



## RESEARCH ARTICLE

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

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## Abstract

**Background:** The purpose of this study was to assess the vitamin D supplementation intake status among children from different nationalities in the UAE, to determine vitamin D intake practices through diet and lifestyle, and the barriers that parents in the UAE face with providing vitamin D supplementation to their children.

**Methods:** A cross-sectional observational questionnaire-based survey study design was used.. The study was conducted in the U.A.E and the study participants were parents of children from ages 4-15 years. The questionnaire used in this study was both self-administered and interviewer-administered while inquiring the questions from the parents. A convenience sampling technique was used to collect the data. 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 participants (203 mothers, 39 fathers and 6 caregivers) completed the study. Participants reported that the supplements used the most by children were vitamin D supplements (21.85%), followed by multivitamins (21.8%) and calcium supplements (5.6%) and 27.8% of participants in this study reported to no supplementation at all. The rate of vitamin D supplementation among children was higher in those families with higher income levels, parents/caregivers who were more educated, those families who attained health insurance. However, there was no statistical significance between these correlations.

**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 in the UAE. Pediatricians and health care professionals could use our study and use it as an aid

## Open Peer Review

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

to provide screening on lifestyle, sun light exposure, and dietary modifications and also educate parents why and how vitamin D is crucial for their children.

### Keywords

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

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**REVISED Amendments from Version 1**

The title has been revised as per the reviewers' recommendations. The abstract is updated with specific information in the method section and highlights key findings in the result section. The introduction section has been modified and enriched with more recent references to outline the research rationale. The results chapter has been refined with the explanation text with each table and figure. The whole manuscript has been copy-edited for language, grammar, and syntax errors. The limitation of the study is added and addressed important elements of the study design.

**Any further responses from the reviewers can be found at the end of the article**

**Introduction**

Vitamin D is known among the critical minerals to play an important role in maintaining normal body functions.<sup>1</sup> It allows bone mineralization and avoids hypocalcemic tetany (such as involuntary muscle contraction, cramps, spasms, etc.).<sup>2</sup> It is also known for aiding osteoblasts and osteoclasts in developing and remodeling the bone preventing it from being brittle.<sup>3</sup> Other functions of vitamin D in the body include inflammation reduction and regulation of cell growth, neuromuscular and immune function, and glucose metabolism.<sup>4</sup> 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.<sup>5</sup> Vitamin D made in the skin or ingested in the diet is biologically inert and requires two successive hydroxylations first in the liver on carbon 25 to form 25-hydroxyvitamin D [25(OH)D], and then in the kidney for a hydroxylation on carbon 1 to form the biologically active form of vitamin D, 1,25-dihydroxyvitamin D [1,25(OH)2D].<sup>5</sup>

Maintaining optimum levels of calcium and vitamin D during childhood and adolescence is critical for bone growth.<sup>6</sup> 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.<sup>7</sup> 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.<sup>8</sup> Vitamin D has been shown to reduce the risk of premature birth in pregnant women.<sup>9</sup>

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.<sup>10</sup> 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.<sup>11</sup>

Epidemiologic studies, 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 pain and weakness, and falling. 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.<sup>12</sup> Vitamin D deficiency and insufficiency is linked with mood disorders and anxiety among youngsters and adults. The pleiotropic action of vitamin D was already revealed on molecular, cellular, tissue, and organ levels.<sup>13</sup> These observations modified the current knowledge about vitamin D metabolism and methods of diagnosis of vitamin D deficiency states.<sup>14</sup>

Unfortunately, vitamin D is found rare in food.<sup>15</sup> 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 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.<sup>16</sup> 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.<sup>17</sup>

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.<sup>18</sup>

In the U.A.E., due to the consistently predominant hot weather, inadequate exposure to sunlight, and low nutritional intake of vitamin D, results in low serum concentrations of circulating 25(OH)D, a condition known as hypovitaminosis D among the general population.<sup>19</sup> 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.<sup>20–22</sup>

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. 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. Consequently, the prevalence of vitamin D deficiency is high both in children and adults, and new guidelines are needed to overcome this major public health issue.

The purpose of this study was to assess the vitamin D supplementation intake status among children from different population subtypes in the UAE, the natural sources of vitamin D from their diet, and the barriers 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 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. The data was collected over a period of seven months from October 2021 to April 2022. Mean, standard deviation, and mean comparison was utilized for continuous data.

