter prevalence greater than 5% among school-aged children. It was emphasized that the level of agreement between these indicators had not previously been systematically evaluated. The results demonstrated that agreement between neonatal TSH and median urinary iodine concentration in classifying population iodine status was 65%, whereas agreement between neonatal TSH and goiter prevalence was higher, reaching 83%. When compared with MUIC, the sensitivity of neonatal TSH was 0.75 and specificity was 0.53. In relation to goiter prevalence, neonatal TSH showed higher sensitivity (0.86) with a specificity of 0.50. Based on these findings, the authors concluded that neonatal TSH correlates more closely with goiter prevalence than with median urinary iodine concentration and emphasized the need to reconsider existing approaches to population iodine status classification that incorporate this indicator [11].

The presented fragment emphasizes the key role of thyroid hormones in the regulation of multiple physiological processes and the importance of adequate iodine intake for maintaining thyroid homeostasis. It is noted that iodine deficiency remains an epidemiological concern not only in low- and middle-income countries but also in economically developed countries, despite the widespread implementation of food iodization programs and previous improvements in iodine deficiency disorders.

It is indicated that modern dietary patterns—particularly vegan diets, low consumption of iodine-rich foods, and the absence or discontinuation of systematic population iodine status monitoring—may contribute to the development of subclinical iodine deficiency and other iodine deficiency–related conditions. The text highlights that iodization of table salt remains the primary and recommended strategy for ensuring adequate iodine intake at the population

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Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
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https://eurekaoa.com/index.php/5

level. At the same time, potential risks associated with excessive iodine exposure are acknowledged, including the development of hyperthyroidism, autoimmune thyroid diseases, and a relative increase in the risk of papillary thyroid cancer. Nevertheless, it is concluded that, at the population level, the benefits of salt iodization substantially outweigh the potential risks. Special emphasis is placed on the need to develop targeted recommendations and strategies for additional iodine intake for specific population groups in whom iodized salt alone is insufficient to meet physiological requirements. Thus, the importance of a differentiated approach to iodine deficiency prevention is underscored, taking into account contemporary dietary habits and social factors [6].

In the presented systematic review and meta-analysis, the prevalence of iodine deficiency among pregnant women in Ethiopia was assessed, and factors associated with its development were analyzed. The authors emphasized that iodine deficiency remains a serious public health problem, particularly in low-income countries, and that the physiological increase in iodine requirements during pregnancy makes women in this group especially vulnerable. The pooled prevalence of iodine deficiency during pregnancy, determined based on urinary iodine concentration, was 68.76% (95% CI: 55.21–82.31). Subgroup analysis revealed regional variations: prevalence reached 71.93% (95% CI: 54.87–88.99) in the Oromia region, compared with 60.93% (95% CI: 57.39–64.48) in the Amhara region. Analysis of associated factors showed that the use of iodized salt significantly reduced the likelihood of iodine deficiency (OR = 0.18; 95% CI: 0.08–0.44). In addition, iodine deficiency was more frequently observed among women beyond the first trimester of pregnancy, whereas being in the first trimester was associated with a lower risk of iodine deficiency (OR = 0.68; 95% CI: 0.47–0.99) [2].

Population-based assessment of iodine status and its impact on thyroid health is essential for understanding the mechanisms underlying endemic goiter formation and for developing effective preventive strategies. In a cross-sectional population

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Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)

ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

study, Hernando Vargas-Uricoechea et al. (2022) investigated iodine status and its potential effects on thyroid function and autoimmune processes among the adult population of southwestern Colombia. The study included urban and rural residents from four geographic regions of the Cauca Department and involved 412 apparently healthy adults, approximately one third of whom lived in rural areas. Iodine status was assessed using median urinary iodine concentration (mUIC). In addition, serum thyroid-stimulating hormone levels were measured, goiter was evaluated clinically and by ultrasonography, and antibodies to thyroid peroxidase, thyroglobulin, and the TSH receptor were determined. The median urinary iodine concentration in the study population was 153.9 µg/L, with an interquartile range of 220.06, corresponding overall to an adequate iodine intake. However, excessive mUIC levels were identified in 30% of participants, while approximately one quarter of the population exhibited low iodine status. The prevalence of goiter in the study population was high, reaching 41.7% on physical examination and 34% on ultrasonographic assessment. Higher median urinary iodine concentrations were significantly more common among women, individuals with elevated TSH levels, and residents of rural areas. Pronounced socioeconomic disparities were observed: low mUIC levels were more frequently detected among individuals with low socioeconomic status, whereas more-than-adequate or excessive iodine levels were more common among those with high socioeconomic status compared with individuals of middle socioeconomic status ($P \leq 0.001$). Positive titers of anti-thyroglobulin and anti–thyroid peroxidase antibodies were significantly more frequent in individuals older than 60 years ($P = 0.017$ and $P \leq 0.001$, respectively) [10].

