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A Cohort Study and an Audit Project on Vitamin D Prescribing Practices for Children in Pediatric Clinics at a Tertiary Hospital in Jordan

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Vitamin D is required for skeletal development and bone health. A severe deficit can cause rickets and osteomalacia among children and adults respectively. There are few dietary sources of vitamin D. Various recommedations states that all infants and young children aged 6 months to 3 years are advised to take a daily supplement containing vitamin D in the form of vitamin drops.

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Aims: This study was done to assess the adherence NICE recommendations regarding supplementation of vitamin D for children in pediatrics clinics at tertiary hospital in south of Jordan according to the NICE recommendations.
Methods: Data was collected in retrospective manner. The following information was gathered for each sample: gestational age when delivered, age and developmental age, type of feeding, amount, past medical and drug history and allergic history, social history and if prescribed vitamin D or not.
Results: A total of 64 children were recorded in which 42 out of them (65.6%) were prescribed vitamin D supplements.
Conclusion: Collaboration between policymakers and health care professionals is required to fill the gap between guidelines and clinical practice.

Keywords: Vitamin D; skeletal development; vitamin D deficiency management.

1. INTRODUCTION

Vitamin D has a significant impact on baby and child health, growth, and development. Its levels are low in breast milk, putting solely breastfed infants at danger of vitamin D deficit or insufficiency, which contributes to nutritional rickets and osteomalacia [1]. It is commonly known that vitamin D can be derived through the sun or from a few natural food sources. The American Academy of Dermatology identified UV radiation to be a known skin carcinogen, therefore getting vitamin D from the sun or other artificial sources may not be safe or efficient. As a result, many pediatricians and physicians advise vitamin D prescription to attain adequate plasma levels [2]. The National Institute for Health and Care Excellence (NICE) recommends providing vitamin D to newborns and children under the age of four. Also to raise knowledge of the importance of vitamin D among health, social care, related practitioners, and the local population [3]. In this study we aim to review infants and young children aged 6 months to 3 years supplementation of vitamin D according to NICE Recommendations.

2. LITERATURE REVIEW

Vitamin D deficiency is a common health problem among children worldwide, especially in regions with limited sunlight exposure or dietary intake2. Vitamin D supplementation is recommended for preventing or treating various conditions related to vitamin D deficiency, such as rickets, osteomalacia, or hypocalcemia3. However, there is a lack of evidence-based guidelines and standardized protocols for optimal dosing, frequency, duration, and monitoring of vitamin D supplementation in pediatrics age group4. Therefore, conducting clinical audits is essential for evaluating and improving the quality and effectiveness of vitamin D supplementation practices in this population5. To identify the current state of knowledge and best practices on this topic, a comprehensive search of the literature was conducted using PubMed as the search database. The search criteria included all years up to 2023, articles in English only, mesh

Chart 1. A summary table of the relevant audit articles

Author	Cycle	No.of Cases	Improvements methods
Thomas, L [4]	Audit	164	Education of the risks associated with lack of vitamin D. Standardisingpractice, enhancing services and the advice provided to patients areways to encourage compliance to guidelinesand ultimately improve the health of those populations who are at risk.
Santi, M [5]	Audit	795	Collaboration between policymakers and health care professionals is required to fillthe gap between guidelines and clinical practice

term Clinical Audit, and keywords Vitamin D supplementation and Audit. The search results were screened for relevance and quality, and only two audit articles that aimed to optimize vitamin D supplementation in pediatrics age group were selected for further analysis. The rest of the articles were excluded because they did not meet the inclusion criteria or they focused on other aspects of vitamin D deficiency management. A summary table of the main features, findings, and recommendations of the two relevant audit articles was created (chart1) to facilitate comparison and synthesis.

2. MATERIALS AND METHODS

Data collection was done prospectively by taking a relevant history about the baby (gestational age when delivered , developmental age , type of feeding , amount of feeding , past medical history , drug history , allergic history , social history), and if vitamin D was prescribed from mothers of a children aged from six months to 3 years come to the hospital pediatrics clinics on a duration of 5 weeks.

The audit followed ethical principles and obtained approval from the hospital's ethical committee. The data collection process ensured the confidentiality of the patients and their medical records, which were accessed only by authorized personnel and only for audit purposes. The patients' privacy and autonomy were respected throughout the audit. The audit had some limitations, such as the small sample size and the retrospective data collection method. Future audits could use a larger sample size and a prospective data collection method to generate more reliable findings.

