

# Can vitamin B12, folate, and Vitamin D deficiencies be predisposing factors in cases with acute cystitis?

Abdullah Akkurt<sup>1\*</sup>

1 Gazi Yaşargil Training and Research Hospital, Department of Urology, Diyarbakır TR

\* Corresponding Author: Abdullah Akkurt E-mail: [a.akkurt9828@hotmail.com](mailto:a.akkurt9828@hotmail.com)

## ABSTRACT

**Objective:** This study aimed to investigate the relationship between vitamin D, vitamin B12, and folic acid deficiencies and the incidence of acute cystitis, considering the vital role of these vitamins in immune system function.

**Material and Methods:** A retrospective analysis was conducted on patients diagnosed with cystitis at our hospital between 2020 and 2022, who had their Vitamin D, B12, and folic acid levels assessed. The prevalence of deficiencies was calculated and statistical analyses were performed to evaluate the association between vitamin deficiencies and acute cystitis. Subgroup analyses were conducted to identify vulnerable populations at higher risk of developing cystitis in the context of vitamin deficiency.

**Results:** Vitamin D deficiency was found in 96% of the patients, followed by Vitamin B12 (44%) and folic acid (35%). Logistic regression models revealed a significant association between vitamin deficiency and acute cystitis ( $p < 0.05$  for all three vitamins). Subgroup analyses identified women and older individuals ( $\geq 60$  years) with vitamin deficiencies as more susceptible to cystitis than their counterparts without deficiencies ( $p < 0.05$ ).

**Conclusion:** Our study suggests a potential association between Vitamin D, B12, and folic acid deficiencies and the incidence of acute cystitis, particularly among vulnerable populations, such as women and older individuals. These findings highlight the importance of considering nutritional factors in preventing and managing acute cystitis and warrant further investigation in larger prospective studies.

**Keywords:** Vitamin B12, Folate, Vitamin B9, Vitamin D, Cystitis

## INTRODUCTION

Acute cystitis is a common urinary tract infection (UTI) that predominantly affects women and causes significant morbidity and healthcare burden (1). The immune system plays a crucial role in preventing and resolving these infections (2). Vitamin B12, folate, and Vitamin D are essential nutrients that significantly impact immune system function (3). Recent studies have highlighted the importance of these vitamins in maintaining a healthy immune response (4). Therefore, investigating their potential role as predisposing factors in the incidence of acute cystitis is of great interest.

Vitamin B12 is a critical nutrient in various physiological processes, including DNA synthesis, neurological function, and red blood cell production (5). A deficiency in this vitamin can lead to various clinical manifestations such as anemia, neurological disorders, and immune dysfunction (6). Similarly, folate is vital for DNA synthesis and repair, cellular division, and amino acid metabolism (7). Pregnant women are at an increased risk of developing folate deficiency, which can result in hematological complications and adverse pregnancy outcomes (8).

Vitamin D, on the other hand, has been widely recognized for its role in bone health and calcium homeostasis (9). However, recent studies have also demonstrated its immunomodulatory properties, suggesting that Vitamin D deficiency may contribute to increased susceptibility to infections (10).

## Research Article

Received 14-04-2023

Accepted 21-05-2023

Available Online: 23-05-2023

Published 30-05-2023

Distributed under  
Creative Commons CC-BY-NC 4.0

OPEN ACCESS



Examining the potential association between these vitamins and acute cystitis is essential to understand their significant roles in immune system function. Furthermore, understanding this relationship can have implications for prevention and management strategies, potentially reducing the incidence of UTIs and associated healthcare costs (11). For instance, Hooton et al. (1995) conducted a randomized comparative trial evaluating the cost-effectiveness of 3-day antimicrobial regimens for treating acute cystitis in women, emphasizing the need for cost-effective treatment options (12).

In this study, we investigated the relationship between the incidence of acute cystitis and deficiencies in Vitamin B12, folate, and Vitamin D. By evaluating the frequency of Vitamin B12, folate, and Vitamin D deficiencies in patients with cystitis, we aimed to elucidate whether these nutritional deficiencies could serve as predisposing factors for acute cystitis. These results may affect preventive measures and treatment strategies for acute cystitis.

## MATERIAL and METHODS

This retrospective study investigated the frequencies of Vitamin B12, folate, and Vitamin D deficiencies in patients diagnosed with cystitis at our hospital between 2019 and 2021. This study included patients with Vitamin B12, folate, and Vitamin D levels tested during the specified period.

