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Knowledge, Attitude, and Practice of Vitamin D Intake Among Pregnant Women in Calabar: Implications for Maternity Care in the Tropics

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Abstract

Background: Vitamin D is a micronutrient essential for calcium and phosphorus homeostasis. It is required for optimal maternal health, fetal skeletal development, bone formation and good immune function. Though the vitamin is present in many locally available foods, as well as through supplementation and exposure to sunshine, these practices may require adequate knowledge and a good attitude towards vitamin D by pregnant women. This study aimed to assess these parameters among pregnant women in a tropical developing country setting with adequate daily sunshine.
Methods: The study design was descriptive cross-sectional, with pregnant women attending an antenatal care clinic at the University of Calabar Teaching Hospital (UCTH), selected through simple random sampling technique. A structured and pretested questionnaire was used to obtain quantitative data on knowledge, attitude, and practice of vitamin D intake and sunshine exposure. Data was entered and analyzed using SPSS version 25.0. Chi-square, Fisher's exact, and independent t-tests were employed as inferential statistics to enable us extend results obtained from the sample population to the general population. Level of significance was set at $P < 0.05$.
Result: Two hundred and twenty-four (224) participants were studied, with a response rate of 95.2%. The mean percentage knowledge score was 28.0 ± 2.6% ranging from 13 to 79.2%. Only one-quarter of the participants had good mean knowledge scores. Most participants (54.9%) had poor attitude. The most commonly consumed vitamin D-rich foods were milk (83.5%), egg yolk (78.6%), yogurt (66.9%) and butter (65.0%). Only 69 (30.8%) participants sometimes took vitamin D supplements.
Conclusion: Most pregnant women had inadequate knowledge, poor attitude, and practice of vitamin D intake and sunshine exposure in the study setting. Antenatal clinic consultations should include health enlightenment on adequate intake of vitamin D rich food, vitamin D supplementation and the need for exposure to sunshine to prevent adverse fetomaternal consequences.

Keywords: Knowledge, Attitude, Practice, Pregnant Women, Vitamin D intake

Introduction

Vitamin D is a fat-soluble vitamin and micronutrient responsible for calcium and phosphorus homeostasis in the human body. It can be derived from both dietary sources and dermal synthesis following exposure to sunlight[1] Ultraviolet radiation from sunlight causes a non-enzymatic conversion of 7-dehydroxycholesterol in the skin to pre-vitamin D which is ultimately converted to the active form 25 hydroxycholecalciferol 25(OH)D.[1,2]

Vitamin D is essential in pregnancy and is required for optimal maternal health, adequate fetal skeletal

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development, and bone formation. Adequate intake of vitamin D also supports good immune function and reduces the risk of autoimmune diseases.[2,3]

Morbidities associated with Vit D deficiency during pregnancy include gestational diabetes, bacterial vaginosis, preeclampsia, recurrent pregnancy loss, polyhydramnios, preterm birth, increased primary cesarean section, and postpartum depression. Poor skeletal mineralization in utero may manifest as neonatal hypocalcemia and tetany, delayed ossification of the cranial vertex, enlarged size of the cranial fontanelles, impaired fetal bone ossification, congenital rickets, craniotabes and osteopenia in the newborn.[2-4]

Studies have shown that vitamin D is not limited to bone health. Vitamin D has been linked to the regulation of immune function, hematopoietic system, cancer development and progression, glucose homeostasis through insulin production and resistance, and cognitive function. Hence vitamin D deficiency may be associated with many diseases such as asthma, cardiovascular diseases, diabetes mellitus, and cancers.[2,4-7]

Vitamin D deficiency affects about a billion people globally with a high prevalence in women including antenatal and lactating mothers.[8] There appear to be a worldwide epidemic of vitamin D deficiency among pregnant women as a result of inadequate intake with a prevalence of between 4.7 to 80%.[8-10]

Religious, and cultural factors local clothing customs, limited exposure to sunlight, environmental pollution, use of sunscreen creams, and inadequate knowledge and attitude concerning vitamin D intake are possible factors responsible for this trend.[7-11]