3. RESULTS

3.1 First Loop

Evaluation of the audit findings identified that the 100% standard NICE guidelines meet the reach of 42 of 64 (65.6%) children Fig. (1) Table (1).

Of 64 children, all of the children were appropriate for developmental age. Also, 18 (28.1%) of children were on bebelac, 8 (28.1%) of babies were on breastfeeding, 5 (7.8%) children were on home food,2(3.1%) on liquid food,5(7.8%) on Nido,3(4.7%) on primilac, and 13(20.3%) on S-26. Figure (2) Table (2).

Table 1. Frequencies of if vit. D was prescribed

If vit. D was prescribed	Counts	% of Total	Cumulative %
Yes	42	65.6 %	65.6 %
No	22	34.4 %	100.0 %

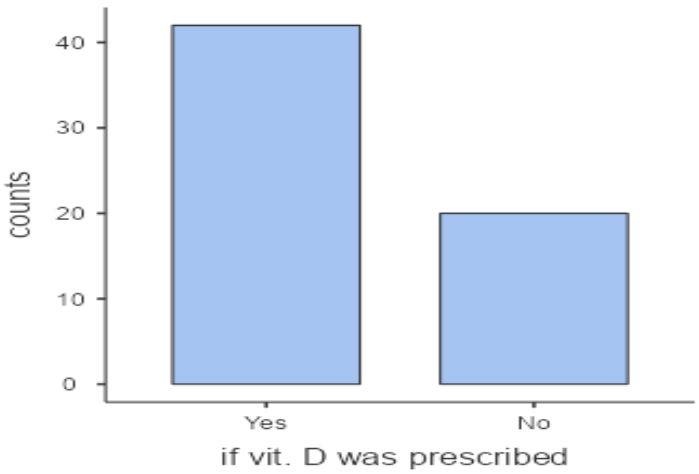

Fig. 1. Shows the frequency and percentage of prescribed vit.D or not

Table 2. Frequencies of Type of feeding

Type of feeding	Counts	% of Total	Cumulative %
Bebelac	18	28.1 %	28.1 %
Breastfeeding	18	28.1 %	56.3 %
Home food	5	7.8 %	64.1 %
Liquid food	2	3.1 %	67.2 %
Nido	5	7.8 %	75.0 %
Primilac	3	4.7 %	79.7 %
S-26	13	20.3 %	100.0 %

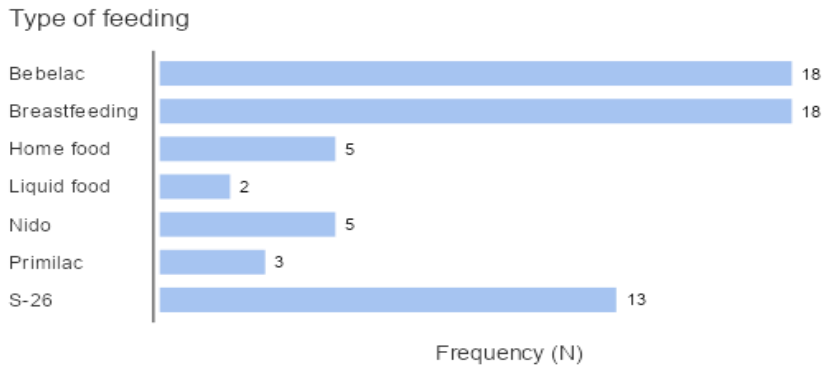

Fig. 2. Shows the frequency and percentage of types of feeding

The mean amount of feeding was 453ml with a standard deviation 273 Figure. The mean and standard deviation for the age of children, and gestational age when delivered were 10 months (0.86), and 37.2 (2.08), respectively. Of 59 children 44 (74.6%) are free, while one has Spina bifida and shunt procedure, one has Metabolic syndrome/glycogen storage disease, one has ASD, one has chronic obstructive pulmonary disease, an otitis media, one has Developmental dysplasia of the hip, one has type-1 DM and atopic dermatitis, one has the respiratory condition of a newborn, one has Q fever, one has AR, one has Aspiration, one has a seizure, one has Down syndrome, one has Down syndrome, one has celiac disease, one has tracheitis, and one has type 1 dm alone Fig. (3) Table (3).

