Dentistry 3000

Vol 13, No 1 (2025)
ISSN 2167-8677 (online)
DOI 10.5195/d3000.2025.1020

Serum B12 and Folic Acid Level among a Sample of Iraqi Patients with Geographic Tongue

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Abstract

Objective: To assess the serum concentrations of vitamin B12 and folic acid in individuals suffering from geographic tongue. It also aims to investigate whether deficiencies in these hematinic nutrients are significantly linked to the occurrence of this condition**. Subjects and Methods**: The data for this retrospective analysis were obtained from the medical records of individuals with oral lesions who required laboratory testing for serum B12 and folic acid between October 2024 and May 2025 due to suspected anemia. 30 patients had geographic tongue who examined by oral medicine specialist at college of dentistry/university of Baghdad and 30 healthy subjects, according to the inclusion and exclusion criteria. Statistical analysis was performed to compare mean levels between groups and to evaluate potential correlations. **Results**: The average serum levels of Vitamin B12 ($p < 0.001$) and folic acid ($p < 0.05$) were significantly decreased in patients with geographic tongue compared to healthy controls. A considerable proportion of these patients had values falling below the normal reference range. These findings suggest a possible involvement of hematinic deficiencies in the underlying pathogenesis of geographic tongue. **Conclusion**: The study's findings indicate that deficiencies in vitamin B12 and folic acid may contribute to the development of geographic tongue. Evaluating and addressing these nutritional gaps could be beneficial in the clinical approach to managing GT, particularly in patients presenting with symptoms. Additional longitudinal research is warranted to better understand the causal relationship and the potential benefits of targeted supplementation.

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Citation: Ali NSM. (2025) Serum B12 and Folic Acid level among a Sample of Iraqi Patients with Geographic Tongue. Dentistry 3000. 1:a001 doi:10.5195/d3000.2025.1020
Received: August 18, 2025
Accepted: August 28, 2025
Published: September 10, 2025
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Introduction

Geographic tongue (GT) is a common and benign inflammatory disorder of the oral mucosa, generally manifesting as annular lesions marked by the absence of filiform papillae. These depapillated areas appear red and atrophic, often bordered by a distinct yellowish-white margin. The dorsal surface of the tongue is the most frequently affected site, although the lateral borders may also be involved in some cases [1]; It was first described in 1931 [2]. Among the many names for geographic tongue are migratory glossitis, annulus migrans, and erythema migrans as well. On the tongue, the disease manifests as irregular red spots with white borders that are somewhat elevated. These lesions frequently have a map-like appearance, which is the basis for the term "geographic" [3], the lesions associated with geographic tongue may persist for several days to months before resolving spontaneously, often reappearing at different sites on the tongue. Notably, no scarring is observed during remission [4]. GT is predominantly localized to the dorsal surface of the tongue [5]. It impacts approximately 1-3% of the whole population and is present in the males and females [6], other studies indicate a slightly elevated prevalence in females, demonstrating a female-to-male ratio of approximately 2:1 [7]. This could be linked to GT's correlation with female hormones [8]. Geographic tongue primarily occurs in adolescents and adults, with instances documented in persons ranging from 5 to 84 years of age. Among adults the clinical signs are generally more apparent than in children [9-11]. Although the exact etiology of GT remains unknown, numerous contributing factors have been proposed. These include genetic predisposition, psoriasis, allergic conditions, diabetes mellitus, hormonal imbalances, nutritional deficiencies, psychological stress, and the use of certain medications such as oral contraceptives. Additionally, this condition has been documented in conjunction with

systemic disorders like Reiter's syndrome, Down syndrome, and lichen planus [12,13].
Hematologic deficiencies, especially those related to vitamin B12 and folic acid, have garnered significant attention as potential contributing factors. These vitamins are crucial for DNA production, cellular division, and the preservation of epithelium integrity. Deficiencies can result in various mucosal changes, including glossitis and other oral lesions [14]. Several studies have suggested a potential association between geographic tongue and low serum levels of these nutrients [14,15].
The present study aims to examine serum concentrations of vitamin B12 and folic acid in persons diagnosed with geographical tongue to healthy controls, and to evaluate the possible link between these deficiencies and the presence of the condition, with the goal of informing appropriate clinical management strategies.

