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Quality of Diet Pattern, Sun Exposure, and Vitamin D Statues Among Kurdish Children and Adolescent/Kurdistan Region/Iraq

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ABSTRACT
Background and Aim: Vitamin D has revealed huge attention in the scientific and public health community, and over the world around one billion persons in diverse ages and races now being either inadequate or deficient. The study aim is to assess vitamin D status, sun exposure and diet pattern of children and adolescent in Erbil and Soran city/Iraqi Kurdistan.
Methods: cross sectional study was conducted on 200 children and adolescents in out-patients laboratories in Soran and Erbil city during period of February to June 2021. Data were collected through using questionnaire interview and result of serum 25(OH) D. ethical approval was taken from Erbil polytechnic university /hawler medical institute/scientific committee. Also data were analyzed through using SPSS version 19.
Results: (30.5%) of samples were in deficient level of serum 25(OH) D (X±SD = 20.280± 13.256), (38.5%) exposed to sun just 5-15 minutes, 77% have not taken vitamin D supplements, 84 (42%) of participants had poor diet pattern. There is significant association between serums 25(OH) D with sun exposure and diet pattern at p-value < 0.001.
Conclusion: overall most of Kurdish children and adolescent had vitamin D deficiency due to poor sun exposure, poor diet pattern and most of them did not take vitamin d as supplements.

Keywords: *vitamin D, sun exposure, diet pattern, children and adolescents.*

1. INTRODUCTION

Vitamin D has demonstrated huge consideration in the scientific and public health community, and nowadays globally around one billion persons in diverse races and different ages being either insufficient or deficient of vitamin D [1].

Vitamin D deficiency usually results from poor sun exposure, malabsorption, or problems related to the kidney and liver. It is the major cause of rickets in children, and osteomalacia in adults [2].

Vitamin D is one of the fat-soluble vitamins that have several essential functions. It plays an important and basic function in bone digestion by organization calcium and phosphate homeostasis and also has role in regulation of cell development, neuromuscular, resistant capacity and reduces of aggravation. Practically there are two forms of vitamin D; vitamin D2 [Ergocalciferol] and vitamin D3 (Cholecalciferol) [3].

Vitamin D produces from the skin via exposure to sun light. The wave length of Ultraviolet B radiation between 290 nm and 315 nm, and furthermore it can be get from food and dietary supplement [4].

Direct sun exposure for an average of 10 to 15 minutes can produce 10,000 to 20,000 IU of vitamin D. various factors have roles in vitamin D synthesis such as skin pigmentation, latitude, and measure uncovering of skin, making it difficult to assess how much vitamin D can get from direct sun exposure. If Newborn and children who have darker pigmentation should remain between 5 to 10 times of sun exposure to attain same levels of 25-hydroxyvitamin D as compared to lighter pigmentation children [5].

It is also present in oily fish, eggs, and fortified food. Level of vitamin D in Infant relies on the vitamin D level of mother at delivery [6]. But as a source of vitamin D in the newborns and infants are dependent on breast milk, sunlight or supplements [7].

Categories of Vitamin D; Vitamin D levels were categorized into 3 main groups according to the categorization of the Institute of Medicine [8] as follows:

- Severely deficiency (< 10 ng/ml)
- Sufficient (>30 ng/mL);
- Insufficient (20–30 ng/mL);
- Deficient (< 20 ng/mL)

Our aims in this study are to assess vitamin D status, sun exposure and diet pattern of children and adolescent in Erbil and Soran city/Iraqi.

2. PATIENTS AND METHODS

2.1. Design and setting of the study:

A cross sectional descriptive study was conducted from period of early February to late of June 2021 in more than ten out-patients laboratories in Erbil and Soran city.

2.2. Sample and sampling method:

Convenient sampling of 200 cases in pediatric age group (age ≤ 18 years old) who prescribed serum 25(OH) D was taken as study sample.

