

Frequency of Vitamin D Deficiency in Children with Nephrotic Syndrome

Misbah Hanif¹, Masood Mazhar², Junaid Khattak³, Muhhaamd Hanif³, Imtiaz Ahmed⁵, Tasneem Kousar⁶

¹PGR pediatric, Recep Tayyip Erdogan Hospital Muzaffargarh

²Senior consultant pediatrics, Recep Tayyip Erdogan Hospital Muzaffargarh

³Senior Registrar, paediatric department M. Islam Medical and Dental College

⁴Associate Professor, paediatric department, SRMC, Tando Adam

⁵Assistant Professor of Biochemistry, SRMC, Tando Adam

⁶Professor, paediatric department, SRMC, Tando Adam

Author's Contribution

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Correspondence

*E: drmisbahszmc@gmail.com

ABSTRACT

Objective: To determine the frequency of vitamin D deficiency in children with nephrotic syndrome.

Methodology: This cross-sectional study was done at pediatric Medicine Department, Recep Tayyip Erdogan Hospital Muzaffargarh from March 2025 to August 2025, on pediatric patients aged 2 to 12 years, both boys and girls, diagnosed with nephrotic syndrome. A 3 ml of venous blood sample was obtained from each patient through aseptic technique to assess the vitamin D level, which was categorized as deficient when serum vitamin D level was < 50 nmol/L on reporting time. All the obtained data was noted on proforma and the analysis was done through SPSS 23.0 version. the data analysis was done through SPSS 23.0 version. The numerical data was presented as mean and standard deviation. The categorical variables were presented as frequency and percentages. Additionally, data was stratified to determine the effect on prevalence of vitamin D deficiency, by applying post stratification chi-square test taking p-value < 0.05 as significant statistically.

Results: Mean age of 6.62 ± 3.10 years and boys were slightly predominant 78 (52.0%). Vitamin D deficiency was around 51.20%. It was statistically insignificant according to age and gender ($p > 0.05$), while socioeconomic status, residential status and sun exposure showed a significant association, with deficiency being more common among children from lower middle socioeconomic status, urban children and less than one hour of daily sun exposure ($p = 0.001$).

Conclusion: Vitamin D deficiency was observed to be highly prevalent among children with nephrotic syndrome, influencing around half of the study population with considerably decreased level.

Key words: Children, Nephrotic Syndrome, Vitamin D, Deficiency

Introduction

The Nephrotic syndrome (NS) is a disease characterized by a constellation of signs and symptoms that occur from injury to the glomerular basement membrane of the kidneys.¹ The condition arises when the glomerular capillary wall undergoes structural changes that compromise its function of filtering, making it unable to prevent proteins from leaking into the urine specifically albumin.² The nephrotic syndrome can be characterized by different features, including excessive protein loss through urine, a significant drop of albumin levels in blood, raised lipid levels, with fluid accumulation causing peripheral edema.³ Beyond these characteristics, children with NS are at considerable risk of developing a range of metabolic complications, specifically the vitamin D deficiency has emerged as a predominantly significant concern. The children with NS commonly experience disruptions in calcium regulation, which can lead to abnormal bone development, low blood calcium levels, declined vitamin D in circulation, reduced calcium uptake in the gut, and raised parathyroid hormone.⁴ Such

disturbances are largely driven by the urinary loss of key plasma proteins and minerals, as well as the side effects associated with steroid-based treatment.⁴

Nephrotic syndrome affects bone health also through both the underlying disease and its treatment, while vitamin D deficiency in NS occurs due to urinary loss of 25(OH)D along with its binding protein, resulting in reduced vitamin D levels. After these losses are substantial and persist over an extended period, a vitamin D deficient state may develop, which in turn can be responsible for the disruptions observed in regulation of calcium.⁵

