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Diet and Dysfunction: The Association Between Thyroid Dysfunction and the Rapid Dietary Transition from a Traditional High-Iodine Diet Amongst Greenlandic Inuit

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Introduction

This editorial and artwork aims to advocate the need for improved access to diagnostic services to mitigate a potential increase in thyroid dysfunction amongst Greenlandic Inuit and across the circumpolar north. This editorial will further suggest that this increase in thyroid dysfunction may be associated with a recent dietary transition away from a traditional, high-iodine diet towards an increasingly westernized, low-iodine diet.

Thyroid Function and Dysfunction

The thyroid produces tetraiodothyronine (T4) and triiodothyronine (T3), hormones that interact with thyrotropin-releasing hormone (TRH) from the hypothalamus and thyroid-stimulating hormone (TSH) from the anterior pituitary gland as part of the hypothalamic-pituitary-thyroid axis [1]. T4, TRH, and TSH function to maintain homeostasis, while T3 is the active form of T4 [1]. T3 plays a major role in regulating body function, inclusive of metabolism, growth, heart function, fertility, the central and autonomic nervous systems, cognition, bone formation, digestive function, and ophthalmic function [1]. Hyperthyroidism refers to high levels of T3 and T4, whereas hypothyroidism refers to low levels, with TSH being inversely related. Overlapping symptoms of these disorders include fatigue, skin conditions, hair loss, weight changes, slowed cognition, visual disorders, altered heart rate, tremors, osteoporosis, depression, insomnia, and more [1].

Dietary Trends Amongst Greenlandic Inuit

Greenlandic Inuit, composing almost 90% of Greenland's population, have historically consumed high amounts of iodine [2, 3]. This diet dominated by marine life resulted in iodine intake proposedly greater than tenfold World Health Organization (WHO) recommended levels [4, 5]. Based on food samples purchased and examined in East and West Greenland from kalaalimineerniarfiks (slaughterhouse and markets) and directly from hunters, the values of iodine in traditional marine foods were found to range up to 1380µg/kg [4]. It is suggested that a traditional Greenlandic Inuit diet results in iodine intake in the order of 200µg/24h up to 1700µg/24h [4]. Contrasting this, a westernized diet consisting of foods imported to Greenland results in iodine intake at about 40-50µg/24h [4]. For reference, the WHO recommends a mean intake of 150µg/24h [6]. Recently, a westernized diet of imported foods with little to no iodine has competed against a traditional diet, with imported foods comprising 75-80% of total energy consumed by Greenlandic adults as of 2013 [2, 5]. It is expected that imported foods will continue to take over Greenlandic Inuit energy consumption due to factors such as

marine contamination, climate change, and media influences [5, 7].

Local Incidence of Thyroid Dysfunction

Historically, thyroid dysfunction has been rarely recorded amongst Greenlandic Inuit. Over nearly 200 years, only two cases of hyperthyroidism were reported, in 1903 and 1929 [8]. However, over a 2-month period in 1998, five cases of Grave's disease causing hyperthyroidism were reported [8]. Since then, there appears to be a recent upwards trend in thyroid dysfunction in Greenland, with more cases being documented [2]. While this could be linked to improved diagnostics, it may also reflect an increase in incidence [8].

The Link Between Diet and Dysfunction

As can be inferred by their molecular names, iodine is a vital component of T3 and T4 [1]. Notably, the body does not produce iodine, therefore it must be obtained from diet [9]. Iodine deficiency can cause both hypothyroidism and hyperthyroidism [10, 11]. It has been significantly shown that, as the consumption of traditional foods decreases, so does urinary iodine excretion to the point of suggesting deficiency [12]. Furthermore, it has been found that Greenlandic Inuit may have adapted to excessive iodine intake over centuries, which would suggest the need for higher iodine intake than WHO recommendations to prevent deficiency [2]. This hypothesis is supported by a pattern of hyperthyroidism and hypothyroidism amongst Greenlandic Inuit with adequate iodine intake according to the WHO that was similar to patterns seen in iodine-deficient populations elsewhere [2].

The Need for Access to Diagnostic Services

Greenland's health system and diagnostic practices are under strain due to small, geographically dispersed communities and a lack of permanent and specialized staff, with 17 physicians for every 10,000 inhabitants [3]. Despite the wide array of symptoms associated with hyperthyroidism and hypothyroidism, the prognosis is often good as both are fairly treatable on the basis of appropriate diagnosis and pharmaceutical, radioactive, and/or surgical management [13, 14]. Thyroid dysfunction is often easily identifiable and typically involves blood tests to determine levels of TSH, T3, and free T4 given the non-specificity of symptom presentation. Without such diagnosis and treatment, however, adverse outcomes are more likely [14]. Therefore, local diagnostic practices largely determine the severity of outcomes associated with thyroid dysfunction.

Local and Global Diagnostic Implications

In a global context, dietary transitions away from traditional foods high in iodine can be seen across the circumpolar north, with suggested similar dietary change patterns across all Arctic Indigenous populations [15]. Given the improved prognoses associated with early diagnosis and treatment, this editorial proposes increased access to diagnostic services across Greenland and other regions in the circumpolar north where there are geographic and staffing limitations. This could involve increased local education and training, recruitment of community health nurses and other health care providers to provide diagnostic services such as routine bloodwork, and the implementation of telehealth services to allow for consultations across large distances. These measures should be extended across the circumpolar north to regions where diets are becoming increasingly westernized to mitigate the potential increase in thyroid dysfunction that may otherwise go largely undetected. Relatedly, appropriate levels of iodine intake for Greenlandic Inuit should be investigated in future research to inform diet-

ary guidelines to prevent iodine deficiency and the associated risk of thyroid dysfunction.

Conclusion

This editorial is of the opinion that there is an association between an increasingly westernized diet low in iodine and an increase in thyroid dysfunction prevalence amongst Greenlandic Inuit. This decrease in iodine intake could prove particularly detrimental given that Greenlandic Inuit may have adapted to historically high levels of iodine, therefore requiring greater intake than WHO recommended levels to prevent deficiency. This emphasizes the need for improved access to diagnostic services to mitigate a potential increase in thyroid dysfunction incidence that may accompany projected dietary trends in Greenland and across the circumpolar north.

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