2.3. Method of data collection:

The data was collected through use questionnaire format (demographic data, sun exposure, diet pattern of

Table 1: Demographic characteristic of children and adolescents

	Items	Frequency n=200	Percent
Age group	Infant	5	2.5
	Toddler	11	5.5
	Preschool	38	19.0
	School age	80	40.0
	Adolescent	66	33.0
X±SD		20.280± 13.256	
Gender	Male	101	50.5
	Female	99	49.5
Residency	Urban	146	73.0
	Rural	54	27.0
Economic	Low	27	13.5
	Middle	159	79.5
	High	14	7.0
Duration of exposure	< 5 minutes	32	16.0
	5-15 minutes	77	38.5
	15-30 minutes	75	37.5
	> 30 minutes	16	8.0
Suntan	Yes	76	38.0
	No	124	62.0
Sunscreen	Yes	37	18.5
	No	163	81.5
Getting Diarrhea	Yes	63	31.5
	No	137	68.5

Vitamin D and vitamin D supplements) and result of serum 25(OH) D.

The serum 25 (OH) D was classified to four categories as follows [8]:

Severely deficiency (< 10 ng/ml)

Deficient (< 20 ng/ml)

Insufficiency (20-30 ng/ml)

Sufficiency (> 30 ng/ml)

The diet pattern and vitamin D supplements categorized for nine (9) categories as follows; Never or < month takes (0 score), Monthly (1 score), 1-2/ month (2 score), 3-4/mo (3 score), 5-6/mo (4 score), weekly (5 score), 2-3/wk (6 score), 4-6 / wk (7 score) and Daily (8score). Then diet pattern according to the score classified to total scores for: Extremely poor, Very poor, poor diet, Adequate, Fair diet pattern, and Good diet pattern

2.4. Ethical consideration:

The ethical approval of the study was taken from Erbil Polytechnic University /Erbil Medical Technical Institutes/Scientific Committee and oral permission was obtained from their parents of children and adolescents

2.5. Data analysis:

The data were analysed using the statistical package for social sciences (SPSS) version 19. Frequency and percentage were used for categorical data and the chi-square test was used to find out the association between variables with P-value < 0.05 was considered as statistically significant, if it was < 0.01 high significant and < 0.001 very high significant.

3. RESULTS

Table (1) shows that the highest percent of participants were in adolescent stage which presents (47%), most of them were female (59%), below three quarter (70%) were lived in urban and majority of them (69%) were lived in middle economic level.

also, most of children and adolescents (38.5%) exposed to sun for 5-15 minutes duration then followed by 15-30 minutes (28%), majority them did not get suntan and more than half (58%) of them have used sunscreen.

Table 2: Diet pattern of samples with source of vitamin D

Items	Never or < month	Monthly	1-2/ mo	3-4/mo	5-6/mo	Weekly	2-3/wk	4-6 / wk	Daily
1. Milk, Vit. D fortified (cup)									
	67	15	20	8	6	19	13	3	49
	33.5%	7.5%	10.0%	4.0%	3.0%	9.5%	6.5%	1.5%	24.5%
2. Yogurt (cup)									
	41	17	16	24	10	15	19	15	43
	20.5%	8.5%	8.0%	12.0%	5.0%	7.5%	9.5%	7.5%	21.5%
3. Cereal Vit. D fortified (cup)									
	134	9	8	13	7	2	6	6	15
	67.0%	4.5%	4.0%	6.5%	3.5%	1.0%	3.0%	3.0%	7.5%
4. Liver cooked									
	79	26	31	18	11	13	12	1	9
	39.5%	13.0%	15.5%	9.0%	5.5%	6.5%	6.0%	0.5%	4.5%
5. Cod liver oil (1 teaspoon)									
	73	29	35	18	15	9	6	3	12
	36.5%	14.5%	17.5%	9.0%	7.5%	4.5%	3.0%	1.5%	6.0%
6. Fish cooked									
	37	17	25	21	14	14	22	11	39
	18.5%	8.5%	12.5%	10.5%	7.0%	7.0%	11.0%	5.5%	19.5%
7. Egg 1 whole									
	102	17	13	7	8	9	6	12	26
	51.0%	8.5%	6.5%	3.5%	4.0%	4.5%	3.0%	6.0%	13.0%

Table 3: Supplement of tablets vitamin D

Items	Never or < month	Monthly	1-2/ month	3-4/mo	5-6/mo	Weekly	2-3/wk	4-6 / wk	Daily
1. Multi-vitamins	134	25	10	7	4	12	3	1	4
	67.0%	12.5%	5.0%	3.5%	2.0%	6.0%	1.5%	.5%	2.0%
2. Calcium vitamins	150	16	11	9	2	5	2	0	5
	75.0%	8.0%	5.5%	4.5%	1.0%	2.5%	1.0%	0.0%	2.5%
3. Vitamin D3	154	8	11	7	7	1	4	1	7
	77.0%	4.0%	5.5%	3.5%	3.5%	.5%	2.0%	.5%	3.5%
4. Calcium + Vit D	124	59	8	4	1	2	2	0	0
	62.0%	29.5%	4.0%	2.0%	.5%	1.0%	1.0%	0.0%	0.0%

Sixty-eight-point five (68.5%) percent did not get diarrhea during last year.