Pregnancy and puerperium are vulnerable periods for Vit D deficiency which is defined as a serum 25(OH) D level below 20ng/ml.[12]

The recommended daily intake of vitamin D ranges widely from 200 to 4000IU[12-15]. The majority of vitamin D intake can be derived from sunlight exposure. Nonetheless, dietary sources include fatty fish such as salmon, mackerel, tuna; egg yolk, cheese, liver, mushrooms, fortified milk, cereals, and juices.[9-11]

Studies have indicated a correlation between Vitamin D intake with some lifestyle features including exposure to sunlight, diet, skin color, use of sunscreen, clothing, and coverage as well as socioeconomic status. In addition, receiving adequate vitamin D from sunlight is linked with traditions and religious beliefs.[9,10]

There is no consensus on recommendation and dosage of routine oral vitamin D supplementation. However, pregnant women are encouraged to receive adequate nutrition which is best achieved through the consumption of a healthy balanced diet which includes vitamin D-rich foods. Sunlight exposure is also recommended as a vital source of vitamin D during pregnancy. Vitamin D supplements should be given to pregnant women with suspected vitamin D deficiency with a recommended intake of 200IU – 4000IU per day.[12-15] This may include women in populations where direct sun exposure is restricted.

A crucial step in ensuring adequate vitamin D intake by pregnant women is by adopting behavioral changes to enhance awareness, increase knowledge, positive attitude, and practices towards vitamin D intake.

Few studies have been conducted to assess the knowledge attitude and practice of pregnant women to Vitamin D intake as well as the determinants of the associated factors.

This study aims to determine the knowledge, attitude, and practices of pregnant women regarding vitamin D intake as well as the determinant factors in Calabar, Nigeria.

Materials and Methods

Study design, population, and setting

The study used a descriptive cross-sectional design selected through simple random sampling technique, with pregnant women attending the antenatal care clinic at the University of Calabar Teaching Hospital (UCTH), from September through to mid-November 2022. The antenatal clinic consultations in UCTH hold on Mondays, Tuesdays, Thursdays and Fridays while the booking clinic holds on Wednesdays. There is an average of thirty (30) new clients who register for antenatal care during the booking clinic every Wednesday.

Sample Size Determination

A minimum sample size of two hundred and sixteen (216) was calculated using the Cochrane formula for cross-sectional studies ($n = z^2*pq/d^2$) with a 95% level of confidence, 5% margin of error, 84.1% prevalence of intake of vitamin D fortified and

vitamin-rich foods, obtained from previous study and assumption of 5% non-response rate.[16]

Study Population, Inclusion and Exclusion Criteria

Eligible participants comprised consenting pregnant women attending the ANC clinic at UCTH, irrespective of gestational age and booking status. Acutely ill pregnant women and albinos who required limitation of sunshine exposure were excluded from participating.

Sampling Technique

Participants were recruited by using a systematic random sampling technique, with the sampling frame being the ANC clinic register and a calculated sampling interval of 4. The expected daily client uptake was divided by the allocated daily sample size for the study period, to yield an estimated sampling interval of 4. Balloting among the initial four clients on the register was done to recruit the first participant, while the calculated sampling interval was used to recruit subsequent participants. The next client on the register was selected if a selected client was ineligible or did not give consent. Recruitment of participants continued until the calculated sample size was completed.

Study Instrument

In this study, information on knowledge, attitude, and practice of vitamin D intake was obtained using a structured and pretested questionnaire. There is currently no validated tool for such assessment, especially because of the global diversity of dietary sources of vitamin D. Hence, questions were derived from previous literature findings, as well as peculiarities of available vitamin D-rich foods and diets in the local study area. The instrument was pretested among twenty (20) pregnant women in General Hospital Calabar, to attain a Cronbach alpha coefficient of 0.72 before use for data collection. Section 1 of the study instrument comprised seven items, which assessed sociodemographic and obstetric characteristics of respondents. Section 2 assessed knowledge of vitamin D using 24 items, with categorization into relevance, sources, and recommended intake of vitamin D.

