



RESEARCH ARTICLE

Evaluation of vitamin D supplementation intake among children; cross-sectional observational study [version 1; peer review: 2 approved with reservations]

Niloufar Sharafi ¹, Aiman Fatima ¹, Syed Wasif Gillani ¹, Nour Kaddour ¹, Rawa Banoori¹, Riham Mohamed Elshafie^{2,3}, Hassaan Anwer Rathore⁴

¹College of Pharmacy,, Gulf Medical University,, Ajman, United Arab Emirates

²Clinical and Hospital Pharmacy Department, College of Pharmacy, Taibah University, Al Madinah Al Munawwarah, Saudi Arabia

³Clinical Pharmacy Department, ASUSH,, Ain Shams University, Cairo, Egypt

⁴College of Pharmacy, QU Health, ,, Qatar University, Doha,, 2713,, Qatar

V1 **First published:** 08 Dec 2022, 11:1456
<https://doi.org/10.12688/f1000research.123373.1>
Latest published: 13 Mar 2023, 11:1456
<https://doi.org/10.12688/f1000research.123373.2>

Abstract

Background: The purpose of this study was to review the vitamin D supplementation intake status among children in the general public, determine the vitamin D supplements practices, and the barriers that parents and children face with supplementation.

Methods: A cross-sectional observational questionnaire-based survey study design was used. A convenience sampling technique was used to collect the data. An online Rao soft sample size calculator was applied to determine the sample size of 319. The response rate of participants was expected to be 63%, the margin of error was 5% and the level of confidence was 95%.

Results: A total of 248 parents (89.1% mothers (n =203)) and 15.7% fathers (n=39) with a mean \pm SD age of 35.4 ± 7.04 years, completed the study (77.7% response rate). Parents reported that the supplements used the most by children were vitamin D supplements (21.85%) and multivitamins (21.8%) followed by calcium supplements (5.6%). However, 27.8% of children in this study did not take any supplements. Of all the parents, 65% (162) of them reported sending their child outside to play while 34.67% (86) of parents had reported no outdoor activity. Approximately 184 (74.2%) parents reported the child's diet to contain multiple natural sources of vitamin D. However, 69 (27.8%) parents reported giving none of the natural sources of vitamin D to their children through the diet. Parents with higher education about 62.9% (n=156) had a higher frequency of providing vitamin D supplements to their children. Children in high-income families (43.63%) were more likely to take vitamin D supplements than those in middle- or low-income families.

Open Peer Review

Approval Status  

	1	2
version 2		
(revision)		
13 Mar 2023		
version 1		
08 Dec 2022		

1. **Tauqeer Hussain Mallhi** , Jouf University, Al-Jouf, Saudi Arabia

2. **Muhammad Umair Khan**, Aston University, Birmingham, UK

Any reports and responses or comments on the article can be found at the end of the article.

Conclusion: The study concluded that challenges like the educational and financial background of parents, family-income level, and health insurance status could help aid in addressing the overall burden of vitamin D deficiency among young children.

Keywords

Vitamin D, deficiency, frequency, supplementation, dietary sources, sunlight exposure, challenges

Corresponding author: Syed Wasif Gillani (dr.syedwasif@gmu.ac.ae)

Author roles: **Sharafi N:** Data Curation, Investigation, Methodology, Writing – Original Draft Preparation; **Fatima A:** Conceptualization, Methodology, Software, Writing – Original Draft Preparation; **Gillani SW:** Conceptualization, Data Curation, Methodology, Supervision, Validation, Writing – Review & Editing; **Kaddour N:** Formal Analysis, Investigation, Writing – Original Draft Preparation; **Banoori R:** Investigation, Project Administration, Resources; **Elshafie RM:** Data Curation, Validation, Writing – Review & Editing; **Rathore HA:** Software, Validation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: The author(s) declared that no grants were involved in supporting this work.

Copyright: © 2022 Sharafi N *et al.* This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Sharafi N, Fatima A, Gillani SW *et al.* **Evaluation of vitamin D supplementation intake among children; cross-sectional observational study [version 1; peer review: 2 approved with reservations]** F1000Research 2022, 11:1456 <https://doi.org/10.12688/f1000research.123373.1>

First published: 08 Dec 2022, 11:1456 <https://doi.org/10.12688/f1000research.123373.1>

Introduction

Vitamin D is known among the critical minerals to play an important role in maintaining normal body functions.¹ It allows bone mineralization and avoids hypocalcemic tetany (such as involuntary muscle contraction, cramps, spasms, etc).² It is also known for aiding osteoblasts and osteoclasts in developing and remodeling the bone preventing it from being brittle.³ Other functions of vitamin D in the body include inflammation reduction and regulation of cell growth, neuromuscular and immune function, and glucose metabolism.⁴ Vitamin D also affects the expression of several genes that code for proteins that govern cell proliferation, differentiation, and apoptosis. Vitamin D receptors can be found in many tissues, and some of them transform 25(OH) D to 1,25 (OH) D.⁵

Maintaining optimum levels of calcium and vitamin D during childhood and adolescence is critical for bone growth.⁶ Vitamin D is said to lower the risk of cancer, prevent viral infections, alleviate musculoskeletal pain, and calm mood disorders including depression, according to some claims. There has also been a surge in scientific interest in studying vitamin D at both the basic and clinical levels to address these and other claims.⁷ Children with vitamin D deficiency develop a disease known as rickets, which is characterized by a frame and fragile bone, making the legs appear bent.⁸ Vitamin D has been shown to reduce the risk of premature birth in pregnant women.⁹

A child's vitamin D deficiency can start as early as birth, which can damage not just their bone metabolism but also their immunological system, making them more susceptible to illnesses early in life.¹⁰ For the treatment of vitamin D deficiency rickets, the American Academy of Pediatrics (AAP) recommends an initial two- to three-month regimen of "high-dose" vitamin D therapy of 1000 units daily in neonates, 1000 to 5000 units daily in infants one to 12 months old, and 5000 units daily in patients over 12 months old.¹¹

Epidemiologic studies, at least in adults, apart from the risk of osteomalacia and osteoporosis, have associated hypovitaminosis D with an increased risk of several cancers, autoimmune diseases (type 1 diabetes, multiple sclerosis, rheumatoid arthritis, and Crohn's disease), heart disease, hypertension, metabolic syndrome, asthma, upper respiratory tract infections, muscle weakness, and falling.¹² The pleiotropic action of vitamin D was already revealed on molecular, cellular, tissue, and organ levels.¹³ These observations modified the current knowledge about vitamin D metabolism and methods of diagnosis of vitamin D deficiency states.¹⁴

