Original Article

The relation of the serum 25-hydroxyvitamin d level with the BMI of the children over 2 years old among the patients referred to javaheri hospital during 2017

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ABSTRACT

Background and Purpose: Regarding the high prevalence of vitamin D deficiency and obesity , there are evidences which show that there are inverse relations between serum 25-hydroxyvitamin D level and the Body mass index (BMI) of children; concerning the limited studies in this field and the paradoxical information, this study has been planned and performed with the aim of analyzing the relation between serum 25-hydroxyvitamin D level with the BMI of the children over two years old among patients referred to Javaheri Hospital during 2017. Materials and Methods: In this descriptive and cross-sectional study, 150 children over two years old have been examined by serum 25-hydroxyvitamin D level test, and the weight of each child has been measured and recorded. It will be considered either as the vitamin D deficiency when serum 25-hydroxyvitamin D level be less than 10 ng/ml and when its level is 10-30 ng/ml, like the Vitamin D insufficiency. Gathered data in SPSS software has been revised, and 25 inputs with recourse to the statistical tests like Kolmogorov-Smirnov, Shapiro-Wilk, chi-square, Mann-Whitney, *and* Kruskal –Wallis be evaluated in two quantitative and qualitative scales.Findings: Individuals understudy have been in the range of 2-11 years old with an average of 2.1±4.28. Seventy-eight of the individuals understudy were girls (52%). The BMI range of the examined children was 12.29 -26.73 kg/m2, with a mean of 15.4 ± 2.13 kg/m2. According to the findings of this study, it is revealed that from the aggregate of 150 children with the demographic characteristics as mentioned-above, 6.7 percentages are afflicted with vitamin D deficiency, and 54.7 percent are afflicted with insufficient vitamin D level. Assuming 5 percent error of the Vitamin D deficiency and insufficiency prevalence in children respectively, are calculated as $CI_{95\%} = [3.6. -10.8]$ and $CI_{95\%} = [50.8. -58.8]$. Also, no significant relations between serum vitamin D level of children with the BMI, and between age and gender have been observed (P-Value>0.05). Discussion & Result: In our study, 61.4 percentages of children are afflicted with either deficiency or insufficiency of vitamin D. Concerning the undesirable Vitamin D status, it is recommended that further analysis be done for finding vitamin D deficiency causes and its prevention and treatment with vitamin supplements.

Keywords: Vitamin D, BMI, Children, Vitamin D Deficiency

Introduction

Vitamin D in all human life stages plays an essential role in body health [1]. Chemical structure of vitamin D is similar to steroid hormones and, like them, plays its part through Nuclear receptors (VDR), which will be manifested via cells of most organs like brain, skin, prostate and breast [2, 3]. Vitamin D will be synthesized in skin and will transfer to the liver through the blood flow and be hydroxylated via 25-hydroxylase enzyme and will turn into calcidiol (25 (OH)D). Then calcidiol transfer to kidney and the active form of Vitamin D or Calcitriol (25(OH)D) will be synthesized via Renal 1-alpha hydroxylase [4-7]. Calcitriol levels in the blood circulation with the half-life of 1-2 months, indicate vitamin D status in all aspects of production, absorption, and resources of vitamin D [8]. Vitamin D can be found in the nutritional resources like fish oil (salmon, sardine), yolk and fortified milk [9]. Unfortunately, in most cases, the amount of vitamin D which is available to the human body via nutritional resources is not sufficient; nevertheless, fortified nutritional resources are limited and are not able to provide the

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required amount for the human body. This point is enumerated as the most crucial cause of the prevalence and the epidemic of vitamin D deficiency in European and American countries. Vitamin D production, under the exposure to the radiation of the ultraviolet sunray in human skin, is its most vital providing source for the human body [10]. Its significant functions are setting Calcium and phosphorus homeostasis and aid to the bone mineralization, at the same time, the wide distribution of the intercellular receptors of this vitamin can be seen among various tissues [11]. Vitamin D strengthens absorption of phosphorus and calcium from bowels and their emission decrease from kidney, and the ameliorated ossification. Therefore, its deficiency is an essential factor in the manifestation of the metabolic bone disorders [12]. Vitamin D deficiency occurs either when mothers don't receive appropriate nutrition or when they are not exposed to the ultraviolet B rays (UVB, 290-320 nm) [13]. The serum level of 25 (OH) D will be used as the certified criterion for assessing this vitamin status [14]. The prevalence of Vitamin D deficiency is widely reported in healthy infants, children, adolescents and adults in the developing and developed countries [15-19]. Studies that have been done in Iran in the cities of Tehran and Isfahan, have respectively reported the amount of vitamin D deficiency prevalence in Tehrani children and adolescent girls during the years 2009 and 2010, as 43.6 and 42 percent. And in Isfahani adolescent girls in 2004, the amount of vitamin D deficiency prevalence is 72 percent [20-22]. Despite the importance of Sun role in vitamin D synthesis, in recent studies, it has been revealed that the amount of vitamin D deficiency is higher in sunny areas which include Middle East countries like Saudi Arabia, Qatar, the United Arab Emirates, Turkey, India and Iran; because in these areas exposure to the sun is much less due to cultural factors [23-25]. Considering the vitamin D status of the body will be done by evaluating serum level 25 (OH) D.