Table 3. Shows Frequencies of past medical history

Past medical history	Counts	% of Total	Cumulative %
free	44	74.6 %	74.6 %
Spina bifida and shunt procedure	1	1.7 %	76.3 %
Metabolic syndrome/glycogen storage disease	1	1.7 %	78.0 %
ASD	1	1.7 %	79.7 %
chronic obstructive pulmonary disease & otitis media	1	1.7 %	81.4 %
Developmental dysplasia of the hip	1	1.7 %	83.1 %
type-1 DM and atopic dermatitis	1	1.7 %	84.7 %
respiratory condition of a newborn	1	1.7 %	86.4 %
Q fever	1	1.7 %	88.1 %
AR	1	1.7 %	89.8 %
Aspiration	1	1.7 %	91.5 %
Seizure	1	1.7 %	93.2 %
Down syndrome	1	1.7 %	94.9 %
celiac disease	1	1.7 %	96.6 %
tracheitis	1	1.7 %	98.3 %
type 1 dm	1	1.7 %	100.0 %

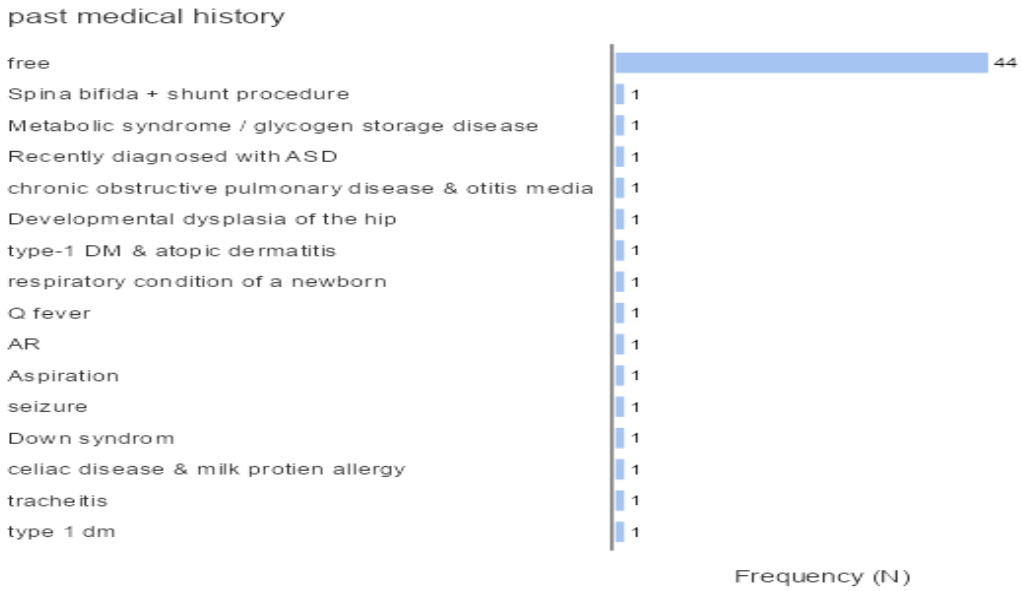

Fig. 3. Shows the frequency and percentage of past medical history

Table 4. Frequencies of if Vit. D was prescribed

If vit. D was prescribed	Counts	% of Total	Cumulative %
Yes	54	84.4 %	84.4 %
No	10	15.6 %	100.0 %

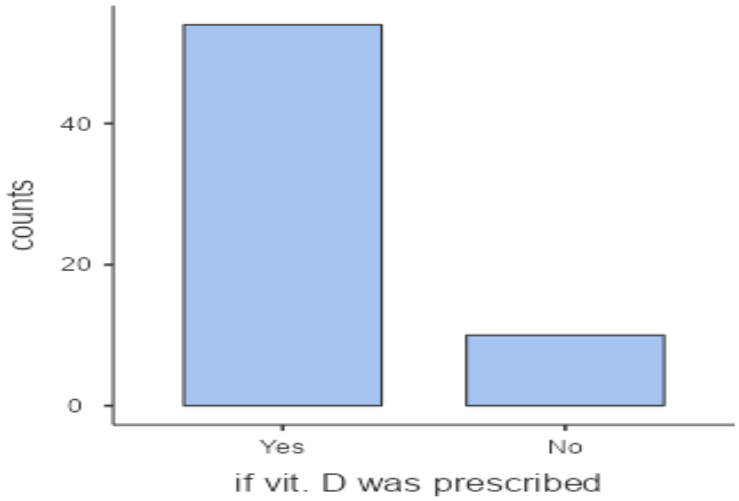

Fig. 4. Shows the frequency and percentage of prescribed vit.D or not

3.2 Second Loop

Re-Evaluation of the audit findings identified that the 100% standard NICE guidelines meet the reach of 54 the 64 (84.4%) children Table (4) Fig. (4).