Unfortunately, vitamin D is found rare in food.¹⁵ Vitamin D is found in only a few foods. Fish liver oils and the meat of fatty fish (such as trout, salmon, tuna, and mackerel) are among the greatest sources. The amount of vitamin D in a human's tissue is influenced by its food. Vitamin D is also found in modest levels in beef liver, egg yolks, and cheese, mostly in the form of vitamin D3 and its metabolite 25(OH)D3.¹⁶ Vitamin D2 is found in varying levels in mushrooms. Some commercially available mushrooms have been exposed to UV radiation to boost their vitamin D2 levels. In addition, the FDA has approved UV-treated mushroom powder as a food additive for use as a vitamin D2 source in food items.¹⁷

Furthermore, vitamin D is added to milk, many ready-to-eat bowls of cereal, and some yogurt and orange juice brands. It is found in modest concentrations in cheese and some margarine.¹⁸

In the U.A.E., the consistent predominant hot weather, inadequate exposure to sunlight, and low nutritional intake of vitamin D result in low serum concentrations of circulating 25(OH) D, a condition known as hypovitaminosis D.¹⁹ Furthermore, recent lifestyles involving using cars for transport over walking, and children indulging in electronics and staying indoors have also influenced low vitamin levels. Low dietary intake of vitamin D and calcium, and other factors, including obesity and low social status, are all associated with low serum levels of vitamin D.²⁰⁻²²

Further research is needed to be conducted on the production of high-potency–food-based vitamin D supplements, the move to mandatory fortification of cereal grain staples, and the development of natural food sources with higher vitamin D content are all potentially safe and efficient pathways for overcoming the barriers to optimal vitamin D status. Although various studies suggest a high prevalence of vitamin D deficiency among adults and children, no randomized controlled trials have been fully performed on vitamin D deficiency and supplementation among children in the UAE. When compared to the expense of providing therapies for many chronic diseases closely linked to vitamin D deficiency, taking vitamin D supplements is a much better alternative.

The purpose of this study was to review the vitamin D supplementation intake status among children in the general public, to evaluate the vitamin D supplements practices, the natural sources of vitamin D from their diet, and the barriers that parents and children face with supplementation.

Methods

Study design and setting

A cross-sectional observational questionnaire-based survey study design was used in this study. The survey was conducted in public places in the U.A.E. The data was collected over seven months from October 2021 to April 2022.

Research tool

The questionnaire was adapted from the literature and evaluated for content validation.

Part one of the questionnaire consists of demographic information (e.g. age, nationality, gender, etc.)

The second part collected information about supplementation intake and natural sources of vitamin D intake (e.g. if the child has milk, yogurt, etc. in his diet).

The last part consists of the outdoor activity level of the child (e.g. hours the child spends playing outdoors).

All the parts of the data were collected based on yes or no or multiple response questions.²³

Variables

Vitamin D deficiency, education level of parents, outdoor activity hours of children, health insurance status of parents, income level of the families.

Primary outcome

- The primary outcome of this study was to observe the vitamin D supplementation intake status.
- The possible reasons for vitamin D deficiency among children.

Parents may have difficulties in supplementing their children's diets due to their financial level, health insurance status, and level of literacy.

Participants and sampling method

A convenient sampling technique was used to collect data from approximately 248 participants from public places in Ajman, U.A.E. An online Rao soft sample size calculator was applied to determine the sample size, which was 319. The response rate of parents was expected to be 63%, the margin of error was 5% and the level of confidence was 95%.²⁴ Around 319 participants were expected and 248 responded and actively participated in the study, 77.7% was the response rate of the study participants.

Missing data

This study has no missing data.

Inclusion criteria

Participants who had at least one child between 4-15 years of age and who agreed to participate.

Exclusion criteria

Children with minor illnesses that are common in the general population and those suspected clinically of having rickets. Children with cognitive and behavioral disorders were excluded from the study.

Ethical issues

Ethics approvals have been obtained for the study. This is the ethics approval number IRB/COP/STD/74/Oct-2021 from GMU.

Consent form

The questionnaire content was described before giving it to the parents and the written consent form was taken from each participant. The consent form was as follows:

“Your participation in this survey is voluntary. You may choose not to participate. If you decide to participate in this survey, you may withdraw at any time. If you decide not to participate in this study, or if you withdraw from participating at any time you will not be penalized. Filling out this form means that you accept to participate in this research.”

Statistical analysis

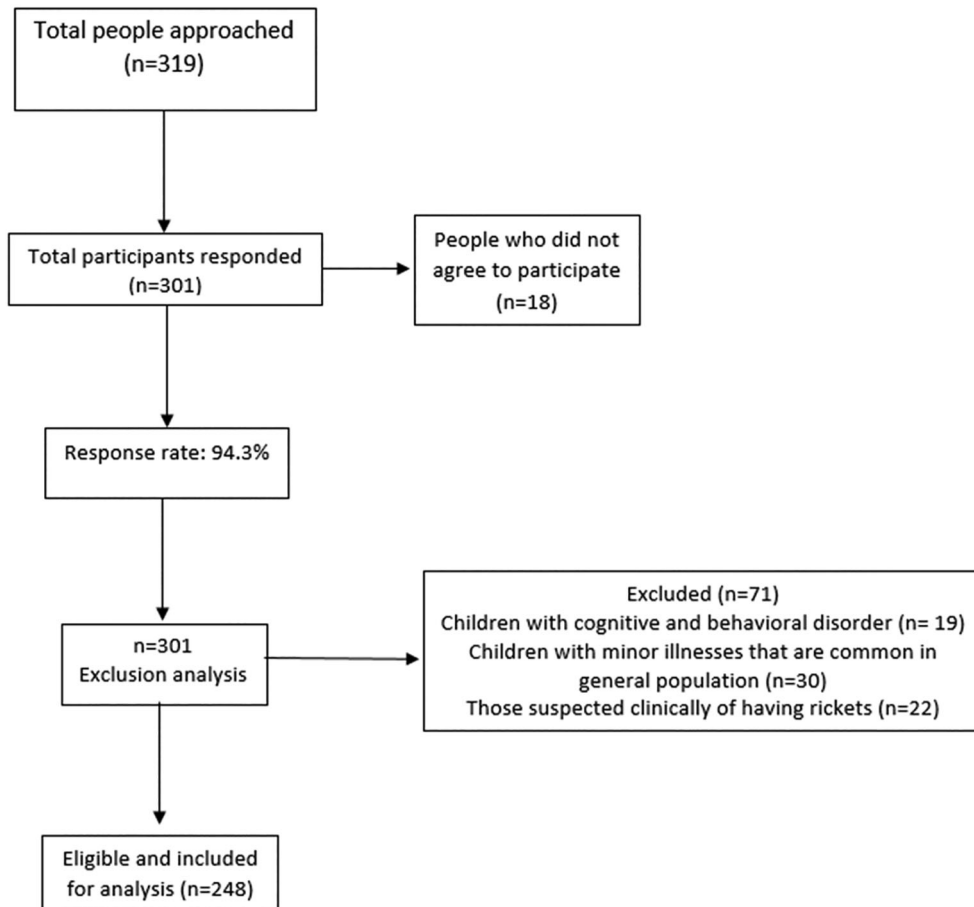
The data analysis was done using the SPSS statistical package for social sciences software. A Chi-square analysis was done. Mean, standard deviation, and mean comparison was utilized for continuous data. Both a tabular and graphic version of the data was used to show it. A 5% degree of confidence and a 0.5 margin of error were chosen.

