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The Effect of Socioeconomic Status on Vitamin D Level in Children's and Adolescents Living at Jeddah, Saudi Arabia

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Abstract

Objective: Due to the limited number of studies on the connection between Vitamin D deficiency and socioeconomic status (household income, number of family members, and parents' education level) this research aimed to further investigate the relationship between socioeconomic state and vitamin D deficiency in Jeddah, Saudi Arabia.

Methods: A cross-sectional study of 378 children and adolescents in an ambulatory clinic at the King Abdulaziz University Hospital, Jeddah, Saudi Arabia was performed from March to September 2015. The parents answered a questionnaire with guidance from the researchers and consent was obtained to take a blood sample to check each child's vitamin D level.

Results: The mean age was 9.5 ± 3, 9 years, and 1.9% had normal vitamin D levels. The mean vitamin D level was higher in low-income families than those with average and high incomes. The level was higher in families with less than 3 members than in families have 3 to 6 or more than 6 members. The mean vitamin D level was higher in families where the father was less educated or uneducated than in families where the father was highly educated. The mother's education levels did not affect the mean vitamin D levels. On analysis with the Tukey test, we found that there was a significant difference in levels between families with low and medium income. The mean difference between low and average monthly income was 4.21 (p=0.034).

Conclusion: Low-income families had the highest mean vitamin D level. No significant correlations were found between vitamin D level and number of family members or parents' educational level.

Keywords: Vitamin-D deficiency; Socioeconomic state; Household income; Household income and nutrition; Family size; Parent's educational level

Abbreviations:

KAUH: King Abdulaziz University; SAR: Saudi Arabia Riyals; SPSS: Statistical Package for Social Science; SD: Standard Deviation; USA: United States of America; UK: United Kingdom

Introduction

In recent years, vitamin D deficiency has become a highly significant subject in the medical world; it has gained the attention of public health professionals and is now recognized as a worldwide epidemic [1]. One of the strongest predictors of vitamin D deficiency is socioeconomic status. This status is represented by low family income, increased family size and parents' educational levels.

Household income level plays an important role in vitamin D deficiency. Low-income families unable to access fortified foods and dietary supplements that contain vitamin D are more likely to have vitamin D deficiency than families with good income. A correlation also exists between vitamin D deficiency and number of family members. Increased family members often result in less parental attention to children's food requirements or less opportunity for close supervision of growth and nutritional health status of the children.

Generally, all parents, especially those with low education levels, believe that common food items are sufficient for their children and vitamin D supplementation is not required. In reality, most foods contain very little vitamin D, which not enough for proper growth and development.

There are few studies on this topic. Therefore, the aim of our research was to further investigate the relationship between socioeconomic state and vitamin D deficiency in the city of Jeddah, Saudi Arabia.

Methods

This is a retrospective cross-sectional study conducted in healthy children and adolescents, in an ambulatory clinic, from March 2015 to September 2015. The study population consisted of 378 children (male: 191 (50.5%); female: 187 (49, 5%); age range: (2-20 years Children younger than 2 years, bigger than 20 years and those with malnutrition, mal-absorption, chronic illnesses like hepatic or renal diseases, and those taking medications like anticonvulsant drugs were excluded from the study.

The parents were instructed to answer a self-reported questionnaire; an assistant guided them through answering the questionnaire. Verbal consent was obtained from the parents to take a blood sample from their children to check the vitamin D level. The normal range for vitamin D level was determined to be from 50 to 75 ng/mL. A level lower than 50 ng/mL was considered deficiency and more than 70 ng/mL was considered high. Children aged between 12-18 years answered the questionnaire on their own. We excluded the children who supplied incomplete questionnaires and whose data was lacking.

Ethical approval was obtained for this study from the Research Ethics Committee at King Abdul-Aziz University Hospital (KAUH).

The Questionnaire

The questionnaire consisted of questions regarding the parent's occupation, education level, family income, type of residence, number of family members and the nutritional state (type of consumed food) of the children.

Considering that a majority of the study population was from Jeddah, the sample in our research was divided into 3 groups according to their income. Less than 5000 Saudi Arabia riyals (SAR) was considered low income, between 5000 and 10,000 SAR was considered average income and more than 10,000 SAR was considered good income. The research population was also stratified according to the number of family members. The population was divided into 3 groups: less than 3 members, from 3 to 6 members, and more than 6 members. Based on the parent's education level, the sample was divided into uneducated, low education level, and high education level.

Blood Analysis

After the parents' consent was obtained, we took a blood sample from the parents and their children in order to check their vitamin D levels. The blood analysis was done in King Abdul-Aziz university hospital.

Statistical Analysis

Data was entered, coded, and analysed using the statistical package for social science (SPSS), version 16.0 (IBM, Armonk, NY, USA). Standard descriptive statistics were presented as percentages or mean ± SD. The Tukey HSD test for equality of variances was used to test the normal distribution of variables in the groups. Analysis of variance was used to analyse the differences of the mean vitamin D level among monthly income average, parent's educational levels and number of family members. The results were considered significant with $p<0.05$ or $p<0.01$.