Section 3 assessed attitude towards vitamin D, with 10 items using a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5), to yield minimum and maximum scores of 10 and 50, respectively. Negatively worded items were reverse-scored. Section 4 assessed the practice of vitamin D intake and sunshine exposure using 20 items. Sunshine exposure was considered enough if the average duration of daily exposure was at least 15 minutes.

Data collection

Quantitative data was obtained via face-to-face interviewer-assisted administration of structured and pretested questionnaires. Following ethical approval and pretesting of the questionnaires, the research assistants received 2-hour daily 2-day training on participant recruitment and engagement, questionnaire administration, and research coordination. Thereafter, the research assistants administered the questionnaires to consenting and eligible participants, during the waiting period after their routine vital check-up at the nursing station. Field-based identification and correction of incomplete or incorrect data was done before data entry into a computer. Data collection began in early September and was concluded in mid-November, 2022.

Data analysis

Research data was entered and analyzed using SPSS version 25.0. Frequency tables were used to present the sociodemographic, knowledge, attitude, and practice of each item assessed. Each correct response to the knowledge question contributed one unit to the sum score, which was converted to a percentage for each subject. Mean knowledge percentage score was obtained, while the scores were categorized as poor (<25.0%), fair (25-49%), good (50-74%) and excellent (>75%). The knowledge percent scores were also re - categorized as unsatisfactory (poor or fair subgroups) and satisfactory (good or excellent subgroups). Similarly, the mean attitude score was obtained, while sum scores were categorized into poor (<30) and good (>30), with minimum and maximum scores of 10 and 50, respectively. Chi-square and Fisher's exact tests were employed as inferential statistics to assess categorical variables associated with vitamin D supplementation and sunshine exposure as key practice items. Independent t-test was used to compare mean knowledge and attitude percentage scores, between the bivariate categories of vitamin D

supplementation and sunshine exposure statuses. P-value was set at 0.05.

Ethical consideration

The study was approved by the University of Calabar Research Ethics Committee before data collection. Also, subjects gave informed and written consent before data collection. Voluntary participation, privacy, confidentiality, and other principles of research ethics were communicated and adhered to throughout the study. Short (3-5 minutes) health education on relevance and dietary sources of vitamin D was provided to subjects after data collection.

Results

Two hundred and twenty-four (224) participants were studied, with a response rate of 95.2%. The mean age was 29.3 ± 4.9 years, ranging from 16 to 43 years old. Most participants were 30 years old or younger (63.4%), had a tertiary level of education (73.7%), married (98.2%), parous (73.2%), and within the second trimester of gestation (65.6%)

Table 1: Socio-demographic and Obstetric Characteristics of Participants (n = 224)

Variable	Frequency	Percentage
Age group (in years)		
<20	11	4.9
21-30	131	58.5
31-40	80	35.7
>40	2	0.9
Educational Level		
Primary	2	0.9
Secondary	57	25.4
Tertiary	165	73.7
Marital Status		
Married	220	98.2
Unmarried	4	1.8
Nature of Occupation		
Mostly Indoors	96	42.9
Mostly outdoors	53	23.7
Partly Indoors and Outdoors	75	33.5
Parity		
Nulliparous	60	26.8
Multiparous	158	70.5
Grand multiparous	6	2.7
Gestational Age		
First Trimester	77	34.4
Second Trimester	147	65.6
Natural Skin Colour		
Dark/Black	121	54.0
Olive	56	25.0
Medium	17	7.6
Fair	30	13.4

Mean gestational age was 14.1 ± 4.1 weeks, ranging from 5 to 23 weeks. Approximately one-fifth (21.0%) had fair/medium skin color, while the commonest occupation was mostly indoors (42.9%).