Bias

There is no bias in any trend in the collection, analysis, interpretation, or review of the data that can lead to conclusions that are different from the truth.

Results

The study reported no missing data. A total of 248 parents (89.1% mothers (n=203)) and 15.7% fathers (n=39) with a mean±SD age of 35.4±7.042 years, completed the study. About 62.9% (n=156) parent were holding a university degree, while 26.2% (n=65) of the participants completed a secondary school, 9.7% (n=24) completed primary school and 1.2% (n=3) of parent were uneducated. Moreover, almost 61.7% (n=153) of mothers were unemployed, while a smaller number of mothers 27% (n=67), and 11.3% (n=28) were employed and employed with medical background. For fathers the 70.2% (n=174) were employed and 21% (n=52), 4.8% (n=12) and 4% (n=10) were self-employed, employed with a medical background and unemployed, respectively. Approximately 42.7% (n=106) participants had income level of more than 10,000, while 35.5% (n=88), 10.1 (n=25) and 4.8 (n=12) had income level of 5,000-10,000, 2,000-5,000 and less than 2,000, respectively. More than half of the participants has insurance and only a few participants 28.6% (n=71) had no insurance (Table 1).



Study flow diagram.

Table 1. Sociodemographic parameters of the study participants.

Characteristics	N(%)
Gender	
Mother	203(81.9)
Father	39(15.7)
Others*	6(2.4)
Age (mean±S.D.)	35.4±7.042
Education Level	
Not educated	3(1.2)
Primary School	24(9.7)
Secondary School	65(26.2)
University	156(62.9)
Father Employment	
Employed	174(70.2)
Unemployed	10(4.0)
Self-employed	52(21)
Employed with Medical Background	12(4.8)
Mother Employment	
Employed	67(27)
Unemployed	153(61.7)
Employed with Medical Background	28(11.3)
Income	
Level Less than 2,000	12(4.8)
2,000-5,000	25(10.1)
5,000-10,000	88(35.5)
More than 10,000	106(42.7)
Insurance	
Government	51(20.6)
Private	126(50.8)
None	71(28.6)

*Caregivers.

This research has participants from different countries (total=23). The majority (67%) of participants are from five countries (India, Iran, Pakistan, Syria, and Emirates). The completed data has been presented in [Figure 1](#).

A higher proportion of children received supplements whose parents were educated to the level of secondary school and above. [Table 2](#) shows the literacy level of parents and supplementation.

The data on outdoor activity levels included the average frequency of outdoor activity per day. Of all the parents, 65% (162) of them reported sending their child outside to play while 34.67% (86) had no outdoor activity. The mean hours of outdoor activity for the children were 2.046±1.61. It was found that on average, children spent 0.15-6 hours playing outside in the sun therefore exposed to sunlight ([Table 3](#)).

Parents reported that supplements used the most by children were Vitamin D supplements (21.85%) and multivitamins (21.8%) followed by calcium supplements (5.6%). However, 27.8% of children in this study did not take any supplements. While other parents reported mixed intake of supplements (for example some children took vitamin D plus calcium supplements while others took vitamin D and multivitamins ([Figure 2](#)).

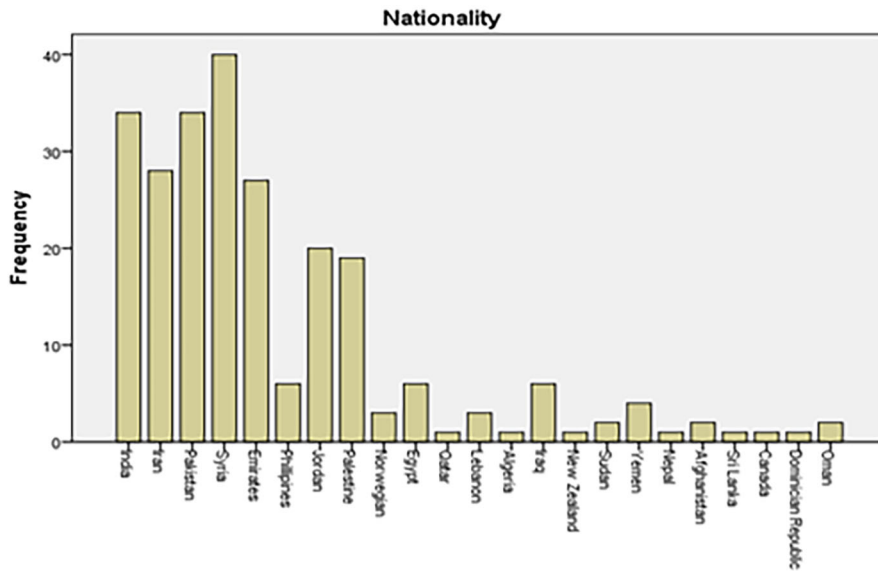


Figure 1. Nationality distribution of study participants.

Table 2. Literacy level of participants and supplementation practice.

		Supplements taken			
		Vitamin D	Calcium supplements	Multivitamins	Multiple sources
		N(%)	N(%)	N(%)	N(%)
Education level	Not educated	1(1.85)	1(7.14)	1(1.85)	0
	Primary school	5(9.25)	0	11(20.37)	3(5.35)
	Secondary school	15(27.77)	9(64.28)	10(18.51)	18(32.14)
	University	33(61.11)	4(28.57)	32(59.25)	35(62.5)

Table 3. Outdoor activity level of children.

Characteristics	N(%)
Activity	
Yes	162(65)
No	86(34.67)
Hours mean±S.D.	2.046±1.61
Min- Max (hours)	0.15-6 hours

Figure 3 summarizes and describes that out of the 248 participants, 184 (74.2%) parents reported their child’s diet to contain multiple natural sources of vitamin D (for example some children had milk plus cheese in their diet while others had yogurt plus cheese plus vitamin D fortified orange juice). However, 69 (27.8%) parents reported giving none of the natural sources of vitamin D to their children through the diet.