Results

The sample included 378 children, (female: 187, male: 191), with a mean age of 9.5 ± 3.9 years. The vitamin D level was normal in only 7 (1.9%) children. Table 1 illustrates the frequency and percent of study populations according to household income, family members, father's education and mother's education levels. The mean vitamin D level was higher in low-income families (29.73) than in families with average (25.52) and good (26.9) incomes. Families with less than 3 members had a higher mean level (32.97) than did families with 3 to 6 members (27.7) and families with more than 6 members (25.6). There was no difference in the mean vitamin D level based on the fathers education levels; families having uneducated fathers (27.3), fathers with low education (27.5), and highly educated fathers (26.7) all had mean vitamin D levels. Also, there was no difference in the mean vitamin D level based on the mother's education levels; families having uneducated mothers (25.9), mothers with low education (27.33) and highly educated mothers (26.8) all had similar mean vitamin D levels.

Variables	Categories	Frequency	Percent
Household income	Low	72	25.40%
	Average	88	31.00%
	Good	124	43.70%
Family members	Less than 3	2	0.70%
	3-6	188	63.10%
	More than 6	108	36.20%
Father's Education	Uneducated	10	3.30%
	Low	103	34.00%
	High	190	62.70%
Mother's Education	Uneducated	23	7.70%
	Low	112	37.30%
	High	165	55.00%

Table 1: The frequency and percent of study populations according to many variables

There is significant evidence to reject the null hypothesis (Table 2). In low-income families, the vitamin D level was higher than in families with average income. Therefore, we concluded that monthly income categories had significantly different vitamin D levels ($p=0.041$). However, the actual difference in the mean levels between the different monthly income groups was clear after using the Tukey HSD test. We found that there was significant difference between low- and medium-income families (mean difference 4.21, $p=0.034$) (Figure 1).

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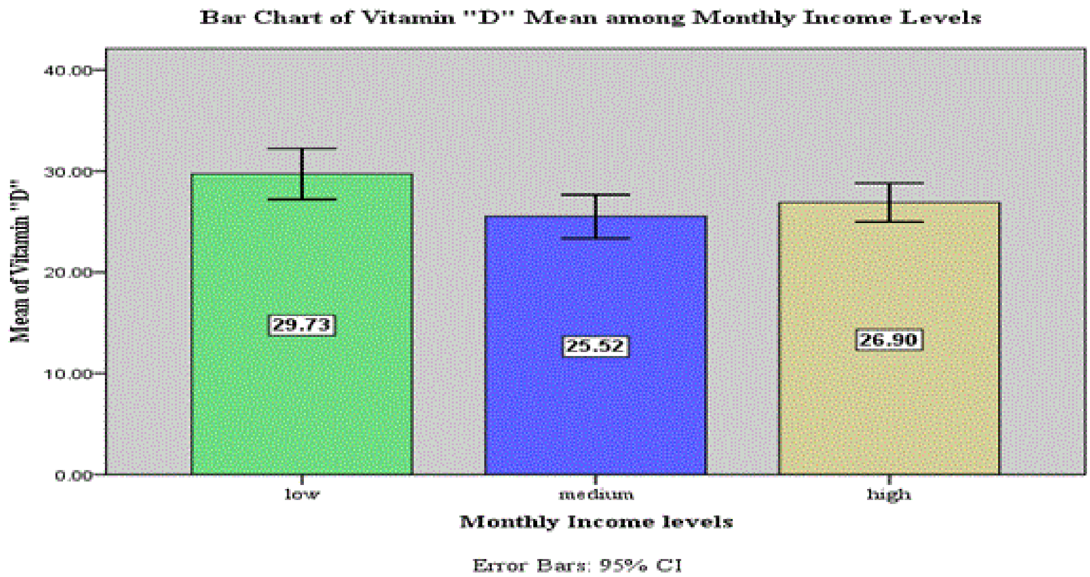

Figure 1: Bar chart of vitamin D mean among monthly income levels.

Categories	Mean ± Std. Deviation	p-value
Low	29.7 ± 10.74	0.041
Medium	25.5 ± 10.11	
High	26.9 ± 10.74	

Table 2: Testing the difference of vitamin D mean in correlation with monthly income average by using one-way ANOVA test.

There was no significant difference in mean vitamin D levels according to number of family members (p=0.181), although we noted that the mean vitamin D level was higher in families with less than 3 members than in families with 3 to 6 or more than 6 members (Table 3).

Categories	Mean ± Std. Deviation	p-value
Less than 3	32.97 ± 16.42	0.181
3-6	27.7 ± 10.7	
More than 6	25.6 ± 9.82	

Table 3: Testing the difference of vitamin D mean in correlation with number of family members by using one-way ANOVA test.

No significant differences were noted in mean vitamin D levels based on the father's education (p=0.839) (Table 4). However, we did note that the mean vitamin D level was higher in families where the fathers had low or no education than in families with highly educated fathers.

Categories	Mean ± Std. Deviation	p-value
Uneducated	27.30 ± 10.89	0.815
Low	27.45 ± 10.52	
high	26.70 ± 10.48	

Table 4: Testing the difference of vitamin D mean in correlation with father's education levels by using one-way ANOVA test.