In addition to the skeletal traces like the preservation of the normal bone remodeling, mineralization during adulthood and prevention from rickets in children, it has been recently reported that vitamin deficiency plays a role in the development of many chronic diseases like obesity, hypertension, cardiovascular diseases, diabetes mellitus, metabolic syndrome, auto-immune and inflammatory diseases and some cancers [26, 27]. Nowadays, obesity is to be regarded as the most prevalent nutritional disease among Iranian children and adolescents [28]. Obesity and its consecutive problems impose extravagant expenses on societies. Iran is a country with moderate income, which is experiencing quick epidemiologic transition [29]. Adolescent overweight or obesity increases hypertension, abnormal lipid profile (blood cholesterol disorder), Diabetes type 2 and advanced atherosclerosis [30]. The amount of vitamin D is low in mother's milk [31]. Therefore, deficiency of this vitamin is more common among breastfed infants [32]. If the mother herself also has vitamin D deficiency, her infant problem and scarcity be exacerbated; in this regard using the formula, fortified milk or nutritional supplements with the content of vitamin D like vitamin AD and D droplets and multivitamin for compensation will be prescribed for infants in order to prevent this vitamin deficiency [33].

In the study of Cizmecioglu et al. in 2012 in Turkey, on 301 girls and boys at the age of 11-19 including, 177 girls and 124 boys have been defined that 12 percentages of them are suffering from vitamin D deficiency. Insufficient levels of this vitamin have also been reported in 53 percentages of them. The results also show that serum 25 (OH) D level is decreased with the BMI increase. Holistically, girls were more than boys exposed to this vitamin deficiency [34]. In the study of Bonakdaran et al. in 2015, it has been defined that 85.6 percentages of children are afflicted with vitamin D deficiency and only 31children had sufficient levels of vitamin D. Findings of this study show that vitamin D deficiency has high prevalance among the children between 2-7 years old. In this study, no significant relationships between vitamin D and BMI have been found. Also, no significant relationships between waist circumference and serum level of vitamin D have been observed [35]. Concerning the importance of diagnosis and treatment of vitamin D deficiency for prevention from its complications, the researchers in this study are therefore coping with the analysis of the relation between vitamin D with the BMI of children above two years old.

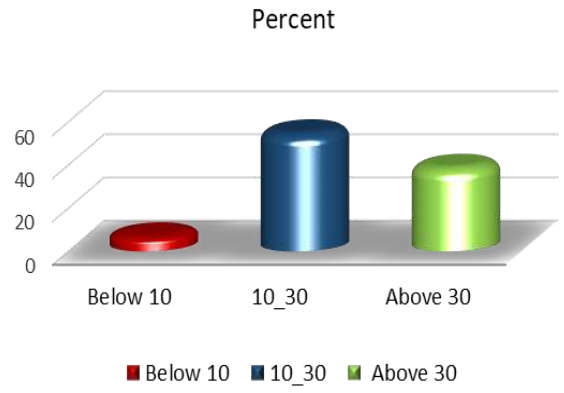
Materials and Methods

This descriptive and cross-sectional study have been done on 150 children over 2 years old referred to Javaheri Hospital in Tehran in 2017. Standards for entering this review include inclination of children family for attendance and standards for leaving the review consists of children family's lack of inclination for the continuation of their participation in the study, impossibility of measuring serum vitamin D level and the presence of hereditary or genetic diseases. Sampling was natural and random. In this study, all the Helsinki principles have been used. After confirmation in the Ethics Committee of Islamic Azad University, Tehran Medical Branch (Code of Ethics: IR.IAU.TMU.REC.1396.43), the individuals have been analyzed for facilitating the research purpose. To gather data, the researcher has used information-gathering form and the required blood sample has been provided by an inexperienced laboratory technician that in an appropriate condition could be transferred to the laboratory in order to be examined by the experienced technicians in the blood transfusion laboratory. Demographic information has been gathered through an interview in person and through a structured questionnaire. Then experienced technicians of the laboratory will provide two ccs Blood of the cases and transfer it to the laboratory in an appropriate condition. Then serum 25-hyroxyvitamin D level will be measured and each child height and weight will be measured and recorded. Then through statistical parametric and non-parametric tests, the relation between serum 25-hyroxyvitamin D level and the body mass index will be measured. Finally,