Children in high-income families (43.63%) were more likely to receive vitamin D supplements than those in middle- or low-income families (Table 4).

Parents with private health insurance 51.85% were more likely to give vitamin D supplements to their children compared to those with government health insurance 25.92% and no health care insurance 22.22% (Table 5).

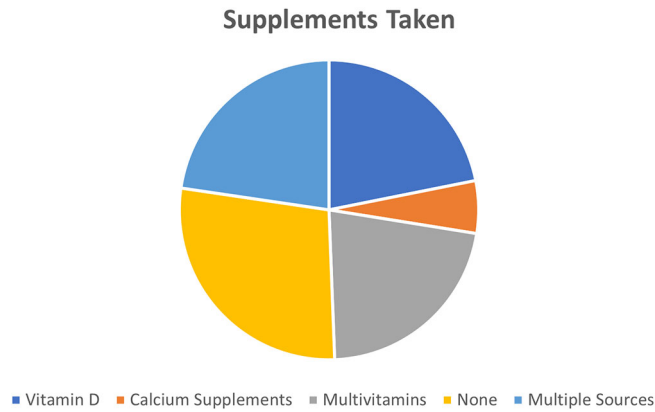


Figure 2. Supplementation intake among the study participants.

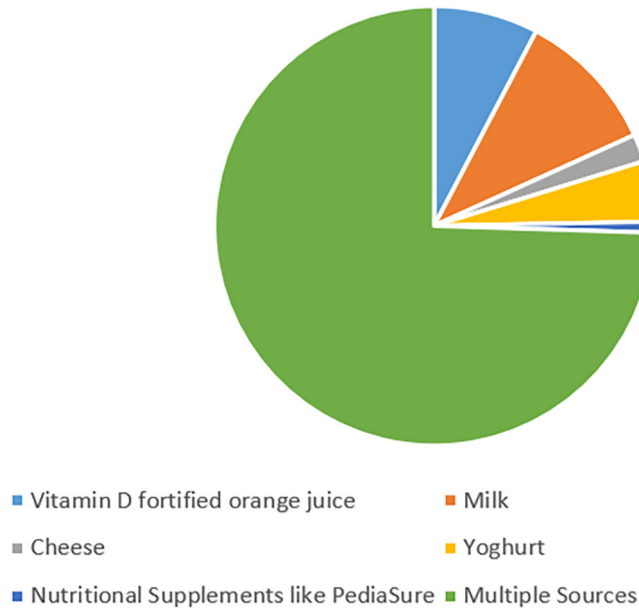


Figure 3. Children's intake of natural sources containing vitamin D.

Table 4. Participant's income level and supplementation practices.

		Supplements taken				
		Vitamin D	Calcium supplements	Multivitamins	Multiple sources	None
		N(%)	N(%)	N(%)	N(%)	N(%)
Income level	Less than 2,000	5(9.09)	0	6(11.11)	1(1.78)	2(2.89)
	2,000-5,000	8(14.54)	0	8(14.81)	6(10.71)	8(11.59)
	5,000-10,000	18(32.72)	7(50)	17(31.48)	21(37.5)	30(43.47)
	More than 10,000	24(43.63)	7(50)	23(42.59)	28(50)	29(42.02)

The study included participants from 23 various nationalities. The top five countries with the most participants were, India, Pakistan, Syria, and the U.A.E. Out of 34 participants from India, only 11 (32.35%) reported the use of vitamin D supplementation by their children, four (11.76%) reported using calcium supplements, six (17.64%) reported using multivitamins and the other 6 of them (17.64%) reported giving multiple sources of vitamins to their children.

Table 5. Health insurance status of study participants and vitamin D supplementation intake.

		Supplements taken			
		Vitamin D	Calcium supplements	Multivitamins	Multiple sources
		N(%)	N(%)	N(%)	N(%)
Insurance	Governmental	14(25.92)	0	14(25.92)	5(8.92)
	Private	28(51.85)	14(100)	20(37.03)	38(67.85)
	No insurance	12(22.22)	0	20(37.03)	13(23.21)

Table 6. Nationality of study participants [top 5=163 (67%)] and vitamin supplements.

	Supplements taken				
	Vitamin D	Calcium supplements	Multivitamins	Multiple sources	None
	N(%)	N(%)	N(%)	N(%)	N(%)
India (N=34)	11(32.35)	4(11.76)	6(17.64)	6(17.64)	7(20.58)
Iran (N=28)	6(21.42)	3(10.71)	10(35.71)	1(3.57)	8(28.57)
Pakistan (N=34)	4(11.76)	3(8.82)	1(2.94)	12(34.29)	14(41.17)
Syria (N=40)	12(30.76)	1(2.56)	9(23.07)	10(25.64)	7(17.94)
Emirates (N=27)	5(18.51)	2(7.4)	7(25.92)	11(40.74)	2(7.4)

However, out of the 34 participants from India, seven (20.58%) did not use any vitamin supplements at all. While out of 28 participants from Iran, only 6 participants, (21.41%) reported the use of vitamin D supplementation by their children, three (10.71%) reported using calcium supplements, ten (35.71%) reported using multivitamins and the other eight of them (28.57%) reported giving multi-sources of vitamins to their children. Among the 34 participants from Pakistan, the lowest amount of vitamin D supplements intake, only four (11.76%) participants reported giving supplements to their children and three (8.82%) reported using calcium supplements, only one (2.94%) parent reported using multivitamins and the other 12 of them (34.29%) reported giving multi-sources of vitamins to their children. Out of 27 participants from Emirates, few participants which are five (18.51%) of them reported the use of vitamin D supplementation by their children, two (7.4%) reported using calcium supplements, seven (25.94%) reported using multivitamins and the rest 11 (40.74%) reported giving multi-sources of vitamins to their children. The participants from Syria reported the highest vitamin D intake among the countries, out of 40 participants from India, only 12 (30.76%) reported the use of vitamin D supplementation by their children, one (2.56%) reported using calcium supplements, nine (23.07%) reported using multivitamins and the other 10 (25.64%) reported giving multiple sources of vitamins to their children [Table 6](#).

Discussion

This cross-sectional study demonstrates that inadequacy of vitamin D remains a risk in the U.A.E due to its geographical location being at the equator leading to the hot harsh climate throughout the year limiting the children's exposure to sunlight. Depending on the effectiveness of UVB photons to promote vitamin D production, the amount of sun exposure necessary for the creation of ultraviolet B-induced vitamin D in the skin impacts cutaneous synthesis.²⁵ This study also identifies the association between socioeconomic and demographic barriers with vitamin D supplementation among children. Children in high-income families (43.63%) were more likely to take vitamin D supplements than those in middle- or low-income families.