77% have not taken vitamin D with sixty two percent (62%) have never taken Calcium + Vit D tablet.

Table 4: Classification of diet pattern (source of vitamin D) of Children and Adolescents

Classification of diet pattern	Frequency	Percent
Extremely poor	15	7.5
Very poor	21	10.5
Poor diet	84	42.0
Adequate	52	26.0
Fair diet pattern	20	10.0
Good diet pattern	8	4.0
Total	200	100.0

Table 2; shows that 1/3 of participants (33.5%) have never drunken Milk and Vit. D fortified while quarter (24.5%) of them drunk a cup daily.

Regarding yogurt; highest percent (21.5%) have eaten a cup of yogurt daily and the near the same range (20.5%) have never eaten a cup yogurt while most of them (67.5%) never or < a month eaten a cup Cereal Vit. D fortified. Also, thirty-eight (39.5%) of did not eat liver cooked.

Highest of participants (36.5%) have never drunken teaspoon Cod liver oil, 19.5% have eaten fish cooked, and more than half percent (51%) did not eat egg while 20% ate it daily.

Table 3: shows that most children and adolescents (67%) have never taken a tablet of multi-vitamins and three quarter (75%) did not take calcium vitamin and

Table 4: indicates that high percent of participants 84 (42%) were within level of poor diet pattern according to source of vitamin D.

Table 5; it shows that most of samples (30.5%) were in deficient level of vitamin (X±SD = 20.280± 13.256) followed by sufficient, insufficient, and severely deficient (24.5%, 23.5% and 21.5%) respectively.

There is no significant association between age group, gender, and level of vitamin D (p value > 0.05). But There is very high significant association between economic status, diarrhea and duration sun exposure with level of vitamin D (p value < 0.001) in which high level economically had severely deficient while middle status had low percent then low status also who had diarrhea in last year were more seen in severely deficient than non-diarrheic participants in which the level of vitamin D increased with increasing sun exposure (Table 6).

Table 5: Assessment Vitamin D3 Level of Children and Adolescents

Classification of Vitamin D level	Frequency	Percent
Severely deficiency (< 10 ng/ml)	43	21.5
Deficient (< 20 ng/ml)	61	30.5
Insufficiency (20-30 ng/ml)	47	23.5
Sufficiency (> 30 ng/ml)	49	24.5
Total	200	100.0
X±SD	20.280± 13.256	

Table 6: association between age, gender, economical level, diarrhea, and sun exposure with level of vitamin D