Dietary sources of iodine play a key role in determining population iodine status, particularly in countries where milk and dairy products constitute an important component of the diet. In a systematic review and meta-analysis, Joanne K. Tattersall et al. (2024) assessed the variability of iodine concentration in milk across different countries, taking into account seasonal factors and dairy

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Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

production systems. The authors conducted a systematic search of national food composition tables and published scientific sources from 2006 onward. Data from 66 sources covering 34 countries were included in the analysis. Iodine concentration in milk showed substantial inter-country variability, ranging from 5.5 to 49.9 µg per 100 g of product, with a median value of 17.3 µg/100 g. The meta-analysis demonstrated statistically significant seasonal differences, with iodine content in winter milk being higher than in summer milk, with a mean difference of 5.97 µg/100 g ($p = 0.001$). In addition, iodine concentration in conventional milk was significantly higher than in organic milk, with a mean difference of 6.00 µg/100 g ($p < 0.0001$).

Subgroup analysis revealed that differences between organic and conventional milk were statistically significant only during the summer period ($p = 0.0003$). The authors emphasized that the observed seasonal fluctuations and production system–related differences may have a substantial impact on dietary iodine intake and, consequently, on population iodine status. Therefore, these factors should be taken into account in dietary studies and in the assessment of iodine sufficiency at the population level [8].

In the presented review, Iwona Kiela- Kazmierczak et al. address iodine deficiency as a persistent global public health threat, affecting an estimated 2 billion people worldwide, with pregnant women identified as one of the most vulnerable groups. The authors emphasize that large-scale prevention of iodine deficiency disorders began in the twentieth century with the implementation of universal salt iodization programs, which led to a substantial reduction in the prevalence of endemic goiter. However, they note that this strategy has not fully eliminated iodine deficiency. Particular attention is given to contemporary changes in dietary behavior and public health recommendations aimed at reducing salt intake as part of noncommunicable disease prevention strategies, including the prevention of hypertension and certain cancers. Reduced salt consumption—given that iodized salt remains the primary source of iodine for most

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Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

populations—is considered a potential contributor to the re-emergence of iodine deficiency. Despite the availability of alternative dietary iodine sources, such as fish, seafood, dairy products, water, and certain vegetables, the authors highlight that high consumption of processed foods made with non-iodized salt, adherence to alternative or restrictive diets, and intentional reduction of salt intake may result in inadequate iodine intake. The review concludes that iodine deficiency remains a relevant public health issue even in countries with established salt iodization programs and necessitates the development of additional preventive strategies. The authors stress that no universal diet currently exists that can fully meet physiological iodine requirements and emphasize the continued need for iodine-containing dietary supplements, particularly among high-risk population groups [5].

In the presented systematic review and meta-analysis, Emily Keats et al. evaluated the impact of large-scale food fortification (LSFF) programs on micronutrient status and health outcomes in populations of low- and middle-income countries. The authors noted that micronutrient deficiencies remain highly prevalent in these settings and disproportionately affect women and children, while the effectiveness of LSFF programs in low- and middle-income countries has previously been insufficiently studied. The analysis included both published and unpublished studies without restrictions on sex or age. Meta-analyses were conducted for quantitative outcomes, with the calculation of relative risks, odds ratios, and standardized mean differences along with 95% confidence intervals. Fortification of staple foods with key micronutrients—including vitamin A, iodine, iron, and folic acid—was evaluated.