Another contributing factor is the effect of corticosteroid therapy, which remains the cornerstone of NS management. However, the prolonged steroid uses may lead to osteoporosis and negatively impact both bone mineral content and bone mineral density in pediatric population. However, the degree of bone mineralization that occurs during childhood plays a

significant role in determining skeletal bone mineral content in later adult life.⁶ The studies of children with NS have demonstrated the rates of 25-hydroxyvitamin D deficiency ranging from 20 to 100%, which is in strong difference to deficiency rates of only 9–18% observed in the general pediatric population.⁷ Another study conducted on 50 children of age 1-15 years, diagnosed with nephrotic syndrome, reported the 46% had deficiency of vitamin D, while insufficiency was present in 28% and normal levels were seen in only 26% of patients.⁸ Several investigations indicate that disruption of the glomerular filtration barrier in nephrotic syndrome is driven by circulating permeability-related factors; however, the specific factors responsible remain unknown.^{9,10} According to earlier discussion, vitamin D occupies a distinctive role in the pathophysiology of nephrotic syndrome: it is both lost through disease-related mechanisms, leading to deficiency, and, due to its immunomodulatory effects, its disruption may influence the progression and natural history of the disorder.¹¹

Overall the deficiency of vitamin D is commonly observed among children with nephrotic syndrome due to urinary loss of vitamin D-binding protein and albumin, which disrupts normal vitamin D metabolism. Further than its established role in bone and mineral homeostasis, vitamin D also has immunomodulatory properties that may influence inflammatory pathways implicated in nephrotic syndrome. Though numerous studies have reported high rates of vitamin D deficiency in pediatric nephrotic populations, data remain limited and inconsistent, with few studies assessing its prevalence in different clinical phases of the disease or its association with severity of disease.^{12,13} The determination of vitamin D status is therefore important for improving clinical management, establishing local prevalence data, guiding screening practices, and informing potential interventions to support bone health and overall outcomes among children affected by NS.

Methodology

This cross-sectional study was done at pediatric Medicine Department, Recep Tayyip Erdogan Hospital Muzaffargarh. The Non-probability consecutive sampling was used. A sample size of 150 patients was calculated through WHO sample size calculator using formula for single proportion, where, frequency of Vitamin D deficiency in nephrotic syndrome 46% was used as proportion with 95% confidence level and 5% margin of error 5%. Study duration was six months from March 2025 to August 2025. The study was conducted after permission from institutional ethics review committee of Indus Hospital & Health Network (IHNN). The pediatric patients aged 2 to 12 years, both boys and girls, diagnosed with nephrotic syndrome were included.

Conversely the children with chronic kidney diseases, chronic liver disease, children already on vitamin D supplementation, and those whose parents or caretakers not willing to take a part of study were excluded. The nephrotic syndrome was defined as the presence of periorbital swelling and pedal edema with nephrotic-range proteinuria, confirmed by history and medical records, in newly diagnosed and receiving treatment children. Before data collection as informed consent was obtained from the parents, visiting pediatric medicine department. Baseline demographic data including age, gender, residential area, duration of sun exposure and socioeconomic status were recorded. Three ml of venous blood sample was obtained from each patient through aseptic technique to assess the vitamin D level, from single laboratory through standard method.

Vitamin D status was categorized as deficient when serum vitamin D level was < 50 nmol/L on reporting time. All the obtained data will be noted on proforma. Furthermore, the data analysis was done through SPSS 23.0 version. The numerical data was presented as mean and standard deviation. The categorical variables were presented as frequency and percentages. Additionally, data was stratified to determine the effect on prevalence of vitamin D deficiency, by applying post stratification chi-square test taking p-value < 0.05 as significant statistically.

Results

This study enrolled 150 pediatric patients with mean age of 6.62 ± 3.10 years, and average duration of daily sun exposure of 1.25 ± 1.45 hours per day. Overall mean serum vitamin D level was 24.53 ± 5.92 nmol/L, ranging from minimum 10.23 nmol/L to maximum 36.11 nmol/L. Table I

Table I: Descriptive statistics of age, vitamin D and sun exposure duration .(n=150)

Statistics	Age of children	Duration of sun exposure	Vitamin D levels
Mean	6.62 years	1.25 hours	24.53 nmol/L
SD	3.10 years	1.45 hours	5.92 nmol/L
Minimum	1.00 years	0.50 hours	10.23 nmol/L
Maximum	12.00 years	12.50 hours	36.11 nmol/L

Out of all boys were slightly predominant 78 (52.0%) and girls were 72 (48.0%). According to residential status, 63 patients (42.0%) were from rural areas, while 87 (58.0%) belonged to urban regions. Additionally, the most of patients were from the middle socioeconomic class (82, 54.7%), followed by low socioeconomic patients were (59, 39.3%),

whereas only (9, 6.0%) patients had upper socioeconomic class. Table II.