Parents with private health insurance (51.85%) were more likely to provide vitamin D supplements to their children compared to those with government health insurance (25.92%) and no health insurance (22.22%).

Furthermore, it was found in this study that parents' education and literacy level largely determines children receiving vitamin D supplementation. Parents in this study with a lower literacy rate who did not complete primary school were less likely to give vitamin D supplements to their children. However, evidence of gender differentials in vitamin D supplementation was not found in this study.

In U.A.E., since there is no law requiring the fortification of vital foods with vitamin D, there are few vitamin D-fortified products on the market.²⁶ Among the participants of the study, 184 (74.2%) reported the child's diet to contain multiple natural sources of vitamin D (for example some children had milk plus cheese in their diet while others had yogurt plus cheese plus vitamin D fortified orange juice) and most parents reported that their child has milk in their diet. Moreover, 69 parents (27.8%) reported giving none of the natural sources of vitamin D to their children through the diet. As a result, individual vitamin D dietary intake is strongly influenced by dietary preferences as well as the country's fortification plan. Without supplementation, however, vitamin D status is heavily on endogenous vitamin D synthesis, which is influenced by genetic determinants and lifestyle.²⁷

Vitamin D aids calcium absorption in the intestine by facilitating active calcium transport across the mucosa. Vitamin D insufficiency is usually caused by a lack of calcium in the diet and leads to bone deterioration or osteoporosis.²⁸ The results of this study are generalizable since it has been done on general population and multiple ethnicities in the U.A.E, it reflects that this study is generalizable to different parts of the world.

Limitations of the study

However, this study had potential limitations. From a methodological point of view, the weakness of the study is that it is based on a cross-sectional design. The inherent problem of a cross-sectional design is that the outcome (vitamin D supplementation status) and the exposure (in this case, socioeconomic characteristics and a State's social and economic development status) are collected simultaneously, thereby preventing conclusions regarding causality. The data was mostly collected from mothers. The present literature lacks data on the vitamin D level of children, thus a comparison between outdoor level activity of the children and the vitamin D level of children was presented in this study.

Conclusion

The findings of the study concluded that the educational and financial background of parents and health insurance status could aid in addressing the challenges parents face with providing vitamin D supplements to their children as well as nutritional assessment for early natural supplement treatment.

Data availability

Figshare. Parents reported Vitamin D Supplementation among Children (Responses). DOI: <https://doi.org/10.6084/m9.figshare.20207165.v1>.²⁹

This project contains the following data:

- The purpose of this study was to review the vitamin D supplementation intake status among children in the general public, determine the vitamin D supplements practices, and the barriers that parents and children face with supplementation.

References

1. DeLuca HF: **The metabolism and functions of vitamin D. Steroid Hormone Resistance.** 1986; pp. 361–375.
[Publisher Full Text](#)
2. Bikle DD: **Vitamin D and bone.** *Curr. Osteoporos. Rep.* 2012 Jun; **10**(2): 151–159.
[PubMed Abstract](#) | [Publisher Full Text](#)
3. Feng X, McDonald JM: **Disorders of bone remodeling.** *Annual Review of Pathology: Mechanisms of Disease.* 2011 Feb 28; **6**: 121–145.
[PubMed Abstract](#) | [Publisher Full Text](#)
4. Fleet JC, DeSmet M, Johnson R, et al.: **Vitamin D, and cancer: a review of molecular mechanisms.** *Biochem. J.* 2012 Jan 1; **441**(1): 61–76.
[Publisher Full Text](#)
5. Bikle DD: **Vitamin D: production, metabolism, and mechanisms of action.** *Endotext.* 2021 Dec 31.
6. Cashman KD: **Vitamin D in childhood and adolescence.** *Postgrad. Med. J.* 2007 Apr 1; **83**(978): 230–235.
[PubMed Abstract](#) | [Publisher Full Text](#)
7. Weydert JA: **Vitamin D in children's health.** *Children.* 2014 Sep; **1**(2): 208–226.
[PubMed Abstract](#) | [Publisher Full Text](#)
8. Sahay M, Sahay R: **Rickets–vitamin D deficiency and dependency.** *Indian J. Endocrinol. Metab.* 2012 Mar; **16**(2): 164–176.
[PubMed Abstract](#) | [Publisher Full Text](#)
9. Kassai MS, Cafeo FR, Affonso-Kaufman FA, et al.: **Vitamin D plasma concentrations in pregnant women and their preterm newborns.** *BMC Pregnancy Childbirth.* 2018 Dec; **18**(1): 1–8.
10. Battersby AJ, Kampmann B, Burl S: **Vitamin D in early childhood and the effect on immunity to Mycobacterium tuberculosis.** *Clin. Dev. Immunol.* 2012 Jan 1; **2012**.
11. Lee JY, So TY, Thackray J: **A review on vitamin d deficiency treatment in pediatric patients.** *J. Pediatr. Pharmacol. Ther.* 2013 Oct; **18**(4): 277–291.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
12. Gröber U, Spitz J, Reichrath J, et al.: **Vitamin D: update 2013: from rickets prophylaxis to general preventive healthcare.** *Dermato-endocrinology.* 2013 Jun 1; **5**(3): 331–347.
[PubMed Abstract](#) | [Publisher Full Text](#)
13. Lai YH, Fang TC: **The pleiotropic effect of vitamin D.** *International Scholarly Research Notices.* 2013; **2013**.
14. Dominguez LJ, Farruggia M, Veronese N, et al.: **Vitamin D sources, metabolism, and deficiency: available compounds and**