The results demonstrated that the implementation of LSFF programs leads to significant increases in serum micronutrient concentrations across different population groups and is associated with improvements in functional health outcomes. Specifically, a 34% reduction in anemia prevalence was observed (RR = 0.66; 95% CI: 0.59–0.74), along with a 74% reduction in the odds of goiter (OR

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Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

= 0.26; 95% CI: 0.16–0.43) and a 41% reduction in the risk of neural tube defects (OR = 0.59; 95% CI: 0.49–0.70). It was noted that women aged 18 years and older derived greater preventive benefits from fortification programs than children, which the authors attributed to higher consumption of fortified staple foods. In addition, vitamin A fortification was estimated to potentially prevent vitamin A deficiency in nearly 3 million children annually. The authors emphasized that the effectiveness and sustainability of large-scale food fortification programs depend on contextual and programmatic factors, including dietary patterns, program coverage, and implementation quality. However, evidence on the influence of these factors in low- and middle-income countries remains limited, highlighting the need for further research [4].

Iodine deficiency disorders remain a significant public health problem, particularly among pregnant women, in whom iodine requirements increase substantially. In a population-based cross-sectional observational study conducted in an urban slum area of West Delhi, the prevalence of iodine deficiency disorders among women in the third trimester of pregnancy was assessed. The study was carried out between October 2014 and July 2016 and included 178 pregnant women.

Sociodemographic data were collected through questionnaires and interviews. The assessment of iodine deficiency disorders was comprehensive and included measurement of urinary iodine concentration, evaluation of thyroid function parameters, clinical assessment of goiter by palpation, and analysis of iodine content in household salt. Urinary iodine concentration was measured using a spectrophotometer, thyroid hormone levels were determined with the IMMULITE 1000 analyzer, and iodine content in salt was assessed using the standard iodometric titration method. The results showed that 59.9% of pregnant women had inadequate iodine intake. The median urinary iodine concentration was 132.5 µg/L, with an interquartile range of 145 µg/L. Clinical signs of grade 1 goiter were detected in two participants, accounting for 1.15% of the examined

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Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

women. Inadequate iodine content in household salt (<15 ppm) was found in 19.8% of samples used at home. Evaluation of thyroid function revealed a high prevalence of hypothyroidism, which was diagnosed in 27.9% of pregnant women. Mean hormonal values were 2.51 ± 1.19 mIU/L for thyroid-stimulating hormone, 11.6 ± 2.38 μg/dL for thyroxine, and 170.7 ± 41.5 ng/dL for triiodothyronine. The authors concluded that iodine deficiency and associated thyroid dysfunction are highly prevalent among pregnant women living in socioeconomically disadvantaged areas [9].

In a cross-sectional study, Trevor Kayla et al. assessed the prevalence of iodine deficiency among pregnant women in the rural districts of Gwembe and Sinazongwe in the Southern Province of Zambia using two key indicators: urinary iodine concentration and the presence of goiter determined by palpation. The authors emphasized that iodine deficiency during pregnancy is associated with severe adverse outcomes, including miscarriage, stillbirth, congenital anomalies, perinatal mortality, and irreversible impairment of cognitive development.

The study was conducted between April 2016 and March 2018 and included 412 pregnant women selected using a multistage cluster sampling method. Urinary iodine concentration was measured using an ultraviolet spectrophotometric method. Background information was drawn from the 2013 national survey on iodine content in household salt, which reported that 95.41% of households used iodized salt with an iodine concentration ≥15 ppm. The median urinary iodine concentration among the pregnant women was 150 μg/L (interquartile range 100–200 μg/L). Overall, 49% of women had insufficient iodine intake (UIC <150 μg/L), 34% had adequate intake (150–249 μg/L), 13% had excessive intake (250–499 μg/L), and 5% had excessive iodine intake (>500 μg/L). Despite this distribution, the prevalence of goiter among pregnant women was extremely low, at only 0.02% in the 18–49-year age group.

The authors concluded that iodine deficiency does not constitute a current public health problem in the studied districts, and the very low prevalence of goiter

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

confirms the effectiveness of the existing salt iodization program. However, the relatively high proportion of women with excessive and very high urinary iodine levels indicates a potential risk of iodine-induced thyroid disorders. Therefore, the authors emphasized the need for further refinement of salt iodization programs, ensuring uniform iodine exposure, and implementing monitoring and, where appropriate, rational use of iodine supplementation within antenatal care services [3].

Adequate iodine intake during pregnancy is essential not only for maternal health but also for normal neuropsychological development of the fetus. In a systematic review, Anna M. Monaghan et al. (2021) examined the relationship between indicators of iodine status in pregnant women—including urinary iodine concentration and dietary iodine intake—and neuropsychological outcomes in children. The authors noted that mild to moderate iodine deficiency during pregnancy may have adverse long-term consequences; however, the available evidence in the literature remains heterogeneous.