Table II: Demographic characteristics of patients. (n=150)

Variables	N	%
Gender		
Girls	72	48.0
Boys	78	52.0
Total	150	100.0
Residential area		
Rural	63	42.0
Urban	87	58.0
Total	150	100.0
Socioeconomic status		
Low	59	39.3
Middle	82	54.7
Upper	9	6.0
Total	150	100.0

This study showed, vitamin D deficiency around 51.20% of the study population, indicating that more than half of the pediatric patients had suboptimal levels of vitamin D, highlighting a significant burden of vit. D deficiency in this pediatric population as shown in figure 1.

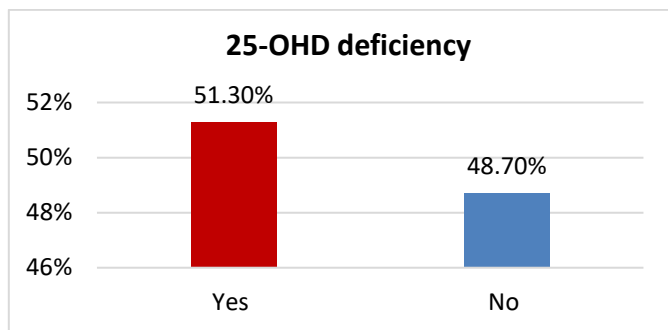


Figure 1. Vitamin D deficiency among patients. (n=150)

Table III presents the stratification of vitamin D deficiency across demographic and clinical variables.

Table III: Stratification of vitamin d deficiency with demographic and clinical variables. (n=150)

VARIABLES		Vitamin D Deficiency		Total	P-value
		Yes	No		
Gender	Girls	40	32	72	0.320
		26.7%	21.3%	48.0%	
	Boys	37	41	78	
		24.7%	27.3%	52.0%	
Age groups	1-4 years	27	22	49	0.809
		18.0%	14.7%	32.7%	
	5-8 years	25	26	51	
		16.7%	17.3%	34.0%	
	9-12 years	25	25	50	
Socioeconomic status	Low	19	40	59	0.001
		12.7%	26.7%	39.3%	
	Lower mid	54	28	82	
		36.0%	18.7%	54.7%	

Residential area	Upper	4	5	9	0.015
		2.7%	3.3%	6.0%	
	Rural	25	38	63	
		16.7%	25.3%	42.0%	
Sun exposure duration per day	Urban	52	35	87	0.007
		34.7%	23.3%	58.0%	
	<=1 hour	66	49	115	
		44.0%	32.7%	76.7%	
>1 hour		11	24	35	
		7.3%	16.0%	23.3%	

Discussion

The deficiency of vitamin D remains a widespread public health concern throughout the world, specifically among children and adolescents, even in regions with plentiful sunlight exposure. Though this study examined the particularly 150 children with nephrotic syndrome with mean age of mean age of 6.62 ± 3.10 years, limited sun exposure average 1.25 ± 1.45 hours/day and relatively balanced gender distribution, with 52.0% females and 48.0% males, representing a current picture of this vulnerable pediatric population. The findings were supported by Illalu S et al¹³ where mean age of children with nephrotic syndrome was 4.6 years and boys to girl's ratio as 1.4:1. Furthermore the Zamani SA et al¹⁴ and Sikandar S et al¹⁵ also reported the comparable findings.

In this study observed prevalence rate 51.20% of vitamin D deficiency establishes consistency with recent national and international studies, like Zubair A et al¹⁵ reported that; (51.4%) of children had vitamin D deficiency and (37.1%) children had severe deficiency. Consistently Alim M et al¹⁶ reported that the all od study cases had suboptimal vitamin D levels, with just over half showing deficiency (51.7%) and the remaining nearly half (48.3%) representing insufficiency. Moreover, a latest study from North India conducted by Maji M, Kumar M et al¹⁷ reported that the most of the children had suboptimal status of vitamin D, with vitamin D deficiency detected among over three quarters of patients (77.1%), and an additional 18.8% noted to have vitamin D insufficiency, almost similar to our findings. In aligns to our findings, Som S et al¹⁸ demonstrated a 66% prevalence of vitamin D deficiency among children with nephrotic syndrome, with overall average level of 11.53 ± 6.31 ng/mL. Though, according to anther latest Nigerian study conducted by Solarin AU et al¹⁹ stated that the most of the children had severe deficiency of vitamin D (54.5%), followed by deficiency among (41.8%) cases, while only (3.6%) patients had insufficient levels among children with nephrotic syndrome. Furthermore, Jesmin T et al⁴