gained data will be analyzed by means of statistical software SPSS version 25, for the quantitative variants, average and standard deviation and for the qualitative variants, absolute and relative frequencies were recorded. Appropriate statistical tests are used for the analysis of relations.

Findings

Results of this research have revealed that children above two years old have the average height of 85-145 cm with the medium of 105.813 13.862± cm, weight average of 10.4 -48 kilograms with the medium of 17.8± 6.5 kilograms and the average BMI of 12.29 – 26.73 kg/m2 with the mean of 15.472.127± kg/m2 and all individuals understudy were in the range of 2-11 years old with average of 2.0894.283±. Moreover, Girl children with 52 percent (78 No) among the whole cases understudy comprise the majority in the survey. Nevertheless, serum vitamin D level of children has been reported in the range of 3-137 ng/ml, with an average of 30.76 ± 19.94 ng/ml. Serum vitamin D level has been estimated as in 10 cases (6.7 percent), below 10 ng/ml, in 82 cases (54.7 percent) between 10-30 ng/ml and 58 cases (38.7 percent) above 30 ng /ml; in other words, insufficiency and deficiency of vitamin D have been observed in 61.4 percentages of the children under analysis in our study (Graph 1).



Graph 1- Serum vitamin D level in the children understudy (ng /ml)

Table 1 shows the relations between body mass index (BMI) and serum vitamin D level in the children above two years old understudy. Average serum vitamin D level is observed in 38.8 percentages of the cases with the BMI below 18.5 kg/m2 and 30 percentages of the cases with the BMI of 18.5-24.9 kg/m2. Spearman Correlation test has also shown that there is no relation between BMI and vitamin D (P-value= 0.906).

Table 1: Spearman Correlation Test-Analysis of the Relation between Serum Vitamin D level of Children and BMI

		BMI	Vit D
BMI	Correlation Coefficient	1.000	-.010
	Sig. (2-tailed)	.	.906
	N	150	150
Vit D	Correlation Coefficient	-.010	1.000
	Sig. (2-tailed)	.906	.
	N	150	150

The average of the serum vitamin D level in girls and boys is respectively estimated as 30.9420.84± and 30.5619.05±. In 38.5 percentages of girls and 38.9 percentages of boys, the normal level of vitamin D has also been observed. Mann-Whitney and chi-square tests have shown that, these differences are not meaningful, and there are no relations between gender and body mass index (BMI) (P-Value>0.05) (Table 2 and 3).

Table 2: Mann Whitney Test - Comparison of the Serum Vitamin D Level according to the Gender of the Cases

P-Value	Standard Deviation	Medium	Gender
0.867	20.84409	30.9462	Girl
	19.04978	30.5583	Boy

Table 3: Qui-Square test - Analysis of serum vitamin D level according to the Gender (in Qualitative Scale)

P-Value	Above 30 N(%)	10-30 N(%)	Below 10 N(%)	Gender
0.867	30(38.5 %)	42(53.8 %)	6(7.7 %)	Girl
	28(38.7 %)	40(55.6 %)	4(5.6 %)	Boy

It has been reported that, the average age of the individuals who are afflicted with vitamin D deficiency, Insufficiency levels and normal vitamin D levels is respectively 4.351.55±, 1.864.27± and 4.282.47± ng/ml. Kruskal –Wallis test has shown no meaningful relationship between the age of children and their BMI (P_Value=0.551) (table 4).

Table 4: Kruskal –Wallis Test for the Analysis of the Average Age of children According to the serum vitamin D level

P-Value	Standard Deviation	Medium	Vit D
551.0	1.54650	4.3500	Below 10
	1.85950	4.2744	10-30
	2.47463	4.2845	Above 30
	2.08978	4.2833	Total

Gained findings of the Spearman test are indicative of no relation between age and body mass index of the cases (P-Value= 0.514) (table 5).