No significant difference was noted in the mean vitamin D levels according to the mother's education levels (p=0.815) (Table 5). However, it was noted that mean vitamin D levels were lower in families with uneducated mothers and higher in families where the mothers had a low or a high level of education.

Categories	Mean ± Std. Deviation	p-value
Uneducated	25.9 ± 8.56	0.815
Low	27.33 ± 10.23	
High	26.8 ± 10.82	

Table 5: Testing the difference of vitamin D mean in correlation with mother's education levels by using one-way ANOVA test.

Discussion

This study explored the variations in vitamin D intake and vitamin D levels according to socioeconomic status. As mentioned earlier, there is a relationship between family income and vitamin D levels; this is because income directly affects nutritional status. For example, children from low-income families have less access to vitamin D-rich foods like fatty fish, beef liver, egg yolks and cheese than do children from families with average or good income [2,3]. There is also a significant correlation between family size and vitamin D levels, due to the fact that smaller families are usually privy to better levels of education, income, health, and economic level than larger families. As very few common food items contain vitamin D, which is essential for children's growth and health, most children are recommended vitamin D supplementation. Parents should be educated regarding the importance of this supplementation for their children. If the parents are educated, they are more likely to understand the need for this supplementation and act on the advice they receive.

The sample in our study was divided into three groups based on family income: low-income (25.4%), average-income (31.0%), and good-income (43.7%) families.

Household income is reported to have a significant correlation with vitamin D levels; a study by Wallace et al. on children 4 years or older in the USA showed that children from low-income families may be at greater risk of calcium and vitamin D insufficiency [4]. In another study on 4,167 children (mean age, 6 years) in the Netherlands, the risk of vitamin D deficiency was higher in children of mothers who had a lower income [5]. However, a study of 175 male adolescents aged 13-17 years in Paris did not show any correlation between household income and vitamin d levels [6]. Another cross-section study in Thailand (159 children aged between 6-12 years) reported that household income was not different between children with low vitamin D levels and those with adequate levels [7]. In our study, we found a significant difference in the mean vitamin D levels between low and medium income families (difference of 4.21, p=0.034). 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.

The study in the Netherlands also 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 [4]. In a cross-sectional study on 8214 children aged less than 19 years in the USA, it was reported that the total dietary intake of vitamin D was significantly greater in the high-income than in the medium-income group [8]. Another study in the USA on 382 healthy children aged 6-21 years and a Canadian study on 1753 healthy children aged 9, 13 and 16 years have shown that serum vitamin D levels are lower among low-income youth [9,10]. Significant differences were seen in vitamin D intake between high- and low-income families in two studies, one in the UK (7,474 children in Bristol, mean age 10 years) [11] and one in Madrid, Spain (110 pre-school children) [12]. In the present study, no significant difference was seen in the intake of vitamin D-rich food such as fatty fish, beef, liver, egg yolks, and cheese according to household income. This was unexpected, because families with high incomes are supposed to have better access to fortified food and dietary supplements than those with low income. The similarity in vitamin D levels across all 3 categories of income may be due to increased consumption of junk food in children, in addition to reduced attention from parents.

A study in Finnish children aged 3 months to 3 years reports that the intake of vitamin D through foods and supplements was more often insufficient in families with more than three children than in families with only one child [13]. However, in this study, no significant difference in vitamin D levels was noted based on the number of family members (p=0.181). In contrast, in our study, we noted that the mean vitamin D level was higher in families with less than 3 members than in families with between 3-6 and more than 6 members. This could be due to the fact that smaller families can provide more attention to their children and more closely supervise their children's growth and nutritional health status.

The Finnish study also confirmed that there is a positive correlation between parental education and vitamin D supplementation to children [13]. A study of public elementary schools in Corvallis, USA reported that vitamin D deficiencies are seen even in highly educated communities [14]. Parental education has a significant association with vitamin D deficiency in children, as noted in a study in Britain on children aged between 6 months and 5 years. This is thought to be due to the fact that parents do not have sufficient knowledge about the importance of vitamin D supplementation in their children, which has a noticeable effect on vitamin D levels. In our study, no significant difference was seen in vitamin D levels according to the father's education levels (p=0.839), but we noted that the mean vitamin D level was higher in families with low and uneducated fathers than in families with highly educated fathers, although it is expected that highly educated fathers have greater access to fortified food and dietary supplements for their families due to their high income. Also, no significant difference in vitamin D levels was seen according to the mother's education levels (p=0.815); however, we noted that the mean vitamin D levels were lower in families with uneducated mothers than in families with low and highly educated mothers. This can be explained by their insufficient knowledge about the importance of vitamin D supplementation due to their poor educational level.

Conclusion

Our study suggests that the prevalence of vitamin D deficiency in Saudi families was not significantly correlated to socioeconomic status. Nevertheless, this represents a major public health concern in Saudi Arabia. Therefore, public health efforts should concentrate on making vitamin D-fortified foods more available to the public, encourage the consumption of such fortified foods, and educate people on the use of supplements to improve vitamin D levels in Saudi families, especially those with low socioeconomic status.

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