observed that the vitamin D insufficiency was the most predominant finding among (51.51%) of the patients, following by deficiency in around one quarter of cases (27.27%), and severe deficiency was noted among in 15.15% of cases. Some variation in the findings across the studies likely reflects differences in dietary fortification practices and seasonal exposure of the sunlight, whereas the consistent findings across regions suggest that vitamin D deficiency in nephrotic syndrome is a widespread problem that extends beyond the ethnic and geographical limitations.

In this study mean serum vitamin D level was 24.53 ± 5.92 nmol/L falls substantially below the 50 nmol/L threshold recommended by current pediatric guidelines. Our finding also aligns with recent evidence found average vitamin D levels as 23.7 ± 9.2 nmol/L among Indian children with nephrotic syndrome during the active phase of illness. On the other hand, Som S et al²¹ conducted study by involving 60 Indian pediatric patients, and found average vitamin D level was 11.53 ± 6.31 ng/mL ng/mL. Another latest analysis by Jesmin T et al⁴ reported that the average vitamin D level was 13.47 ± 8.80 ng/ml among children with nephrotic syndrome. Present study, while providing valuable insights into vitamin D deficiency among children presented with nephrotic syndrome, with few limitations, like cross-sectional design study, relatively limited sample size of the study and not analyzed the prevalence based on ethnic backgrounds and dietary

habits. Moreover, the seasonal difference in sun exposure and vitamin D levels was not analyzed, did not evaluate the dietary vitamin D intake or determination of parathyroid hormone and not compared the healthy control group to compare affected and unaffected pediatric cases. However, the routine screening for vitamin D level should be incorporated into the management of nephrotic syndrome pediatric patients, with consideration of prophylactic supplementation and awareness of family regarding safe sun exposure and the vitamin D related diet. Further large-scale and interventional longitudinal studies are recommended to regulate the optimal strategies of supplementation, evaluate the effects on clinical outcomes, investigate the genetic susceptibility, and to assess the cost-effectiveness of widespread vitamin D supplementation, specifically in limited resource nations.

Conclusion

Vitamin D deficiency was observed to be highly prevalent among children with nephrotic syndrome, influencing around half of the study population with significantly decreased level. Such higher burden underscores the requirement for routine screening and supplementation appropriately as a part of the comprehensive treatment of pediatric nephrotic syndrome to potentially enhance the clinical outcomes and overall health of children.