### Research tool

The questionnaire was adapted from another study; *The effectiveness of a short food frequency questionnaire in determining vitamin D intake in children* which was conducted on 296 healthy 6- to14-y-old African American and Caucasian children residing in Pittsburgh, Pennsylvania, USA and evaluated for content validation from the main authors of that study.<sup>23</sup> However, only a selected number of questions from the original questionnaire were used in the survey of our study.<sup>23</sup> Our survey questionnaire consisted of around 10 questions in total.<sup>23</sup> We had generated an Arabic and English version of it for participants' ease.

Part one of the study questionnaire consists demographic information (e.g. age, nationality, gender, etc.). This part of the questionnaire also includes the literacy/education levels of the parents/caregivers, income levels and health insurance status of the parents/caregivers in the study. This part of the questionnaire comprises of the data on the barriers parents/ caregivers face with providing vitamin D supplementation to their children.

In order to investigate the many possible reasons of vitamin D deficiency, the second part of our study questionnaire comprised of questions related to supplementation intake and natural sources of vitamin D intake through their diet (e.g. if the child has milk, yogurt, etc. in his diet). The last part consists questions on the outdoor activity level of the child (e.g. hours the child spends playing outdoors). Most parts of the data were collected based on yes or no, or multiple choice questions with a space for the 'other' responses as well.<sup>23</sup>

### Variables

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

### Primary outcomes

Poor supplementation practices of vitamin D among children associated with low dietary sources of vitamin D, low exposure to sunlight, low literacy rates among parents/caregivers, low family income, absence of health insurance among the families are the primary outcomes of our study.

### 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%.<sup>24</sup> Around 319 participants were determined by the Rao soft sample size calculator, however 301 responded, 71 of them did

not fit in our inclusion criteria and 248 participants 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. A total of 248 participants were included and all 248 of them actively participated in our study. During analysis, we found no missing data on our participants.

#### Inclusion criteria

Participants living in the UAE 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 to avoid bias which would affect the results.

#### Ethical issues

Ethics approvals have been obtained for the study. This is the ethics approval number IRB/COP/STD/74/Oct-2021 from Gulf Medical University, Ajman.

#### Consent form

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. 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 Statistical Package for Social Sciences (SPSS). Prevalence of low vitamin D supplementation and its distribution with socio-economic characteristic was analyzed. 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

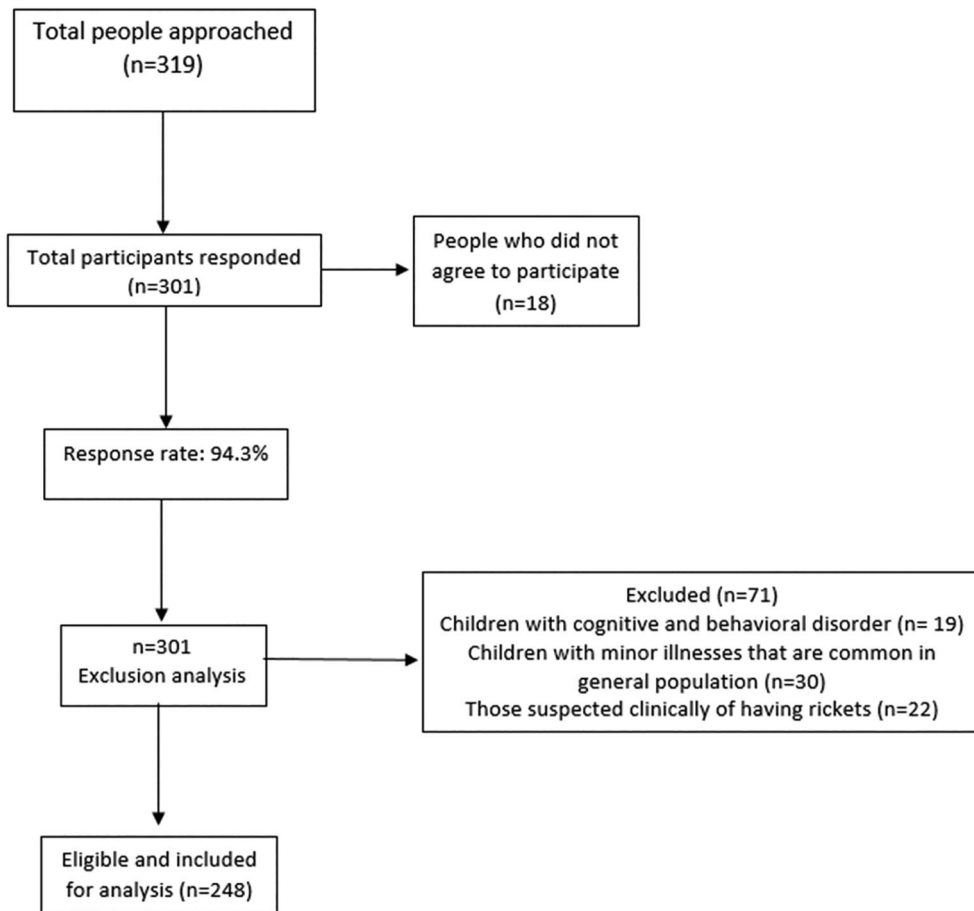
There is no bias in any trend in the collection, analysis, interpretation, or review of the data that can lead to conclusions that are different from the truth. However, since this was an observational study, variations in the results may be due to sample size.