Items		Classification				Total	P-value Chi-square
		Severely deficiency	Deficient	Insufficiency	Sufficiency		
Age group	Infant	1	1	1	2	5	0.227
		20.0%	20.0%	20.0%	40.0%	100.0%	
	Toddler	2	4	4	1	11	
		18.2%	36.4%	36.4%	9.1%	100.0%	
	Preschool	3	16	12	7	38	
		7.9%	42.1%	31.6%	18.4%	100.0%	
	School age	18	27	16	19	80	
		22.5%	33.8%	20.0%	23.8%	100.0%	
	Adolescent	19	13	14	20	66	
		28.8%	19.7%	21.2%	30.3%	100.0%	
Total		43	61	47	49	200	
		21.5%	30.5%	23.5%	24.5%	100.0%	
Gender	Male	21	36	23	21	101	0.390
		20.8%	35.6%	22.8%	20.8%	100.0%	
	Female	22	25	24	28	99	
		22.2%	25.3%	24.2%	28.3%	100.0%	
Total		43	61	47	49	200	
		21.5%	30.5%	23.5%	24.5%	100.0%	
Economic level	Low	10	9	4	4	27	0.000
		37.0%	33.3%	14.8%	14.8%	100.0%	
	Middle	23	50	42	44	159	
		14.5%	31.4%	26.4%	27.7%	100.0%	
	High	10	2	1	1	14	
		71.4%	14.3%	7.1%	7.1%	100.0%	
Total		43	61	47	49	200	
		21.5%	30.5%	23.5%	24.5%	100.0%	
Diarrhea	Yes	24	13	11	15	63	0.001
		38.1%	20.6%	17.5%	23.8%	100.0%	
	No	19	48	36	34	137	
		13.9%	35.0%	26.3%	24.8%	100.0%	
Total		43	61	47	49	200	
		21.5%	30.5%	23.5%	24.5%	100.0%	
Sun exposure	< 5 minutes	19	5	5	3	32	0.000
		59.4%	15.6%	15.6%	9.4%	100.0%	
	5-15 minutes	19	26	19	13	77	
		24.7%	33.8%	24.7%	16.9%	100.0%	
	15-30 minutes	5	27	21	22	75	
		6.7%	36.0%	28.0%	29.3%	100.0%	
	> 30 minutes	0	3	2	11	16	
		.0%	18.8%	12.5%	68.8%	100.0%	
Total		43	61	47	49	200	
		21.5%	30.5%	23.5%	24.5%	100.0%	

There is very high significant association between diet pattern and level of vitamin D (p value < 0.001) in which high level of vitamin D was seen in good diet pattern (Table 7).

4. DISCUSSIONS

An important stage for developing skeletal and bone density are childhood and adolescence. Also, other factors have major role for getting optimal bone mass such as; genotype, diet, physical activity, and sufficient level of vitamin D. It also is affected by many other factors such as sun exposure to the sun, clothing mode, skin pigmentation, and latitude of region, eating of dairy products, fish, and vitamin supplementation [9].

In this study we assessed the level of vitamin D with some associated factors such as; sun exposure, consumption of source of vitamin D and vitamin supplements.

In recent study we found that just quarter of samples were within normal range of vitamin D otherwise the rest were within insufficient level (Table 5). The same result was discovered in retrospective study which done in Erbil city laboratories by Abdulrahman and Rahman, (2018), in which most of individuals living in Erbil city had deficiency of vitamin D [10]. There were many Studies reported vitamin D deficiency and insufficiency worldwide as follows.

Table 7: association between diet pattern and level of vitamin D

Classification of diet pattern		Classification				Total	P-value Chi-square
		Severely deficiency	Deficient	Insufficiency	Sufficiency		
	Extremely poor	6	4	5	0	15	0.000
		40.0%	26.7%	33.3%	.0%	100.0%	
	V. Poor	8	7	6	0	21	
		38.1%	33.3%	28.6%	.0%	100.0%	
	Poor diet	19	27	24	14	84	
		22.6%	32.1%	28.6%	16.7%	100.0%	
	Adequate	5	17	8	22	52	
		9.6%	32.7%	15.4%	42.3%	100.0%	
	Fair diet pattern	4	5	4	7	20	
		20.0%	25.0%	20.0%	35.0%	100.0%	
	Good	1	1	0	6	8	
		12.5%	12.5%	.0%	75.0%	100.0%	
Total		43	61	47	49	200	
		21.5%	30.5%	23.5%	24.5%	100.0%	

The same result also found by Hassan et al., (2019) they reported that a high prevalence of vitamin D deficiency in the study population with a majority 101

(53.7%) being vitamin D deficient, 64 (34.0%)

insufficient and only 23 (12.2%) had sufficient levels of vitamin D [11]. Also Higher frequency of vitamin D deficiency was discovered in compared to those in Europe, North America, and New Zealand [12]. on the other hand, one western population noticed to have a higher rate are adolescents in the Public Health England database where 20% of boys 11–18 years old and 24% of girls 11–18 years old demonstrated a 25(OH)D level <25 nmol/L [13].

A study in the Netherlands on school children by Voortman et al., (2014) also reported that 6.2% were severely vitamin D–deficient, 23.6% were vitamin D–deficient, 36.5% had sufficient concentrations, and only 33.7% had optimal concentrations [14].

Another Retrospective study consistent with our result which conducted in Ankara Turkey (2012) which assessed the records of four hundred forty (440) children and adolescents aged between 0 - 16 years; they found that 40% of the participants were vitamin D levels less than 20 ng/mL [15].