References

1. Taherahmadi H, Yousefichaijan P, Rezagholizamenjany M, Dorreh F, Ahangar DM, Hassanzadeh S. Evaluation of the efficacy of vitamin D consumption on nephrotic syndrome condition in children: a clinical trial study. *Nephro-Urol Mon.* 2020;12(1):1-4.
<https://doi.org/10.5812/numonthly.97001>
2. Ahmed HM, Morgan DS, Doudar NA, Naguib MS. High serum endothelin-1 level is associated with poor response to steroid therapy in childhood-onset nephrotic syndrome. *Saudi J Kidney Dis Transpl.* 2019;30(4):769-74.
<https://doi.org/10.4103/1319-2442.265451>
3. Prince S, Naresh K, Tulasi R. Case report on paediatric nephrotic syndrome. *EJIFCC.* 2020;31(2):164-8.
4. Jesmin T, Begum F, Al-Mamun A, Sharmim MS, Akter A, Shanta SN, Huque SS, Jahan S, Begum A. Vitamin D status on remission of relapsing nephrotic syndrome among children at a South Asian tertiary hospital. *Egypt Pediatr Assoc Gaz.* 2025;73(1):32.
<https://doi.org/10.1186/s43054-025-00374-7>
5. Yang SP, Ong L, Loh TP, Chua HR, Tham C, Meng KC. Calcium, vitamin D, and bone derangement in nephrotic syndrome. *J ASEAN Fed Endocr Soc.* 2021;36(1):50-5.
<https://doi.org/10.15605/jafes.036.01.12>
6. Cetin N, Gencler A, Sivriköz IA. Bone mineral density and vitamin D status in children with remission phase of steroid-sensitive nephrotic syndrome. *Saudi J Kidney Dis Transpl.* 2019;30(4):853-62.
<https://doi.org/10.4103/1319-2442.265461>
7. Selewski DT, Chen A, Shatat IF, Pais P, Greenbaum LA, Geier P, Nelson RD, Kiessling SG, Brophy PD, Quiroga A, Seifert ME. Vitamin D in incident nephrotic syndrome: a Midwest Pediatric Nephrology Consortium study. *Pediatr Nephrol.* 2016;31(3):465-72.
<https://doi.org/10.1007/s00467-015-3236-x>
8. Badyal A, Kumar K. Evaluation of vitamin D status in children with nephrotic syndrome in remission in a tertiary care hospital of North India. *JK Sci.* 2020;22(2):92-5.
9. Sikandar S, Waheed N, Ilyas K. The status of vitamin D in children with nephrotic syndrome in outpatient nephrology department, Children Hospital PIMS. *Pak-Euro J Med Life Sci.* 2023;6(3):253-60.
10. Odaka J, Kanai T, Ito T, Saito T, Aoyagi J, Betsui H. Apolipoprotein CI levels are associated with the urinary protein/urinary creatinine ratio in pediatric idiopathic steroid-sensitive nephrotic syndrome: a case-control study. *Int J Nephrol.* 2017;2017:6392843.
<https://doi.org/10.1155/2017/6392843>
11. Maji M, Kumar M, Chacham S, Mirza AA, Bhat NK, Mandal S. Severity of vitamin D deficiency in children with nephrotic syndrome: a study from a tertiary care center in Northern India. *Saudi J Kidney Dis Transpl.* 2022;33(5):608-16.
<https://doi.org/10.4103/1319-2442.389421>
12. Mangi I, Lashari S, Kumar R. Assessment of biochemical measurements with vitamin D deficiency in nephrotic

- syndrome patients. *Pak J Kidney Dis.* 2024;8(1):27-33. <https://doi.org/10.53778/pjkd81247>
13. Illalu S, Venkatareddy VS, Fattepur SR. Study of prevalence of vitamin D deficiency in nephrotic syndrome. *Int J Contemp Pediatr* 2019;6:288-94
 14. Zamani SA, Abbasi A, Bazargani B, Askarian F, Fahimi D, Moghtaderi M. Vitamin D deficiency in relapsing idiopathic nephrotic syndrome in children: prevalence, correlates, and therapeutic implications. *Int J Endocrinol.* 2025;2025:5199898. <https://doi.org/10.1155/ije/5199898>
 15. Zubair A, Moorani KN. A High Prevalence Of Vitamin D Deficiency In Children With Steroid Sensitive Nephrotic Syndrome. *Pakistan Journal of Kidney Diseases.* 2017;1(3).
 16. Alim M, Sharma N, Rastogi D, Yadav AS, Kumar D, Gupta H. Vitamin D Status and Clinical Outcomes in Pediatric Idiopathic Nephrotic Syndrome: A Prospective Observational Study from North India. *Annals of African Medicine.* 2025 Nov 26:10-4103..
 17. Maji M, Kumar M, Chacham S, Mirza AA, Bhat NK, Mandal S. Severity of vitamin D deficiency in children with nephrotic syndrome: a study from tertiary care center in Northern India. *Saudi Journal of Kidney Diseases and Transplantation.* 2022 Sep 1;33(5):608-16.
 18. Som S, Irshad M, Roy A, Sarkar S. Prevalence of vitamin D deficiency in children with nephrotic syndrome in a tertiary care hospital in Eastern India. *Sch J App Med Sci.* 2019;7(12):4098–4101. doi:10.36347/sjams.2019.v07i12.054.
 19. Solarin AU, Adekunle MO, Oladimeji AB, Olutekunbi OA, Lamina MO, Oshomah-Bello OE, Adetola OI, Animasahun BA, Njokanma OF. Vitamin D status and serum vitamin D binding protein levels in Nigerian children with nephrotic syndrome. *African Journal of Nephrology I Volume.* 2022;25(1).