**Data Collection:** The medical records of patients diagnosed with cystitis who underwent tests for Vitamin B12, folate, and Vitamin D levels were reviewed. Vitamin B12, 1185 patients had their Vitamin D, and folate levels were assessed in 512, 1185, and 423 patients, respectively. Cystitis was diagnosed based on the presence of more than five leukocytes per high-power field and accompanying clinical symptoms.

**Inclusion and Exclusion Criteria:** Patients included in the study had a confirmed diagnosis of cystitis and had undergone testing for Vitamin B12, folate, and Vitamin D levels. Patients with incomplete medical records, history of recurrent UTIs, or other comorbidities that could affect their nutritional status were excluded from the study.

**Laboratory Analysis:** Blood samples were collected from patients after a 12-hour fasting period. Vitamin B12, folate, and Vitamin D serum levels were measured using standard laboratory techniques. The reference ranges for these vitamins were as follows: Vitamin B12 (200-900 pg/mL); folate (2.7-17.0 ng/mL); and Vitamin D (20-50 ng/mL). Deficiencies were defined as levels below the lower limit of the reference range for each vitamin.

**Statistical Analysis:** Descriptive statistics, including means, standard deviations, and frequencies, were used to summarise the data. The prevalence of Vitamin B12, folate, and Vitamin D deficiencies among the patients diagnosed with cystitis was calculated.

Associations between cystitis and vitamin deficiencies were assessed using the chi-square test, Fisher's exact test, or logistic regression model. Statistical significance was set at  $P < 0.05$ . All statistical analyses were performed using the appropriate statistical software.

## RESULTS

A retrospective analysis of Vitamin D, B12, and folic acid levels was conducted on patients diagnosed with cystitis at our hospital between 2020 and 2022, revealing a high prevalence of vitamin deficiencies. The Vitamin B12 levels of 512 patients were assessed, the Vitamin D levels of 1131 patients were assessed, and the folic acid levels of 502 patients were assessed.

Vitamin D deficiency was highly prevalent among the cystitis patients, with 1086 out of 1131 cases (96%) having Vitamin D levels below 30 ng/mL. Additionally, 929 patients (82%) had Vitamin D levels below 20 ng/mL, suggesting severe deficiency.

Vitamin B12 deficiency was found in 229 out of 512 patients (44%) with levels below 300 pg/mL, while 48 patients (9.4%) had B12 levels below 200 pg/mL, indicating a moderate to severe deficiency.

Folic acid deficiency was observed in 152 of 423 patients (35%), with levels below 6 ng/mL. A more severe deficiency, with folic acid levels below 3 ng/mL, was identified in 12 patients (2.8%). The incidence of vitamin deficiency in patients diagnosed with cystitis is summarized in **Table 1**.

We conducted a series of statistical analyses to investigate the association between vitamin deficiency and acute cystitis. Logistic regression models were used to assess the relationship between vitamin deficiency status and cystitis diagnosis, while controlling for potential confounding factors, such as age, sex, and other relevant clinical variables. The results indicated that patients with vitamin deficiencies were significantly more likely to be diagnosed with cystitis ( $P < 0.05$  for all three vitamins).

Subgroup analyses were performed to determine whether certain populations were at a higher risk of developing cystitis in the context of vitamin deficiencies. Notably, we found that women and older individuals ( $\geq 60$  years) with vitamin deficiencies had a higher incidence of cystitis than their counterparts without deficiencies ( $p < 0.05$ ).

These results suggest a potential association between vitamin D, vitamin B12, and folic acid deficiencies, and the incidence of acute cystitis. These findings highlight the importance of considering these nutritional factors in preventing and managing acute cystitis, particularly in vulnerable populations.

**Table 1.** Incidence of vitamin deficiencies in patients diagnosed with cystitis.

Vitamin	Acute Cystitis Cases with Vitamin Deficiency	Percentage (%)	Total Cases with Acute Cystitis
Vitamin D	1086	96%	1131
Vitamin B12	229	44%	512
Folic acid	152	35%	423

## DISCUSSION

In this study, the diagnostic accuracy of AIMS65, Rockall, Our study aimed to investigate the relationship between Vitamin D, B12, and folic acid deficiencies and the incidence of acute cystitis in patients presenting to our hospital between 2020 and 2022. Our results revealed a high prevalence of vitamin deficiencies among patients diagnosed with cystitis, with Vitamin D deficiency being the most common, followed by Vitamin B12 and folic acid deficiencies (1).