Table 2: Knowledge of Vitamin D among pregnant women (n = 224)

Knowledge Category Item	Correct Response %		Incorrect Response %	
Relevance of vitamin D and symptoms of its lack				
Is vitamin D important for pregnant women?	103	54.9	101	45.1
Is vitamin D important for children?	126	56.3	98	43.8
Poor growth is a symptom of a lack of vitamin D	68	30.4	156	69.6
Muscle weakness is a symptom of a lack of vitamin D	60	30.4	156	69.6
Constipation is a symptom of a lack of vitamin D	39	17.4	105	82.6
Sources of vitamin D				
8 Bed rest at home is a source of vitamin D	48	21.4	176	78.6
Eating certain foods is a source of vitamin D	110	49.1	114	50.9
Exposure to light from the bulb is a source of vitamin D	43	19.2	181	80.8
Exposure to sunlight is a source of vitamin D	76	33.9	148	66.1
Taking supplements is a source of vitamin D	95	42.4	129	57.6
Green vegetables are good food sources of vitamin D	100	44.6	124	55.4
Eggs are a good food source of vitamin D	80	35.7	144	64.3
Beans are a good food source of vitamin D	37	16.5	187	83.5
Yogurt is a good food source of vitamin D	54	24.1	170	75.9
Garri (cassava flakes) is a good food source of vitamin D	61	27.2	163	72.8
Milk is a good food source of vitamin D	62	27.7	162	72.3
Fatty fish is a good food source of vitamin D	67	29.9	157	70.1
Recommended intake and role of sunlight				
Do you know the recommended daily intake of vitamin D?	11	4.9	213	95.1
Does heavy clothing reduce the amount of sunlight vitamin D?	43	19.2	181	80.8
Which milk contains more vitamin D?	9	4	215	96
Do infants need extra vitamin D as droplets or supplements?	55	20.1	169	75.4
Should babies be intentionally exposed to sunlight for vitamin D?	45	20.1	179	79.9
Knowledge percentage score categories Frequency Percent				
Detailed knowledge percent categories				
Low (<25.0%)	96	42		
Fair (25-49%)	77	34.4		
Good (50-74%)	47	21		
Excellent (>75%)	4	1.8		
Total	224	100		
Bivariate knowledge percent categories				
Inadequate (low or fair)	173	77.2		
Adequate (good or excellent)	51	22.8		
Total	224		100	

Table 3: Attitude towards vitamin D among pregnant women (n = 224)

	Attitude item	Strongly Disagree n(%)	Undecided n(%)	Agree n(%)	Disagree n(%)	Strongly agree n(%)
1	I need to spend more time in the sun to get enough vitamin D to be healthy	12 (5.4)	17 (7.6)	94 (42.0)	34 (15.2)	67 (29.9)
2	I worry about getting enough vitamin D	6 (2.7)	20 (8.9)	115 (51.3)	49 (21.9)	34 (15.2)
3	It is more important to stay out of the sun than it is to get enough vitamin D*	10 (4.5)	36 (16.1)	129 (57.6)	23 (10.3)	26 (11.6)
4	Most foods that are rich in vitamin D are not tasty*	21 (9.4)	39 (17.4)	125 (55.8)	20 (8.9)	19 (8.5)
5	I need to eat more foods that contain vitamin D	12 (5.4)	11 (4.9)	116 (51.8)	41 (18.3)	44 (19.6)
6	I think I need to take vitamin D supplements	8 (3.6)	17 (7.6)	123 (54.9)	44 (19.6)	32 (14.3)
7	It is difficult to see where to buy vitamin D supplements*	18 (8.0)	42 (18.8)	118 (52.7)	19 (8.5)	27 (12.1)
8	Vitamin D supplements are generally not affordable*	20 (8.9)	37 (16.5)	124 (55.4)	19 (8.5)	24 (10.7)
9	It is difficult to be consistent with taking vitamin D supplements*	10 (4.5)	28 (12.5)	116 (51.8)	38 (17.0)	32 (14.3)
10	I think I have enough vitamin D in this pregnancy*	6 (2.7)	18 (8.0)	158 (70.5)	21 (9.4)	21 (9.4)
Attitude score categories		Frequency		Percentage		
Poor (<30 out of a maximum of 50)		123		54.9		
Good (>30 out of a maximum of 50)		101		45.1		
Total		224		100		

Table 4: Practice of vitamin D-related behaviour (n =224)