#### Results

A total of 248 participants; 81.9 % mothers (n=203) , 15.7% fathers (n=39) with a mean±SD age of 35.4±7.04 years, and 2.4% others who were guardians or care takers (n=6), completed the study. From our analysis on the socio-economic status of our participants, we found that about 62.9% (n=156) of our study participants had university level of education, while 26.2% (n=65) of our participants completed secondary school only, 9.7% (n=24) of participants only completed primary school as their level of education and 1.2% (n=3) of participants were uneducated.

Moreover, 61.7% (n=153) of mothers were unemployed, while a smaller percentage of mothers which is 27% (n=67) were employed, and 11.3% (n=28) of them were employed in a medical setting. As for the fathers who took part in our study, 70.2% (n=174) of them were employed and 21% (n=52), 4.8% (n=12) and 4% (n=10) were self-employed, employed in a medical setting, and unemployed, respectively. Approximately 42.7% (n=106) participants had a family income level of more than 10,000, while 35.5% (n=88), 10.1% (n=25) and 4.8% (n=12) of the families' income levels were 5,000-10,000, 2,000-5,000 and less than 2,000, respectively. More than half of our study participants had a health insurance plan and only 28.6% (n=71) of our participants reported to have no health coverage (Table 1).

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



**Study flow diagram.**

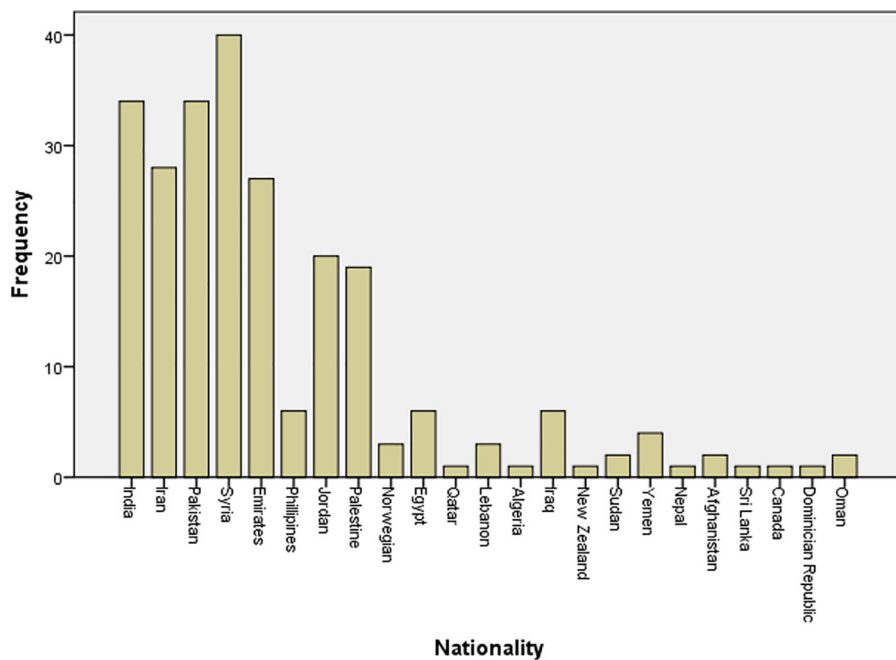
**Table 1. Sociodemographic parameters of the study participants.**

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)

**Table 1.** *Continued*

Characteristics	N(%)
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.