Table 5: Spearman Correlation Test- Analysis of the Relation Between Age and the BMI of the Cases Understudy

Correlations

		BMI	Age
BMI	Correlation Coefficient	1.000	.054
	Sig. (2-tailed)	.	.514
	N	150	150
Age	Correlation Coefficient	.054	1.000
	Sig. (2-tailed)	.514	.
	N	150	150

Sixty percentages of the case with healthy BMI are girls and 40 percentages of them are boys. Qui-square test shows that these differences are not meaningful, and there are no significant relations between gender and the BMI of children (P-Value=0.511) (table 6).

Table 6: Qui-Square test – Analysis of the body mass index of children according to their genders

		Gender		P-Value
		Girl N(%)	B N(%)	
BMI	<18.5	72(51.8%)	67(48.2%)	0.511
	18.5-24.9	6(60.0%)	4(40.0%)	
	25-30	0(0.0%)	1(100.0%)	

Discussion

Done analyses have shown that in children understudy about 61.4 percentages of them have vitamin D deficiency. Nevertheless, findings of this research have shown that there are no meaningful relations between gender and body mass index (BMI) . The prevalence of vitamin D deficiency and insufficiency in the study of Neyestani et al. [36] have been reported 86 percent. Dong et al. [37] in 2010 have indicated that the total prevalence of insufficient vitamin D levels and vitamin D deficiency is respectively 56.4 and 28.8 percent. In the study by Abadkooh et al. (2014), 100 percentages of the cases understudy, which includes adolescent girls, had vitamin D insufficiency [38]. Studies mentioned above, in comparison with this research, show a higher prevalence of deficiency. Among the causes of the observed differences, different geographical regions, sample volume and the season of the project performance and the different society from the viewpoint of gender, age and BMI can be mentioned.

Zhou et al. in 2015, with analyzing children between 1-5 years old of Adelaide city in Australia have estimated vitamin D deficiency and insufficiency as 4 and 16 percent [39]. Vitamin D deficiency is entirely parallel with the gained findings of our study and is opposed to the reported results of vitamin D insufficiency. Nevertheless, in the survey by Abadkooh et al. in 2014, a negative correlation between serum level 25-hyroxyvitamin D and waist circumference [38]. In the study by Taheri et al. (2012), fasting serum *25(OH)*D level with BMI had inverse relations in both groups of diabetic patients and diabetes control; this relation was meaningful in diabetic patients [40]. In another descriptive cross-sectional study, analysis of vitamin D deficiency prevalence on 1111 children 9-12 years old (573 boys and 538 girls) has been done. Dietary calcium intake is specified by utilizing FFQ in 503 cases understudy; Serum vitamin D had an inverse relation with body mass index [36].

In the current research, the relation between body mass index (BMI) with the serum vitamin D level in children over two years old has been considered; that gained results of this study shows that there are no relations between BMI and vitamin D in these cases. Moreover, in the analysis between serum vitamin D level and children's gender, it has been found that no significant variation can be seen between vitamin D and gender in terms of statistics. On the contrary, in the study by Delvin et al. in 2010 with the analysis of 867 girls and 878 boys in the range of 9-16 years old, no significant links between serum vitamin D and BMI could be found [41]. Besides, in the study by Muhairi et al. with the analysis of 315 cases in the range of 15-18 years old (including 150 boys and 165 girls), it has been revealed that 65.1 percentages of the cases are either afflicted with vitamin D deficiency or the insufficiency levels of it. Vitamin D deficiency in 10 percent of the boys and in 28 percent girls has been reported. Vitamin D deficiency has shown meaningful relation with female gender, fast food consumption and BMI increase [42]. Dong et al. (2010) have observed meaningful relations between serum 25 (OH) D and abdominal obesity in the analysis of the serum vitamin D status with obesity in American adolescents [37]. Whereas, studies by Muhairi et al. [42] and Cizmecioglu et al. [34] proved that girls had shown lower levels of vitamin D than boys. the reason for this difference can be found in the difference of the age ranges in our study. In our study, cases were in age range of 2-11 years old and in this study all cases were in their adolescence and adulthood. Because one of the reasons for the differences in the levels of vitamin D levels was based upon gender which is per se relevant to the dress of the cases and as in lower ages boys and girls have relatively the same dressing, perhaps these differences can be justified.

Conclusion

In our study, it has been estimated that the prevalence of vitamin D deficiency between 3.6 to 10.8 percent, and the prevalence of this vitamin insufficiency is 50.8 to 58.8 percent; which is suggestive of the high incidence of the low levels of vitamin D in children. Moreover, there are no meaningful relations between serum vitamin D level of children with their BMI, age and gender.

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