	Variable	Almost Daily n(%)	2-3 times weekly n(%)	1-3 times monthly n(%)	Very rare/never n(%)
	Intake of vitamin D-rich foods (in last 3 months)				
1	How often did you consume milk?	101 (45.1)	86 (38.4)	31 (13.8)	6 (2.7)
2	How often did you consume yogurt?	61 (27.2)	89 (39.7)	56 (25.0)	18 (8.0)
3	How often did you consume butter?	42 (18.8)	81 (36.2)	57 (25.4)	44 (19.6)
4	How often did you consume egg yolk?	73 (32.6)	103 (46.0)	34 (15.2)	14 (6.3)
5	How often did you consume liver?	53 (23.7)	58 (25.9)	79 (35.3)	34 (15.2)
6	How often did you consume sardine?	52 (23.2)	72 (32.1)	67 (29.9)	33 (14.7)
7	How often did you consume mackerel?	48 (21.4)	61 (27.2)	69 (30.8)	46 (20.5)
8	How often did you consume salmon?	25 (11.2)	69 (30.8)	59 (26.3)	71 (31.7)
9	How often did you consume tuna?	19 (8.5)	46 (20.5)	71 (31.7)	88 (39.3)
10	How often did you consume cod liver oil?	18 (8.0)	40 (17.9)	54 (24.1)	112 (50.0)
11	How often did you consume cheese?	24 (10.7)	42 (18.8)	41(18.3)	117 (52.2)
12	How often did you consume mushroom?	21 (9.4)	37 (16.5)	34 (15.2)	132 (58.9)
	Non-dietary vitamin D-related behaviour (within last 1 month)				
13	How often do you take vitamin D supplement?	Never 105 (46.9)	Rarely 50 (22.3)		Frequently 7 (3.1)
14	How much time do you generally spend in the sun?	Never 0 (0.0)	Little 68 (30.4)		Enough 27 (12.1)
15	Did you take calcium supplements in last 1 month?		Yes n(%)		No n(%)
16	Did you take cod liver supplements in last 1 month?		78 (34.8)		146 (65.2)
17	Did you take other fish oil supplements in last 1 month?		78 (34.8)		146 (65.2)
18	Did you take multivitamin supplements in last 1 month?		64 (28.6)		160 (71.4)
19	Have you ever tested your blood level for vitamin D?		49 (21.9)		175 (78.1)
20	Have you ever received counselling or educational materials concerning vitamin D?		5 (2.2)		219 (97.8)

Table 2 shows the frequency distribution of proportion with correct response to each of the items showing knowledge of vitamin D, as well as categories of knowledge score. Fifty-one subjects comprising 22.8% had a satisfactory level of knowledge of vitamin D. Though most subjects knew of the importance of vitamin D to mothers (54.9%) and children (56.3%), less than half provided correct responses to all other 22 items assessing symptoms, sources and recommended intake of vitamin D. For instance, only 19.2% and 16.5% provided correct responses to items assessing if light bulbs and beans were sources of vitamin D, respectively. Also, only 4.9% and 4.0% knew of the recommended daily intakes of vitamin D, as well as which milk source had more concentration of vitamin D, respectively.

The mean percentage knowledge score was 28.0 ± 2.6 ranging from 13 to 79.2%.

Items that made relatively more contribution to positive attitude were the perception of a need to spend 15 – 30 minutes under the sun daily (45.1%), worrying about not getting enough vitamin D (37.1%), and the need to eat more vitamin D-rich foods (37.9%). Items that made relatively more contribution to negative attitudes were perceived difficulty in buying vitamin D supplements (26.8%) and most vitamin D-rich foods that are not tasty (26.8%).

The mean attitude score was 31.4 ± 3.6 ranging from 21 to 50. Most subjects (54.9%) had poor attitudes (Table 3).