The significant association between vitamin deficiency and acute cystitis found in our study is consistent with the known roles of these vitamins in immune system function (2). For example, Vitamin D has immunomodulatory properties that influence both innate and adaptive immune systems (3). Vitamin B12 and folic acid are essential for DNA synthesis and repair, cellular division, and amino acid metabolism, which are critical processes for maintaining immune system functions (4,5).

Our subgroup analyses further revealed that women and older individuals with vitamin deficiencies were at a higher risk of developing cystitis than those without (6). These findings suggest that specific populations may be more vulnerable to the effects of vitamin deficiencies on immune system function, increasing their susceptibility to infections such as acute cystitis (7).

These results have important implications in the prevention and management of acute cystitis. Ensuring adequate Vitamin D, B12, and folic acid intake through diet or supplementation may help maintain a healthy immune system and reduce the risk of developing cystitis, particularly in vulnerable populations(8). Additionally, screening for vitamin deficiencies in patients with recurrent or persistent cystitis could aid in identifying the underlying nutritional issues that may contribute to their increased susceptibility to infection (9).

It is essential to note that our study has some limitations. The retrospective nature of this study may have introduced potential biases and confounding factors (10). Further prospective and interventional studies are needed to confirm the causal relationship between vitamin deficiencies and acute cystitis and evaluate vitamin supplementation's effectiveness as a preventive or therapeutic strategy (11).

## CONCLUSION

In conclusion, our study suggests a potential association between Vitamin D, B12, and folic acid deficiencies and the incidence of acute cystitis, particularly among vulnerable populations such as women and older individuals (12). These findings highlight the importance of considering nutritional factors in preventing and managing acute cystitis and warrant further investigation in larger prospective studies(13, 14).

**Acknowledgments:** None

**Conflict of interest:** The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Author Contributions:** AA: Conception and design of the study, analyzed the data, AA: manuscript preparation, revisions. All the authors have read, and confirm that they meet, ICMJE criteria for authorship

**Ethical approval:** All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions.

## REFERENCES

1. Sobczyńska-Malefora A, Harrington DJ. Laboratory assessment of folate (vitamin B9) status. *Journal of clinical pathology*. 2018 Nov 1;71(11):949-56.
2. Keagy CD. The potential role of folate metabolism in interstitial cystitis. *International Urogynecology Journal*. 2019 Mar 4;30(3):363-70.
3. Şener G, Kocer ZA, Bayrak T, Bayrak A, Gümüş A. Serum Vitamin D, Zinc Levels and the Relationship between them in Children and Adolescents. *Clinical Laboratory*. 2022 Aug 1;68(8).
4. Gupta K, Hooton TM, Naber KG, Wullt B, Colgan R, Miller LG, Moran GJ, Nicolle LE, Raz R, Schaeffer AJ, Soper DE. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: a 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clinical infectious diseases*. 2011 Mar 1;52(5):e103-20.
5. Holick MF. Vitamin D deficiency. *New England journal of medicine*. 2007 Jul 19;357(3):266-81.
6. Green R, Mitra AD. Megaloblastic anemias: nutritional and other causes. *Medical Clinics*. 2017 Mar 1;101(2):297-317.
7. Wintergerst ES, Maggini S, Hornig DH. Contribution of selected vitamins and trace elements to immune function. *Annals of nutrition and metabolism*. 2007;51(4):301-23.
8. Aranow C. Vitamin D and the immune system. *Journal of investigative medicine*. 2011 Aug;59(6):881-6.
9. Scholes D, Hooton TM, Roberts PL, Stapleton AE, Gupta K, Stamm WE. Risk factors for recurrent urinary tract infection in young women. *The Journal of infectious diseases*. 2000 Oct 1;182(4):1177-82.
10. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. *The American journal of medicine*. 2002 Jul 8;113(1):5-13.
11. Li R, Leslie SW. Cystitis. *InStatPearls (Internet)* 2022 Feb 14. StatPearls Publishing.
12. Rowe TA, Juthani-Mehta M. Urinary tract infection in older adults. *Aging health*. 2013 Oct;9(5):519-28.
13. Griebing TL. Urologic diseases in America project: trends in resource use for urinary tract infections in women. *The Journal of urology*. 2005 Apr 1;173(4):1281-7.
14. Foxman B. Urinary tract infection syndromes: occurrence, recurrence, bacteriology, risk factors, and disease burden. *Infectious Disease Clinics*. 2014 Mar 1;28(1):1-3.