- guidelines for its treatment.** *Metabolites*. 2021 Apr; **11**(4): 255.
[PubMed Abstract](#) | [Publisher Full Text](#)
15. AlFaris NA, AlKehayez NM, AlMushawah FI, *et al.*: **Vitamin D deficiency and associated risk factors in women from Riyadh, Saudi Arabia.** *Sci. Rep.* 2019 Dec 30; **9**(1): 1–8.
 16. Roseland JM, Phillips KM, Patterson KY, *et al.*: Feldman D, Pike JW, Bouillon R, *et al.*, editors. *Vitamin D in foods: An evolution of knowledge*. 41–78.
 17. Food US, Administration D: **Food additives permitted for direct addition to food for human consumption; vitamin D2 mushroom powder.** *Fed. Regist.* 2020; **85**: 41916–41920.
 18. U.S. Food and Drug Administration: January 4, 2018.
[Reference Source](#)
 19. Muhairi SJ, Mehairi AE, Khouri AA, *et al.*: **Vitamin D deficiency among healthy adolescents in al ain, united Arab emirates.** *BMC Public Health*. 2013 Dec; **13**(1): 1–7.
[Publisher Full Text](#)
 20. Al-Othman A, Al-Musharaf S, Al-Daghri NM, *et al.*: **Effect of physical activity and sun exposure on vitamin D status of Saudi children and adolescents.** *BMC Pediatr.* 2012 Dec [cited 2021 Mar 11]; **12**(1): 589.
[PubMed Abstract](#) | [Publisher Full Text](#)
 21. Hirani V, Mosdøl A, Mishra G: **Predictors of 25-hydroxyvitamin D status among adults in two British national surveys.** *Br. J. Nutr.* 2008 Jul 17 [cited 2021 Mar 11]; **101**(5): 760–764.
[PubMed Abstract](#) | [Reference Source](#)
 22. Giovannucci E, Liu Y, Rimm EB, *et al.*: **Prospective Study of Predictors of Vitamin D Status and Cancer Incidence and Mortality in Men.** *JNCI J. Natl. Cancer Inst.* 2006 Apr 5 [cited 2021 Mar 11]; **98**(7): 451–459.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Reference Source](#)
 23. Nucci AM, Russell CS, Luo R, *et al.*: **The effectiveness of a short food frequency questionnaire in determining vitamin D intake in children.** *Dermato-endocrinology*. 2013 Jan 1; **5**(1): 205–210.
[PubMed Abstract](#) | [Publisher Full Text](#)
 24. [Reference Source](#)
 25. Kull M Jr, Kallikorm R, Tamm A, *et al.*: **Seasonal variance of 25-(OH) vitamin D in the general population of Estonia, a Northern European country.** *BMC Public Health*. 2009; **9**: 22.
[PubMed Abstract](#) | [Publisher Full Text](#)
 26. Hwalla N, Al Dhaheri AS, Radwan H, *et al.*: **The prevalence of micronutrient deficiencies and inadequacies in the Middle East and approaches to interventions.** *Nutrients*. 2017; **9**: 229.
 27. Wang TJ, Zhang F, Richards JB, *et al.*: **Common genetic determinants of vitamin D insufficiency: a genome-wide association study.** *Lancet*. 2010; **376**: 180–188.
[PubMed Abstract](#) | [Publisher Full Text](#)
 28. Heaney RP: **Vitamin D and calcium interactions: functional outcomes.** *Am. J. Clin. Nutr.* 2008; **88**: 541S–544S.
[PubMed Abstract](#) | [Publisher Full Text](#)
 29. Sharafi N, Fatima A, Gillani SW, *et al.*: **Parents reported Vitamin D Supplementation among Children (Responses).** figshare. Dataset. 2022.
[Publisher Full Text](#)

Open Peer Review

Current Peer Review Status: ? ?

Version 1

Reviewer Report 19 December 2022

<https://doi.org/10.5256/f1000research.135473.r157815>

© 2022 Khan M. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



Muhammad Umair Khan

Aston Pharmacy School, College of Health and Life Sciences, Aston University, Birmingham, UK

This study explores an important subject on vitamin D supplementation among children in the United Arab Emirates. However, the manuscript needs significant revision before it can be published. I have raised some questions/comments in each section which authors may consider in preparing their revisions.

Abstract

- Background
 - I suggest using 'investigate' or 'assess' rather than review.
 - Authors can avoid 'general public'. 'among children' is just fine.
- Methods
 - Consider adding information like: who were the participants? Where was the study conducted? Any statistics used?
- Results
 - As per the information provided, 89.1% were mothers and 15.7% were fathers. It gives a total of 104.8%. Please check these numbers again.
- Conclusion
 - Please reconsider the conclusion. It is not clear what the authors are trying to suggest.

Introduction

- 1st paragraph – last sentence – for the ease of readers, please explain what happens when 25(OH) D transforms to 1,25 (OH) D.
- 3rd paragraph – last sentence - 5000 units daily in patients over 12 months old – is there any upper age limit and it applies to all including adults?
- 4th paragraph - What about epidemiological studies in children? Are there any? What do

they say? In my opinion, it is important to answer these questions as the population of interest in this is children.

- 7th paragraph – first sentence – in children, adults, or general population?
- 8th paragraph – first sentence – too long to comprehend. Please rewrite to improve clarification.
- 8th paragraph – second sentence - What is the prevalence of vitamin D deficiency among adults and children globally and in the UAE?
- 8th paragraph – second sentence - Are authors trying to imply that RCTs are the most appropriate research designs to determine prevalence? Please reconsider and rewrite this sentence.
- 9th paragraph – I would suggest write a broader aim and then the objectives that this study tried to achieve.
- Also, the phrase ‘among children in the general public’ sounds a bit odd to me. I think ‘among children’ in just fine.

Methods

- Can authors provide some examples of the public places that were used?
- Can authors provide some references from where the questionnaire was adapted? Where were those studies conducted? Are there any cultural differences? How did the authors account for that?
- How many questions were there in total and in each section?
- Which section had yes/no and multiple response questions? Were there mixed question in each section?
- How did the authors evaluate the barriers to supplementation? The three sections do not tell anything about the barriers.
- How did the authors investigate the reasons for vitamin D deficiency? I am not sure it was mentioned earlier until this point.
- I am not sure what the authors are trying to tell through the primary outcomes. The first two points look like the objectives. The third point looks like a hypothesis, but I am not sure what that means.
- Around 319 participants were expected – Are the authors trying to imply that 319 participants were contacted?
- Response rate is excellent. How do the authors compare this with the similar other studies?

- Missing data – surprising!
- I suggest authors should mention earlier in the methods section that parents completed the survey.
- Whether the questionnaire was self-administered or interviewer-administered?
- Looking at the information presented in 'consent form', it appears that the questionnaire was self-administered. Did the parents completed the questionnaire right there and then? How did they return the questionnaire?
- Why the authors excluded children with minor illnesses as well as those with cognitive impairment? It was parents who completed the survey.
- A chi-square analysis was done to?
- Both a tabular and graphic version of the data was used to show it – generally we use one form of representation to avoid duplication.
- Bias – Given this is an observational study, how can the authors assure this?
- Authors did not mention about the language in which the questionnaire was designed and distributed to the participants.

Results

- 1st sentence – It was mentioned earlier. Avoid duplication.
- 2nd sentence – I think the brackets are not utilised appropriately.
- From what I understand, 203 mothers and 39 fathers participated in the study. It makes a total of 242 participants. What about other 6 participants?
- If 203 is the correct number, it is 81.8% of the total participants not 89.1%.
- As per the information provided, 89.1% were mothers and 15.7% were fathers. It gives a total of 104.8%. Please check these numbers again.
- I strongly suggest authors to review their calculations and rewrite the results section.
- The name of countries in Fig 1 was not readable.
- It was mentioned earlier that chi-square test was used but the results section did not mention chi-square values and any significance values.