Table 4 shows a frequency distribution of dietary and non-dietary practices of vitamin D intake. The most commonly consumed vitamin D-rich foods were milk (83.5%), egg yolk (78.6%), yogurt (66.9%) and butter (65.0%). The least commonly consumed foods were mushrooms (74.1%), cheese (70.5%), and cod

Table 5: Factors associated with vitamin D supplementation and sunshine exposure

Variable	Vitamin D supplementation	Sunshine exposure				
	Never	At least sometimes	p-value	Enough	Not enough/ Little	p-value
	n(%)	n(%)		n(%)	n(%)	
Age group (in years)						
<30	91(64.1)	51 (35.9)	0.03*	16(11.3)	26(88.7)	0.63
>30	64(78.0)	18 (22.0)		11(13.4)	71(86.6)	
Educational level						
Secondary or less	39(66.1)	20 (33.9)	0.55	6(10.2)	53(88.8)	0.61
Tertiary	116(70.3)	49 (29.7)		21(12.7)	144(87.3)	
Marital status						
Married	151(68.)	69 (31.4)	0.18	25(11.4)	195(88.6)	0.02*
Unmarried	4 (100)	0 (0.0)		2(50.0)	2(50.0)	
Nature of occupation						
Mostly indoor	77(80.2)	19 (19.8)	0.01*	10(10.4)	86 (89.6)	0.21
Mostly outdoor	32 (60.4)	21 (39.6)		10(18.9)	43 (81.1)	
Partly indoor/outdoor	46 (61.3)	29 (38.7)		7 (9.3)	68(90.7)	
Natural skin color						
Dark/black/olive	125(70.6)	52 (29.4)	0.37	23(13.0)	154(87.0)	0.40
Medium/fair	30 (63.8)	17 (36.2)		4 (8.5)	43(91.5)	
Parity						
Nulliparous	35 (58.3)	25 (41.7)	0.03*	8(13.3)	52(86.7)	0.72
Parous	120(73.2)	44 (26.8)		19(11.6)	145(88.4)	
Gestational age						
First trimester	58 (75.3)	19 (24.7)	0.15	12(15.6)	65(84.4)	0.24
Second trimester	97 (66.0)	50 (34.0)		15(10.2)	132(89.8)	
Level of knowledge of vitamin D						
Inadequate	128(74.0)	45 (26.0)	0.00*	19(11.0)	154(89.0)	0.37
Adequate	27 (52.9)	24 (47.1)		8(15.7)	43(84.3)	
Attitude towards vitamin D						
Poor	94 (76.4)	29 (23.6)	0.01*	12(9.8)	111(90.2)	0.24
Good	61 (60.4)	40 (39.6)		15(14.9)	86(85.1)	
Received prior counseling on vitamin D						
Yes	39 (60.9)	25 (39.1)	0.09	10(15.6)	54(84.4)	0.30
No	116(72.5)	44 (27.5)		17(10.6)	143(89.4)	

liver oil (74.1%). Only 69 subjects (30.8%) sometimes or frequently took vitamin D supplements. Also, only 22 subjects (12.1%) spent enough time in sunshine. Sixty-four subjects (28.6%) had ever received counseling or educational materials regarding vitamin D. Only five subjects (2.2%) had ever tested for vitamin D.

Table 5 shows factors associated with vitamin D supplementation and sunshine exposure. Vitamin D supplementation was significantly commoner among subjects that were 30 years or younger (35.9% vs. 22.0%), nulliparous (41.7%) vs. 26.8%), and had outdoor occupation (39.6% vs. 19.8%) ($p<0.05$). Other sociodemographic and obstetric characteristics were not associated with vitamin D supplementation and sunshine exposure ($p>0.05$). Compared with subjects that never supplemented, those that at least sometimes had vitamin D supplementation, had significantly higher levels of percentage knowledge (38.9% vs. 23.1%, $p<0.00$) and attitude (32.4 vs. 30.8, $p=0.01$) scores regarding vitamin D. However, comparing subjects that had enough sunshine, with those that had suboptimal levels of sunshine exposure, there was no significant difference in their levels of percentage knowledge (35.2% vs. 27.0%, $p=0.08$) and attitude (31.6 vs. 31.4, $p=0.81$) scores regarding vitamin D.

Discussion

This study was done to explore the knowledge, attitude, and practice of vitamin D intake among m pregnant women attending antenatal clinics in Calabar, Southern Nigeria.