Subjects and Methods

This retrospective analysis utilized data obtained from the medical records of patients with oral lesions submitted for laboratory assessment of serum vitamin B12 and folic acid since there was clinical suspicion of anemia. The data collection period extended from October 2024 to May 2025. A total of 30 patients diagnosed with geographic tongue, examined by an oral medicine specialist at the College of Dentistry, University of Baghdad, were included in the study group. The control group comprised 30 healthy individuals, chosen based on identical eligibility and exclusion requirements as patients visiting the same center. All participants reported that they had not taken any vitamin supplements in the eight weeks prior to the study. Individuals with systemic diseases, such as chronic renal disorders, psoriasis, Reiter's syndrome, dermatitis, insulin-dependent diabetes, and bronchitis, as well as pregnant women, were excluded from the study [16]. Control subjects were confirmed to be free of geographic tongue and the designated systemic disorders and had not utilized any drugs. In this investigation, blood B12 vitamin levels of ≤ 220 pg/ml and folic acid levels of < 4 ng/ml are considered insufficient [17,18]. SPSS software, version 18.0 (SPSS Inc., Chicago, IL), was used for statistical analysis. Welch's t-test was used to determine statistical significance because the data was quantitative. Statistical significance was defined as a p-value of less than 0.05, while extremely significant was defined as a p-value of less than 0.001.

Results

Thirty people with geographic tongue and thirty healthy controls were included in the final analysis. Age and gender were used to match the GT group with the control group. Every participant was sourced from the University of Baghdad's College of Dentistry's outpatient oral medicine clinic. The average age of the 19 female and 11 male members of the GT group was 34.83 ± 8.66 years. The mean age of the 14 male and 16 female members of the control group was 32.03 ± 8.71 years. The demographic characteristics of both groups are shown in Table 1.

Table 1. Demographic data of the GT patients and healthy controls.

	GT patients	Healthy control
No. of subjects	30	30
Age	34.83 ± 8.66	32.03 ± 8.71
Male:Female	11:19	14:16

Welch's t-test was used in this study to compare the serum vitamin B12 levels of patients with geographic tongue (GT) and healthy controls. For those with low serum vitamin B12 levels, the GT group's mean value was 143.8 ± 36.5 pg/mL (n = 18), while the control group was 202.6 ± 11.5 pg/mL (n = 8).
A highly significant difference between the two groups was indicated by the statistically significant difference ($t \approx -6.18$, $df \approx 23$, and $p < 0.00001$). The GT group had a mean of 396.15 ± 124.3 pg/mL (n = 12) for persons with normal serum vitamin B12 levels, whereas the control group had a mean of 519.5 ± 138.7 pg/mL (n = 22). Additionally, there was statistical significance in this difference ($t = -2.65$, $df \approx 27$, $p \approx 0.012$). The mean serum B12 levels for GT patients were 244.74 ± 82.94 pg/mL (n = 30), whereas the mean for healthy controls was significantly higher at 434.99 ± 120.2 pg/mL (n = 30). There was a significant difference ($t = -7.13$, $df = 58$, $p < 0.001$). Twelve GT patients and fourteen controls were included to examine serum folic acid levels among those with low folic acid levels. Statistical significance was indicated by the mean values of 1.4 ± 0.6 ng/mL and 2.3 ± 1.2 ng/mL, respectively, with $t \approx -2.36$, $df = 24$, and $p \approx 0.027$. The GT group had a mean of 10.5 ± 3.2 ng/mL (n = 18) for people with normal folic acid levels, while the control group had a mean of 15.32 ± 4.3 ng/mL (n = 16). There was a significant difference ($t \approx -3.74$, $df = 32$, $p \approx 0.0007$). Overall, the GT group's mean folic acid level was 6.86 ± 2.52 ng/mL, compared to 9.24 ± 3.25 ng/mL for the control group. A statistically significant difference was discovered ($t \approx -3.17$, $df = 58$, $p \approx 0.0024$). Table 2 provides a summary of all the data.