**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

A higher proportion of children received supplements is associated with parents/caregivers 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 of a child per day. Of all the participants 65% (162) of them reported sending their child outside to play while 34.67% (86) reported no outdoor activity. The mean hours of outdoor activity for the children were 2.046 ± 1.61. It was found that on average, children who are active outdoors, spent 0.15-6 hours playing outside in the sun thereby being exposed to sunlight ([Table 3](#)).

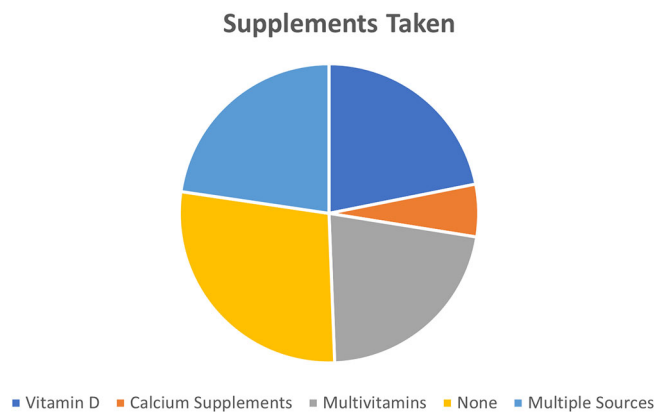
Participants reported that supplements used the most by children were Vitamin D supplements (21.85%) and multivitamins (21.8%) followed by calcium supplements (5.6%). However, 27.8% of children in this study did not take any supplements. While other parents/caregivers reported mixed intake of supplements (vitamin D plus calcium supplements or vitamin D and multivitamins) by their children ([Figure 2](#)).

[Figure 3](#) summarizes and describes that out of the 248 participants, 184 (74.2%) parents reported their children’s diet to contain multiple natural sources of vitamin D (milk plus cheese, or yoghurt plus cheese plus vitamin D fortified orange juice). However, 69 (27.8%) of our study participants reported giving no sources of natural vitamin D to their children through diet.

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

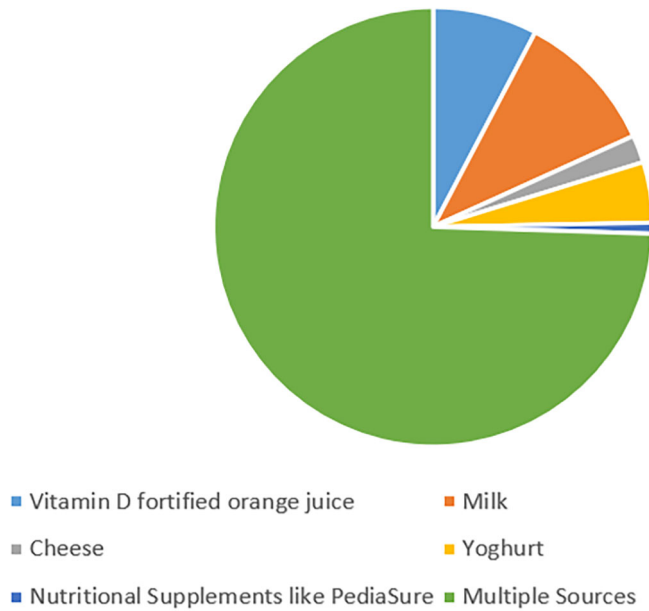
Parents/caregivers with private health insurance (51.85%) were more likely to provide vitamin D supplements to their children compared to those with government health insurance (25.92%) and no health insurance (22.22%) ([Table 5](#)).

Our study included participants from 23 various nationalities. The top five nationalities with the most number of 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.



**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)

**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)

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

**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)

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).

The association between low vitamin D supplementation and socio-economic and demographic characteristics, exposure to sunlight, dietary sources of vitamin D, health insurance status was assessed and the significance of these associations was tested using chi square test. We could not observe any significant associations with low vitamin D supplementation and the other factors.