Deficiency of Vitamin D is public health problem in worldwide, with a reported prevalence of 30-80% in children and adults [16].

We noticed in our study that there is significant association was observed between duration sun exposure and level of vitamin D (p value < 0.001) in which the level of vitamin D increased with increasing sun exposure (Table 9).

Synthesis vitamin D via sun exposure, which may last twice as long in the blood compared with ingested vitamin D, particularly between 10:00 am and 3:00 pm. People who do not have exposure to sunlight are at risk for vitamin D deficiency if they do not ingest adequate amounts of foods that contain vitamin D [17].

A previous study in Kuwait reported that 25(OH) D levels were lower in the group that has no sun exposure compared with one has more sun exposure [18].

In our study we discovered that there is significant association between diet pattern and level of vitamin D (p value < 0.001) in which high level of vitamin D was seen in good diet pattern (Table 11). There is no doubt that poor diet pattern (source of vitamin D) lead to low level of vitamin D; this result agreement with previous result of Voortman et al., (2015) reported that the risk of vitamin D deficiency was lower in children with a higher diet quality score and in children with a high intake of margarines and cooking fats [14].

Also in the same time our participants in children and adolescents did not take enough supplements of vitamin D and multivitamins (Table 3). This result was agreement with a study done in Izmir on subjects of different socioeconomic levels; it was observed that subjects had lower vitamin D levels that these children were not receiving vitamin D supplementation [19].

Our study observed that there is association between economic status and level of vitamin D (p value < 0.001) in which high level economically had severely deficient while middle status had low percent then low status (Table 8).

This is consistent with result of the study which done on 378 children and adolescents in an ambulatory clinic at the King Abdul-Aziz University Hospital, Jeddah, Saudi Arabia (2016), they found a significant difference in the mean vitamin D levels between low and medium income families. High vitamin D levels in children from low-income families can be explained by their increased time spent playing outdoors and exposed to the sun, while children from medium- and high-income families often spend their time with the television, computer and mobile

[20]. Another study result in Netherlands was agreement with our study [14].

We found that there is association between diarrhea and level of vitamin D (p value < 0.01) in which the children and adolescents who had diarrhea in last year were more seen in severely deficient than non-diarrheic participants (Table 9). Several studies supported this result. A study done in Bogota, Columbia reported that vitamin D deficiency was associated with increased incidence of diarrhoea in school aged children [21]. As well another study conducted in Qalubia governorate, Egypt (2014); showed vitamin D deficiency to be associated with an increased rate of diarrhoea [22].

We noted in our study that there is no significant association between gender and level of vitamin D (p value > 0.05). This is meant that both gender (boys and girls) did not exposure to sun light because of skin pigmentation.

Opposite result was found in a cross-sectional study done in Kuwait by Alyahya (2017) showed that a significant difference was found between boys and girls in 25(OH) D (p = 0.0001) and Boys had a higher median 25(OH) D level than girls [18].

Also, no significant difference in vitamin D levels at the end of winter levels were observed between girls and boys (p=0.538) in Bağcılar, İstanbul, while the levels at the end of summer were significantly higher in boys (p=0.015). Sufficient sun exposure was significantly less common in girls than boys (p=0.011) [19].

We reported that statistically there is no significant association between age group and level of vitamin D (p value > 0.05) (Table 6) but highest level of severely deficiency was observed in adolescent group. This is agreement with a study done in German country demonstrated that lower vitamin D status in adolescents compared to toddlers [23].

It seemed that poor sun exposure, diet pattern and supplements of vitamin D are three major influential factors among Kurdish children and adolescents which contributed to deficiency of vitamin D.

5. CONCLUSIONS

The study concluded that high percentage of Kurdish children and adolescents in Soran and Erbil city had low level of vitamin D and poor diet pattern and few percentages took vitamin D supplements. Diet pattern, sun exposure, socio-economic status and diarrhea were influential factors which affected level of vitamin D, while age and Gender were non-significant factors.

AUTHORS' CONTRIBUTIONS

KJ contributed to the conception and design of the study, data analysis, and preparation of the manuscript. HO contributed data collection. HS and HM contributed to supervise and review manuscript. All authors read and approved the final manuscript.

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