In nine of the twelve included studies, pregnant women were classified as having mild or moderate iodine deficiency based on World Health Organization criteria, according to which a median urinary iodine concentration below 150 μg/L indicates insufficient iodine intake during pregnancy. Only four of these nine studies demonstrated a negative association between urinary iodine deficiency indicators and cognitive outcomes in children. Five studies assessed both urinary iodine concentration and dietary iodine intake; in four of these, a negative association was identified between lower iodine levels—based on both biomarkers and dietary data—and adverse neuropsychological outcomes in offspring. Milk was identified as the primary dietary source of iodine in most of these studies. The authors concluded that, despite variability in findings, the majority of studies indicate a high prevalence of mild to moderate iodine deficiency among pregnant women and suggest a potential association between iodine deficiency and impaired neuropsychological development in children. It

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

was also noted that dietary iodine intake data, in some cases, showed a stronger association with cognitive outcomes than urinary iodine measurements alone, underscoring the importance of a comprehensive assessment of iodine status during pregnancy [7].

At the national level, the median urinary iodine concentration was 206.1 µg/L among school-aged children and 163.5 µg/L among pregnant women. The proportion of households consuming adequately iodized salt reached 90.2%. The prevalence of goiter among school-aged children was 2.0%, and the prevalence of thyroid disorders among pregnant women was 0.8%, both of which were below the threshold values recommended by the World Health Organization. It was established that median urinary iodine concentration exhibited a pronounced nonlinear increasing trend with rising household coverage of iodized salt consumption in both children and pregnant women. At the same time, the prevalence of thyroid disorders among pregnant women decreased substantially as iodized salt coverage increased.

The authors also identified a U-shaped relationship between median urinary iodine concentration and the prevalence of goiter in children, as well as thyroid disorders in pregnant women. The lowest prevalence rates were observed at urinary iodine levels of 100–300 µg/L in school-aged children and 150–250 µg/L in pregnant women. At the national level, MUIC values, iodized salt consumption coverage, and programmatic indicators exceeded the threshold levels proposed in the 2007 WHO criteria. However, inclusion of a goiter prevalence criterion of less than 5% when assessments were conducted at the county level resulted in a reduced number of administrative units meeting the criteria for sustainable elimination of iodine deficiency disorders.

Based on these findings, the authors concluded that sustainable elimination of iodine deficiency disorders has been achieved in China at the national level. The study results support the appropriateness of expanding the optimal range of median urinary iodine concentration for school-aged children to 100–299 µg/L,

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Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

as well as the justification for a lower threshold of 150 μg/L for pregnant women. These findings are consistent with proposals by other researchers and may serve as a basis for revising existing international and national guidelines [1].

Conclusion:

The analysis of current literature demonstrates that endemic goiter remains a significant public health problem among women, particularly in iodine-deficient regions, despite population-based iodine prophylaxis programs. Evidence indicates that even in settings where median urinary iodine concentrations meet recommended levels, a considerable proportion of women continue to exhibit thyroid enlargement, subclinical hypothyroidism, and other iodine deficiency–related disorders. Women of reproductive age, especially during pregnancy, constitute a high-risk group due to increased physiological iodine requirements. Pregnancy is consistently identified as a critical period during which iodine deficiency is associated with thyroid enlargement, nodular changes, and functional disturbances, highlighting the importance of early identification of iodine deficiency within primary health care. Importantly, risk factor–based screening approaches fail to detect a substantial number of affected women, supporting the need for more comprehensive early detection strategies. Furthermore, population studies from endemic regions show that insufficient awareness of iodine nutrition and inconsistent use of iodized salt remain key modifiable contributors to the persistence of endemic goiter. These findings suggest that prevention should extend beyond iodine fortification alone and include targeted educational interventions for women, particularly during pregnancy. Overall, the evidence supports strengthening preventive measures, improving epidemiological monitoring, and integrating early detection of endemic goiter into primary health care. A comprehensive approach combining adequate iodine intake, routine thyroid assessment in high-risk female

Eureka Journal of Health Sciences & Medical Innovation (EJHSMI)
ISSN 2760-4942 (Online) Volume 2, Issue 1, January 2026

https://eurekaoa.com/index.php/5

populations, and enhanced health education is essential to reduce the burden of endemic goiter among women

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