There is a paucity of studies here in Nigeria on the knowledge, attitude, and practice of vitamin D intake both in pregnant women and the general population. This study has been done to bridge the gaps in knowledge as well as form a baseline for future studies on the subject in our environment.

The study revealed that our participants had inadequate knowledge of vitamin D intake and deficiency. The mean percentage knowledge score was 28.0% ±2.6(13 -79.2%)

The participants had inadequate knowledge about the importance of vitamin D to pregnant women and their babies, sources, and recommended dietary intake of vitamin D. This is similar to reports from qualitative studies done in Bhaktapur, (Nepal)[17] Greater Manchester[18] and among Iraqi refugee women in the USA.[19] The participants in these three studies also had limited knowledge regarding Vitamin D intake and deficiency. This may be due to the fact that these studies were done among women living in less developed countries with inadequate health practices or recent immigrants from such countries.

This study revealed that the participants had poor attitudes towards the perception of the need for sun exposure to get vitamin D as well as eating vitamin D-rich food and taking vitamin D supplements. This result is similar to findings in studies done in Bhaktapur[17] and Greater Manchester[18] which also revealed negative attitudes to Vitamin D intake. This could be due to to the inadequate health practices in less developed nations or recent immigrants to developed countries.

Our study also revealed that dietary and non-dietary (sunshine exposure, supplements) sources of Vitamin-related practices were poor among the participants. This finding is not surprising given the sub-optimal levels of knowledge and attitude to vitamin D intake and deficiency also present.

The factors associated with vitamin D supplementation and sunshine exposure were nulliparity, age (30 years and younger), and outdoor occupation.

Based on the fact that vitamin D is an essential fat-soluble micronutrient deficiency associated with many negative fetal-maternal consequences[4-7], it is important to establish its baseline knowledge, attitude, and practice of intake and deficiency in our environment.

The level of vitamin D in newborn and lactating children is dependent on that of their mothers,[19,20] thus it is of utmost importance that pregnant and lactating women should have good knowledge, attitude, and practice because this directly impacts their children's health too.

It has been established that the commonest source of vitamin D is sunlight[12,13] which is readily available in our tropical environment almost all year round. Thus, pregnant women should be taught how to have safe and adequate exposure to sunlight.[22]

Pregnant women should also be taught and encouraged to consume adequate quantities of food rich in vitamin D many of which are affordable and readily available in our environment. They should also be taught the need for vitamin D supplementation where necessary to ensure adequate vitamin D intake. All these practices will help prevent adverse consequences associated with hypovitaminosis D in both mothers and their children.

It is also important to note that during the recent COVID-19 pandemic, morbidities and mortalities were documented to be higher in geographical locations and people with lower serum vitamin D levels.[23-25]

This could be explained by the fact that low levels of vitamin D have been linked to an impaired immune system which is worsened in the presence of COVID-19 infection.[23,26] This could also explain the association of hypovitaminosis D with several autoimmune diseases such as bronchial asthma, Type 1 diabetes mellitus, and several cancers.[2,3,23-26]

This study forms a baseline for further studies on vitamin D which will be done in our environment. It also helps us understand why some medical conditions may be associated with vitamin D deficiency though a direct causal relationship has not yet been established.

Conclusion

This study revealed that our participants had inadequate knowledge, poor attitudes and practice of vitamin D intake and deficiency. The results showed that about three-quarters of the participants had inadequate knowledge about vitamin D, more than half of them had poor attitudes and only about one quarter had enough exposure to sunshine/took vitamin D supplements. These may put our participants at risk of vitamin D deficiency with its associated adverse foeto -maternal consequences.

Based on these findings, there is need for health enlightenment of all pregnant women who present for antenatal care on the importance of Vitamin D to both mothers and their babies; also the need to adopt practices that ensure adequate vitamin D intake, through both dietary (vitamin D rich food) and non-dietary sources (exposure to sunshine in adequate and safe levels as well vitamin D supplementation). These sources should be ensured to be safe, readily available, accessible, and affordable. There would also be the need to extend this health enlightenment campaign and other promotional activities to all the pregnant women in the community with the aid of community/religious leaders and mass / social media for optimal results.

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