4. DISCUSSION

Vitamin D is necessary for proper bone development in infants and children. Because breastmilk and some formulas are deficient in vitamin D, newborns should receive oral vitamin D supplementation to prevent vitamin D

deficiency. Another known cause of vitamin D deficiency is malabsorption, which can occur as a result of gastrointestinal disorders such as Crohn's disease, celiac disease, chronic active hepatitis, chronic kidney disease (CKD) with or without dialysis, chronic pancreatitis, cystic fibrosis, diabetes mellitus, gastric bypass, and primary biliary cirrhosis [6]. This can cause rickets in children. A 25(OH) D level less than 20 ng/mL is considered vitamin D deficiency. Patients who fall below this level are at a higher risk of muscle weakness, bone pain, and fragility fractures. A serum 25(OH) D level of 21 to 29 ng/mL without overt clinical symptoms has been defined as vitamin D deficiency. Despite the fact that definitions have been hotly debated. Vitamin D deficiency reduces intestinal absorption of dietary calcium and phosphorus, resulting in an increase in parathyroid hormone levels. With 25(OH) D levels between 30 and 40 ng/mL, parathyroid hormone levels begin to plateau in adolescents and adults [7]. To meet the needs of most people aged 1 to 70 years, the Institute of Medicine recommends 600 IU of vitamin D per day [7].

Children can get vitamin D from sun exposure, fortified foods, and supplements. Supplements come in a variety of formats, including drops, tablets, capsules, and gummies. Milk, yogurt, cereals, and some juices with added vitamin D are among the fortified foods. UVB ray exposure from the sun causes the skin to naturally produce vitamin D. However, because too much sun exposure can harm the skin and raise the risk of developing skin cancer, it should be moderated and balanced with sun protection measures [8].

Depending on a child's age, weight, feeding style, skin tone, location, season, and medical conditions, there are different indications for vitamin D supplementation. Some kids may require more vitamin D than others due to a higher risk of deficiency or a medical condition that interferes with their metabolism or uptake of the vitamin [9]. Children who are overweight, suffer from celiac disease, cystic fibrosis, chronic kidney disease, liver disease, or take anticonvulsant medications, for instance, may require higher doses of vitamin D [10]. To heal their bones, rickets patients may require extremely high doses of vitamin D. Higher vitamin D doses may be beneficial for children with type 1 diabetes to reduce their risk of developing the condition or to improve blood sugar control [11].

The American Academy of Pediatrics recommends that all children receive 400 IU of vitamin D per day from birth to adolescence.23 Because vitamin D deficiency in children has been reported to be between 10% and 65%, rickets is still being reported in the United States. Because breast milk contains little to no vitamin D, breastfed infants are at a higher risk of vitamin D deficiency [11]. Children who are vitamin D deficient should be given 50,000 IU per week or 2000 IU per day for 6 weeks to achieve serum 25(OH)D levels of 30 ng/mL [12]. The IOM advises adults to take 1500–2000 IU of vitamin D daily and children between the ages of 1 and 70 to take 600 IU daily. These suggestions are supported by professional judgment and scientific studies that examined biomarkers for vitamin D status. They are also founded on the practice of using 400 IU of vitamin D to both prevent and treat rickets [13].

Children who receive vitamin D supplements may benefit from decreased rates of type 1 diabetes, improved bone health and growth, decreased risk of respiratory infections, and prevention and treatment of rickets [11].

Additional research is required to confirm the protective effects of vitamin D against certain cancers, autoimmune disorders, and cardiovascular diseases [14].

Although unlikely, vitamin D supplementation in children can have toxicities and side effects. Constipation, diarrhea, vomiting, nausea, and gastrointestinal discomfort are the most typical side effects. The most dangerous toxicity is vitamin D overdose or hypervitaminosis D, which can result in soft tissue calcification, kidney damage, kidney stones, or high blood calcium levels (hypercalcemia). Loss of appetite, thirst, frequent urination, weakness, confusion, headaches, or muscle pain are all signs of vitamin D overdose. When taking very high doses of vitamin D for an extended period of time or when taking specific medications that interact with vitamin D, the risk of vitamin D overdose is higher [15].