Discussion

The serum levels of folic acid and vitamin B12 in people with geographic tongue (GT), a benign but occasionally symptomatic oral disorder of unknown cause, were investigated in this study. When compared to healthy controls, the results showed that vitamin B12 and folic acid deficits were far more common in GT patients. Previous research indicates that nutritional deficiencies, especially haematinic factors like B 12 and folate, may play a role in the pathogenesis of GT. These vitamins are essential for DNA synthesis and epithelial cell regeneration. Insufficient levels of these nutrients may hinder the regeneration of the oral mucosa, resulting in epithelial atrophy and desquamative lesions hallmark of GT [18,19]. Our results are in line with those reported by Alikhani et al., who found significantly lower serum levels of vitamin B12 and folate in GT patients compared to healthy individuals [20]. Similarly, Jahanbani et al. observed an association between hematinic deficiencies and GT, underscoring the importance of evaluating systemic nutritional status in affected individuals [21]. It is well-established that vitamin B12 deficiency may lead to glossitis, mucosal atrophy, and burning sensations in the oral cavity—clinical features that can mimic or overlap with those seen in GT [22,23]. Likewise, folic acid deficiency has been linked to increased mucosal fragility and susceptibility to inflammatory changes on the tongue [24]. However, not all GT patients in our study demonstrated deficiencies in these vitamins, suggesting that nutritional factors, while important, are not the sole contributors to GT. The etiology of GT is likely multifactorial, involving a combination of genetic predisposition, immunological mechanisms, psychological stress, hormonal influences, and possibly allergic or atopic conditions [25]. Nutritional status itself is a complex indicator influenced by socio-economic factors, food availability, and individual metabolic needs. The World Health Organization views nutritional status as both a determinant and a consequence of overall development and health [26]. Optimal nutrition remains crucial for the maintenance of oral and dental tissue integrity [27].
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Despite being frequently asymptomatic and discovered incidentally, GT can cause discomfort in some patients. In such symptomatic cases especially those reporting burning sensations it is advisable to assess serum levels of hematinic nutrients. Although treatment with vitamin supplementation has led to symptomatic relief in some individuals, the supporting evidence remains limited and largely anecdotal [28].

Conclusion

The results of this study confirm that the existence of geographic tongue is significantly correlated with low serum levels of folic acid and vitamin B12. Even though not every patient had these deficits, they seem to have played a significant role in the pathophysiology and clinical presentation of GT. As a result, when evaluating GT patients clinically, especially those who exhibit symptoms like burning or mucosal irritation, hematinic status assessment should be considered. To investigate the therapeutic potential of vitamin supplementation in the management of GT, more prospective research is necessary.

Conflict of Interest

None.

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Table 2. Comparison of serum vitamin B12 and folic acid levels in patients with GT and healthy controls.

Variable	GT patients		Healthy control	
	No.	Mean ± SD	No.	Mean ± SD
Vitamin B12 (pg/ml)				
Low	18	143.8 ± 36.5	8	202.6 ± 11.5**
Normal	12	396.15 ± 124.3	22	519.5 ± 138.7*
Total	30	244.74 ± 82.94	30	434.99 ± 120.2 **
Folic acid (ng/ml)				
Low	12	1.4 ± 0.6	14	2.3± 1.2*
Normal	18	10.5 ± 3.2	16	15.32± 4.3**
Total	30	6.86 ± 2.52	30	9.24 ± 3.25*

* P < o.o5 ** P < o.oo1