Discussion

- The first 3 paragraphs of the discussion are simply results. I suggest authors to summarise the key results in the first paragraph to avoid duplication.

- I think the discussion section needs considerable revision. Currently, it seems like a results section. I suggest authors to focus more explaining the results in light of the broader literature on the topic.
- The results of this study are generalizable – this statement needs more clarification. Earlier authors discussed the climate issues in UAE which is a contributing factor. Is the climate same in different parts of the world? Europe/US/Australia/Africa? Is not, how will the authors support their statement on generalisability?

Conclusion

- I suggest authors to reconsider their conclusion. I am not sure what authors are trying to imply by saying that financial background of parents can aid in addressing the challenges of vitamin D supplementation.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Medicine optimisation, mental health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 23 Feb 2023

Syed Wasif Gillani

Comment 1:

Background

I suggest using 'investigate' or 'assess' rather than review.

Authors can avoid 'general public'. 'among children' is just fine

Response 1: We agree with this comment therefore we have changed the word 'review' to 'assess'.

We also agree to omit 'general public' and mention 'among children'.

Comment 2:

Methods

Consider adding information like: who were the participants? Where was the study conducted? Any statistics used?

Response 2: Thank you for this suggestion. We have added better information for the method section which is now clearer. We have clarified the survey was conducted in public places like malls, parks and hospitals in the U.A.E and the study participants were parents/caregivers of children from ages 4-to 15- years. The questionnaire was both self-administered and interviewer-administered. For parents/care givers who found it difficult to understand the questionnaire, the interviewer verbally inquired questions to the included participants individually from the questionnaire and filled the data on their behalves as they answered. The questionnaire was filled on a secure device with only the main investigators having access to it.

Comment 3:

Results

As per the information provided, 89.1% were mothers and 15.7% were fathers. It gives a total of 104.8%. Please check these numbers again.

Response 3: We agree with the reviewer's comment. We have recalculated our values and changed the numbers to the right ones.

Comment 4:

Conclusion

Please reconsider the conclusion. It is not clear what the authors are trying to suggest.

Response 4: As suggested by the reviewer we have rephrased the conclusion to clearer one in the manuscript.

Comment 5:

1 paragraph – last sentence – for the ease of readers, please explain what happens when 25(OH) D transforms to 1,25 (OH) D

Response 5: We agree to the reviewer's comment and we have added information for the reader to understand what happens when 25(OH) D transforms to 1,25 (OH) D

Comment 6

3 paragraph – last sentence - 5000 units daily in patients over 12 months old – is there any upper age limit and it applies to all including adults?

Response 6: We agree with this suggestion from the reviewer. Therefore, we have mentioned that for the treatment of vitamin D deficiency rickets, the AAP recommends an initial 2- to 3-month regimen of "high-dose" vitamin D therapy of 1000 units daily in neonates, 1000 to 5000 units daily in infants 1 to 12 months old, and 5000 units daily in patients over 12 months old.

Comment 7

4 paragraph - What about epidemiological studies in children? Are there any? What do they say? In my opinion, it is important to answer these questions as the population of interest in this is children.

Response 7: Thank you for this suggestion. We agree to add some information on epidemiological studies in children. Therefore, we have mentioned that it is estimated that the prevalence of deficiency is 62–95.7% in new-borns and breast-feeding groups (0–6 months), 46–80% in 6–60 months of age and 37.8–97.5% in 5–20-year-old children.

Comment 8

7 paragraph - 4rst sentence - in children, adults, or general population?

Response 8: We have now added 'general population' in the paragraph.

Comment 9

8 paragraph - 4rst sentence - too long to comprehend. Please rewrite to improve clari4cation.

Response 9: We thank the reviewer for his comment, we have paraphrased the sentence to a shorter and clearer one.

Comment 10

8 paragraph - second sentence - What is the prevalence of vitamin D de4ciency among adults and children globally and in the UAE?

Response 10: We have answered this comment from the reviewer in the 4th paragraph of our introduction.

Comment 11

9 paragraph - I would suggest write a broader aim and then the objectives that this study tried to achieve

Response: We thank the reviewer for his suggestion here. We have now mentioned our aim, the need of this study to be conducted, and the high prevalence of vitamin D deficiency in the above paragraphs in a better pattern.

Comment 12

Also, the phrase 'among children in the general public' sounds a bit odd to me. I think 'among children' in just one.

Response: We agree with the reviewer and have omitted the phrase 'in the general public'

Comment 13

Methods

Can authors provide some examples of the public places that were used?

Response: Yes, we have provided some examples of the public places that were used in our study.

Comment 14

Can authors provide some references from where the questionnaire was adapted? Where were those studies conducted? Are there any cultural differences? How did the authors account for that?

Response: Yes, we have provided the reference for the other study that we adapted the questionnaire from. We have also mentioned where the other study was conducted. However, our study has no association with the other study's results or population. We have only adapted some of the questions from that study's questionnaire.

Comment 15

How many questions were there in total and in each section?

Response: Thanking the reviewer for this keen observation. We have now mentioned the total number of questions in our questionnaire and the number of sections as well.

Comment 16

Which section had yes/no and multiple response questions? Were there mixed question in each section?

Response: Sections apart from the demographics, consisted of multiple responses and yes/no questions. Yes there were mixed sort of questions in some sections too.

Comment 17

How did the authors evaluate the barriers to supplementation? The three sections do not tell anything about the barriers.

Response: We thank the reviewer for his very thoughtful suggestion. It was important to mention about the barriers the parents face with providing VD supplementation to their children.

Comment 18

How did the authors investigate the reasons for vitamin D deficiency? I am not sure it was mentioned earlier until this point.

Response: Thank you for this suggestion. We have rephrased the sentence and mentioned how we investigated the reasons for VDD.

Comment 19

I am not sure what the authors are trying to tell through the primary outcomes. The 4rst two points look like the objectives. The third point looks like a hypothesis, but I am not sure what that means.

Response: Thank you for this comment, we have paraphrased the primary outcomes in the manuscript.

Comment 20

Around 319 participants were expected – Are the authors trying to imply that 319 participants were contacted?

Response: Thank you for this suggestion. We have rephrased the sentence to make better understanding for the reader on the number of study participants determined by Rao soft sample size calculator and the number of participants who responded and actively participated in our study.

Comment 21

Response rate is excellent. How do the authors compare this with the similar other studies?

Response: Thank you for this comment, association between the response rate and the

sample size is such that the response rate increases when the sample size less than 300 participants.