5. CONCLUSION

Vitamin D deficiency is a widespread and serious problem that affects many children, especially those who have chronic illnesses, who are malnourished, who live in areas with limited sunlight exposure, and who are taking long-term medications. Vitamin D is essential for the health

and development of bones and muscles, as well as for the functioning of the immune system and the prevention of inflammation. Children have a higher demand for vitamin D than adults because their bones are growing rapidly. Therefore, maintaining adequate vitamin D levels is crucial for their well-being. To prevent or treat vitamin D deficiency in children, it is recommended that they follow the guidelines from the American Academy of Pediatrics (AAP) and the Institute of Medicine (IOM) for vitamin D supplementation, taking into account their individual factors and needs. Moreover, pediatricians and family physicians should educate parents about the benefits and sources of vitamin D and monitor their children's vitamin D status regularly.

CONSENT

As per international standard or university standard, Parental written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The audit followed ethical principles and obtained approval from the hospital's ethical committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Tan ML, Abrams SA, Osborn DA. Vitamin D supplementation for term breastfed infants to prevent vitamin D deficiency and improve bone health.The Cochrane Database of Systematic Reviews. 2020; 2(12):CD013046.
   Available:https://doi.org/10.1002/14651858.CD013046.pub2
2. Chang SW, Lee HC. Vitamin D and health -The missing vitamin in humans. Pediatrics and Neonatology. 2019;60(3): 237–244.
   Available:https://doi.org/10.1016/j.pedneo.2019.04.007
3. Day RE, Krishnarao R, Sahota P, Christian MS. We still don't know that our children need vitamin D daily: a study of parents' understanding of vitamin D requirements in children aged 0-2 years. BMC Public Health. 2019;19(1):1119.
   Available: https://doi.org/10.1186/s12889-019-7340-x
4. Thomas L, Patel B P020 Vitamin supplementation survey: an audit of the usage of vitamin D supplementation in paediatric patients, pregnant women and breastfeeding mothers Archives of Disease in Childhood. 2019;104:e2.
5. Santi M, Janner M, Simonetti GD, Lava SAG. (Prescription of vitamin D among Swiss pediatricians. European journal of Pediatrics. 2019;178(7):1119–1123.
   Available: https://doi.org/10.1007/s00431-019-03400-0
6. Holick MF. Vitamin D deficiency. N Engl J Med. 2007;357(3):266-281.
   DOI:10.1056/NEJMra070553
7. Olick MF, Binkley NC Bischoff-Ferrari HA, et al. Endocrine Society. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab. 2011;96(7):1911-1930.
   DOI:10.1210/jc.2011-0385
8. Raymond-Lezman JR, Riskin SI. Benefits and Risks of Sun Exposure to Maintain Adequate Vitamin D Levels. Cureus. 2023; 15(5):e38578.
   Available:https://doi.org/10.7759/cureus.38578
9. Gordon CM, Feldman HA, Sinclair L, Williams AL, Kleinman PK, Perez-Rossello J, Cox JE. Prevalence of vitamin D deficiency among healthy infants and toddlers. Archives of Pediatrics & Adolescent Medicine. 2008;162(6): 505–512.
   Available:https://doi.org/10.1001/archpedi.162.6.505
10. Lee JY, So TY, Thackray J. A review on vitamin d deficiency treatment in pediatric patients. The journal of pediatric pharmacology and therapeutics : JPPT : the Official Journal of PPAG. 2013; 18(4):277–291.
    Available: https://doi.org/10.5863/1551-6776-18.4.277
11. Casey CF, Slawson DC, Neal LR. VItamin D supplementation in infants, children, and adolescents. American Family Physician. 2010;81(6):745–748.
12. Chung M, Lee J, Terasawa T, Lau J, Trikalinos TA. Vitamin D with or without calcium supplementation for prevention of cancer and fractures: an updated meta-analysis for the U.S. Preventive Services Task Force. Ann Intern Med. 2011; 155(12):827-838.

DOI:10.7326 /0003-4819-155-12-201112200-00005

13. Ogan D, Pritchett K. Vitamin D and the athlete: risks, recommendations, and benefits. Nutrients. 2013;5(6):1856–1868. Available:https://doi.org/10.3390/nu5061856
14. Yang CY, Leung PS, Adamopoulos IE, Gershwin ME. The implication of vitamin D and autoimmunity: a comprehensive review. Clinical Reviews in Allergy & Immunology. 2013;45(2): 217–226. Available: https://doi.org/10.1007/s12016-013-8361-3
15. Vogiatzi MG, Jacobson-Dickman E, DeBoer MD. Drugs and Therapeutics Committee of The Pediatric Endocrine Society. Vitamin D supplementation and risk of toxicity in pediatrics: A review of current literature. The Journal of Clinical Endocrinology and Metabolism. 2014; 99(4):1132–1141. Available: https://doi.org/10.1210/jc.2013-3655

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