## Discussion

Several studies have reported the association between socio-demographic and economic factors among parents/caregivers and low vitamin D supplementation practices.<sup>25</sup> There are no previous studies on the prevalence of low vitamin D supplementation practices in children living in the UAE. This cross-sectional study identifies the association between socioeconomic and demographic factors and vitamin D supplementation practices among children. It is noted from our study that due to the consistent hot climate in the UAE, children get little exposure to sunlight. Dietary sources of vitamin D also perhaps plays a vital role in stimulating vitamin D production among young and growing children.<sup>26</sup>

It was found in this study that higher literacy rates among parents, higher income levels and health insurance in the families, increases the frequency of a child's intake of vitamin D supplementation.

In U.A.E., since there is no law requiring the fortification of vital foods with vitamin D, there are a few vitamin D-fortified products in the market.<sup>27</sup> Among the participants of our study, 184 (74.2%) reported the child's diet to contain multiple natural sources of vitamin D. However, 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, vitamin D status is heavily on endogenous vitamin D synthesis, which is influenced by genetic determinants and lifestyle.<sup>28</sup> It would be useful to have national prevalence data on vitamin D deficiency in the UAE, because in addition to its impact on calcium homeostasis, there is accumulating evidence that vitamin D also plays a role in avoiding the onset of diabetes mellitus and numerous other health-related diseases in children.

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.<sup>29</sup> 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.

## 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) are collected simultaneously,

thereby preventing conclusions regarding causality. The data was mostly collected from mothers giving rise to culture or gender bias. A convenient sampling technique was used to collect data from approximately 248 participants. The potential drawback of convenient sampling technique is:

- Sampling bias
- Selection bias
- Difficult to generalize data
- Breaking down of results into demographic data would be difficult

## 5. Conclusion

The epidemiological findings of this study signify the reasons of prevalence of vitamin D deficiency among children from different population subtypes in the UAE. Vitamin D being a crucial element in the growth, development and immunity of children, its deficiency poses a great public health challenge. From our study we understand that factors such as low sun-light exposure, low dietary intake of vitamin D sources, and low intake of vitamin D supplements are the fundamental causes of vitamin D deficiency. Other reasons such as low monthly income of the families, low literacy rates among parents and no health insurance can have an impact on vitamin D supplementation practices. Pediatricians, health care professionals, and ministry of health could use this study as an aid to provide screening on lifestyle, sun light exposure, and dietary modifications, provide access to vitamin D and other supplementation to children and also educate parents why and how vitamin D is crucial for young children.

## Data availability

Parents reported Vitamin D Supplementation among Children (Responses). DOI: <https://doi.org/10.6084/m9.figshare.20207165.v1>.<sup>30</sup>

This project contains the following data:

- The purpose of this study was to assess 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.

Data are available under the terms of the [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) (CC BY 4.0)

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# Open Peer Review

Current Peer Review Status:  

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## Version 2

Reviewer Report 20 March 2023

<https://doi.org/10.5256/f1000research.144822.r166240>

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**Muhammad Umair Khan**

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

I have no further comments

**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.**

Reviewer Report 14 March 2023

<https://doi.org/10.5256/f1000research.144822.r166239>

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**Tauqeer Hussain Mallhi** 

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

The authors have addressed all my comments. I have no further queries related to this manuscript. Thank you for considering the suggestions.

**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.

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**Version 1**

Reviewer Report 19 December 2022

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

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**Muhammad Umair Khan**

<sup>1</sup> Aston Pharmacy School, College of Health and Life Sciences, Aston University, Birmingham, UK

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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**

- 1<sup>st</sup> paragraph – last sentence – for the ease of readers, please explain what happens when 25(OH) D transforms to 1,25 (OH) D.
- 3<sup>rd</sup> 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?

- 4<sup>th</sup> 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.
- 7<sup>th</sup> paragraph – first sentence – in children, adults, or general population?
- 8<sup>th</sup> paragraph – first sentence – too long to comprehend. Please rewrite to improve clarification.
- 8<sup>th</sup> paragraph – second sentence - What is the prevalence of vitamin D deficiency among adults and children globally and in the UAE?
- 8<sup>th</sup> 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.
- 9<sup>th</sup> 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

- 1<sup>st</sup> sentence – It was mentioned earlier. Avoid duplication.
- 2<sup>nd</sup> 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 4<sup>th</sup> 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 4<sup>th</sup> 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? If 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>

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**Tauqeer Hussain Mallhi**

<sup>1</sup> Department of Clinical Pharmacy, College of Pharmacy, Jouf University, Al-Jouf, Saudi Arabia

<sup>2</sup> 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

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