Comment 22

Missing data – surprising!

Response: We have rephrased this to A total of 248 participants were included and all 248 of them actively participated in our study. During analysis, we found no missing data from our participants.

Comment 23

• I suggest authors should mention earlier in the methods section that parents completed the survey.

Response: Thank you for suggesting, we have done this now.

Comment 24

• Whether the questionnaire was self-administered or interviewer-administered

Response: Mentioned now in the manuscript that it was interviewer administered. Thank you.

Comment 25

Looking at the information presented in 'consent form', it appears that the questionnaire was self-administered. Did the parents completed the questionnaire right there and then? How did they return the questionnaire?

Response: The questionnaire was both self-administered and interviewer-administered. The questionnaire content was described before letting the participants administer the data into it and the written consent form was taken from each participant prior to interviewing/ handing out the questionnaire.

Comment 26

Why the authors excluded children with minor illnesses as well as those with cognitive impairment? It was parents who completed the survey

Response: The data was filled by the parents/ care givers but it was about children.

Therefore, to avoid bias between the healthy children and ill children we excluded children with minor illnesses and those with cognitive impairment.

Comment 27

Both a tabular and graphic version of the data was used to show it – generally we use one form of representation to avoid duplication

Response: Thank you for this suggestion but we have not used both the tabular and graphic version for one same piece of data. The frequency of nationality bar graph is different than that of tabular form, where the nationality is associated with supplementation practice.

Comment 28

Bias – Given this is an observational study, how can the authors assure this

Response: Thank you for this suggestion. We have clarified our bias now.

Comment 28

Authors did not mention about the language in which the questionnaire was designed and distributed to the participants

Response: Thank you, we have now mentioned that the article was generated in both English and Arabic

Comment 29

Results 1 sentence – It was mentioned earlier. Avoid duplication.

Response: Thank you. Duplication undone.

Comment 30

2 sentence – I think the brackets are not utilised appropriately.

Response: Thank you for this comment, we have looked into it.

Comment 31

From what I understand, 203 mothers and 39 fathers participated in the study. It makes a total of 242 participants. What about other 6 participants?

Response: Thank you for this correction. We have recalculated and put in the right figures.

Comment 32

• If 203 is the correct number, it is 81.8% of the total participants not 89.1%.

Response: The calculation and figures are now corrected. We have put the right percentage now. Thank you.

Comment 33

As per the information provided, 89.1% were mothers and 15.7% were fathers. It gives a total of 104.8%. Please check these numbers again

Response: Thank you. The correction for percentages of mothers and fathers in our study has now been corrected.

Comment 34

• I strongly suggest authors to review their calculations and rewrite the results section.

Response: Thank you for this suggestion, we appreciate your concern. We have reanalyzed our numbers and percentages and now have put in the right numbers. We have re-written our results.

Comment 35

The name of countries in Fig 1 was not readable

Response: Thank you, we have added a readable picture.

Comment 36

It was mentioned earlier that chi-square test was used but the results section did not mention chi-square values and any significance values.

Response: the result part has been revised accordingly

Comment 37

The first 3 paragraphs of the discussion are simply results. I suggest authors to summarise the key results in the first paragraph to avoid duplication.

Response: Thank you for your highly appreciated suggestion. We have summarized the discussion part to a concise and clear paragraph now.

Comment 38

• I think the discussion section needs considerable revision. Currently, it seems like a results section. I suggest authors to focus more explaining the results in light of the broader literature on the topic

Response: Yes, we agree with the reviewer's comment. Therefore, we have significantly made improvement in this particular section of our manuscript.

Comment 39

The results of this study are generalizable – this statement needs more clarification. Earlier authors discussed the climate issues in UAE which is a contributing factor. Is the climate same in different parts of the world? Europe/US/Australia/Africa? Is not, how will the authors support their statement on generalisability?

Response: Yes, we appreciate and agree with this comment. We have changed the phrase to- The results of this study are generalizable since it has been conducted on general population of children from multiple ethnicities in the U.A.E.

Comment 40

Conclusion

I suggest authors to reconsider their conclusion. I am not sure what authors are....

Response: Thank you so much for pointing out this suggestion to us. We have rephrased our conclusion to a very clear cut, understandable one now

Competing Interests: none

Reviewer Report 14 December 2022

<https://doi.org/10.5256/f1000research.135473.r157818>

© 2022 Mallhi T. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



Tauqeer Hussain Mallhi

Department of Clinical Pharmacy, College of Pharmacy, Jouf University, Al-Jouf, Saudi Arabia

Thank you for the invitation to review this study. The authors made a good effort to explore the use of vitamin D supplementation among children in UAE. I have a few comments on this manuscript.

1. The sample size estimation can be omitted from the abstract section.
2. Please provide a few references that aid in the development of data collection form.

3. Please provide information on the validation and reliability of the data collection form.
4. Please clarify that the data was collected through interviews or self-administration techniques.
5. The quality of figure 1 can be improved.
6. Convenient sampling is also the limitation of this study that precludes the generatability of the findings.
7. There is a need to provide some information on the barriers of vitamin d supplementation in children.
8. The manuscript will require some corrections in syntax at some places.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Pharmacy Practice, Clinical Pharmacy, Pharmacotherapy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 23 Feb 2023

Syed Wasif Gillani

Comment 1: The sample size estimation can be omitted from the abstract section.

Response 1: we agree with this comment therefore; we have accordingly omitted the

sample size estimation from abstract of the manuscript.

Comment 2: Please provide a few references that aid in the development of data collection form.

Response 2: Thank you for this suggestion. The references list is updated and the new references are incorporated in the list to emphasize this point.

Comment 3: Please provide information on the validation and reliability of the data collection form.

Response 3: Thank you for pointing this out. We have added the suggested content to the manuscript.

Comment 4: Please clarify that the data was collected through interviews or self-administration techniques.

Response 4: We agree with the reviewer's assessment. Accordingly, throughout the manuscript, we have clarified that the data was collected on a questionnaire which was filled by the investigators. The investigator verbally inquired questions to the included parents individually from the questionnaire and filled the data on their behalves as they answered

Comment 5: The quality of figure 1 can be improved.

Response 5: As suggested by the reviewer, we have updated figure 1 with improved quality in the results section of the manuscript.

Comment 6: Convenient sampling is also the limitation of this study that precludes the generatability of the findings.

Response 6: We agree that this is a potential limitation of the study. We have added this as a limitation in the discussion part of the manuscript.

Comment 7: There is a need to provide some information on the barriers of vitamin d supplementation in children.

Response 7: We agree with this and have incorporated your suggestion throughout the manuscript.

Competing Interests: none

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com

F1000Research