REVIEW

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Relationship between vitamin D levels with nutritional status and children's obesity in Saiful Anwar Hospital, Malang

Anik Puryatni[1*], Harjoedi Adji Tjahjono[1], Hanna Tetty[1]

[1]Nutrition and Metabolic Diseases Division, Pediatric Department, Faculty of Medicine, Universitas Brawijaya, Malang, East Java, Indonesia.

*Corresponding to:
Anik Puryatni;
Nutrition and Metabolic Diseases Division, Pediatric Department, Faculty of Medicine, Brawijaya University, Malang, East Java, Indonesia;
anik26.fk@ub.ac.id

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ABSTRACT

Background: Obesity is a condition marked by an excessive buildup of body fat tissue and is characterized by a recognizable clinical picture. An imbalance between energy intake and energy output leads to obesity. Both obesity and vitamin D insufficiency are serious health issues of the present. It was claimed that the mobilization of free fatty acids from adipose tissue might be impacted by active vitamin D (1,25-dihydroxy vitamin D). This study aimed to find a relationship between vitamin D levels with nutritional status and children's obesity in Saiful Anwar Hospital.

Methods: This study used a cross-sectional approach with a consecutive sampling method. Seventy-five subjects met the inclusion criteria in the Saiful Anwar Hospital Malang pediatric ward in February-March 2022. The samples were then examined for vitamin D levels. Subjects were grouped based on good nutritional status, overweight, and obesity. The basic characteristics of the research subjects included gender, age, anthropometric status, nutritional status, and vitamin D levels.

Results: The results showed that vitamin D levels were lower in overweight and obese children (median 17.6 and 14.08 kg/m^2) than in normal nutrition children (median 34 kg/m^2). Vitamin D and children's nutritional status had a significant relationship (p=0.001).

Conclusion: Vitamin D levels and children's nutritional status were significantly correlated, with vitamin D levels being lower in overweight and obese children than in children with normal nutrition.

Keywords: good nutrition, obesity, overnutrition, vitamin D.

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INTRODUCTION

Obesity is a state of excessive accumulation of body fat tissue characterized by a characteristic clinical picture. Anthropometrically, overnutrition is measured based on the Z-score using the WHO curve according to the Regulation of the Minister of Health of the Republic of Indonesia number 2 of 2020, where the Z-score of weight/height in the second and the third standard deviation (SD) is classified as obesity in children aged 0-60 months. Children aged 5-18 years with body mass index (BMI)/age within the first SD range will be classified as overweight, and if they are in the second SD range, they will be classified as obese.[1] The cause of obesity is an imbalance between energy intake and expenditure, which leads to an excess of energy that is then stored as fat tissue. This energy balance disorder can be caused by exogenous factors (primary obesity) due to nutrition, as much as 90% and endogenous factors (secondary obesity) due to hormonal disorders, syndromes, or genetic defects. Over the past 30 years, the prevalence of obesity in children and adolescents has drastically increased.[2] Obesity is also associated with 1,25-dihydroxyvitamin D or vitamin D deficiency; both are health problems today. It was stated that active vitamin D could affect the mobilization of free fatty acids from adipose tissue, where vitamin D is needed to maintain bone health and the body's immune system.[3,4] This study aimed to find a relationship between vitamin D levels with nutritional status and children's obesity in Saiful Anwar Hospital.

METHODS

Study participant

The pediatric ward of Saiful Anwar General Hospital in Malang, Indonesia, hosted this cross-sectional study from February to March 2023. Consecutive sampling was used to collect the sample. Patients who met the following inclusion criteria: hospitalized patients in the children's section of RSSA with age <18 years, children with good nutrition, overweight, and obese in Saiful Anwar General Hospital, the patient has not received vitamin D supplementation. The exclusion criteria for this study are that neither the subject's parents nor their legal guardians signed the study's written informed consent nor agreed to participate. To approve the use of their data for the analysis, all patients (or, in the case of pediatric patients, their parents or legal guardians) must provide a written informed consent. The privacy of the patient's data was always upheld.

Study variable

Data were collected using consecutive sampling techniques during the cross sectional study: sociodemographic, nutritional status, general clinical characteristics of the patients, and vitamin D. According to BMI/age calculation, children aged 0-60 months will be classified as (1) well nourished if their BMI/age calculation within -2 SD until +2 SD, (2) over-nutrition if their BMI/age calculation within +2 SD until +3 SD, and (3) obesity if their BMI/age calculation over +3 SD. Meanwhile, in 5-18 years old children, they will be classified as (1) well nourished if their BMI/age calculation is within -2 SD until +1 SD, (2) over-nutrition if their BMI/age calculation is within +1 SD until +2 SD, and (3) obesity if their BMI/age calculation over +2 SD. We employed the total level of 25(OH) vitamin D to measure the vitamin D levels. The levels of vitamin D will be categorized as toxic (>100ng/mL), inadequate (20 ng/mL), insufficient (20-29 ng/mL), and sufficient (30-100 ng/mL). The laboratory examination method used is Enzyme-linked Immunosorbent Assay (ELISA).[5]

Statistical analysis

Descriptive statistics were used to present each piece of data. Means, standard deviations, or median values with an interquartile range are used to express quantitative variables. The frequency of qualitative factors was mentioned. Furthermore, patients were separated into three categories based on their nutritional status: obesity, overnutrition, and good nutrition. The Chi-Square, T-test, or Mann Whitney-test were used to assess the variations in mean value between groups. The Pearson or Spearman correlation test was used to do the correlation analyses. Using IBM SPSS Statistics ver. 25.0 (IBM Corporation, New York, USA), which regarded a p-value of 0.05 to be statistically significant, all statistical analyses were carried out.

Table 1. The demographic and clinical characteristics of the subjects

Variables	Value
Gender, n (%)	
Male	40 (53.3%)
Female	35 (46.7%)
Age (years), median (min-max)	8 (0.25 – 17)
Body weight (kg), mean ± sd[a]	40.15 ± 21.19
Body height (cm), mean ± sd[a]	125.74 ± 27.67
BMI (kg/m²), median (min-max)	20.8 (14.7 – 66.10)
Arm circumference (cm), median (min-max) [b]	22 (13-36)

Note: [a] Normal distribution; [b] Abnormal distribution

Table 2. Differences in vitamin D (25(OH)D) levels based on the nutritional status

Nutritional status	Vitamin D Levels (25(OH)D)		p
	Median	Min-max	
Normal (n=13)	34.0	10.0 – 44.0	0.001**
Overweight (n=31)	17.6	2.0 – 55.26	
Obesity (n=31)	14.08	3.09 – 56.92	

Note: variable relationships were analyzed by Kruskal Wallis test; * p<0.05; ** p < 0.01

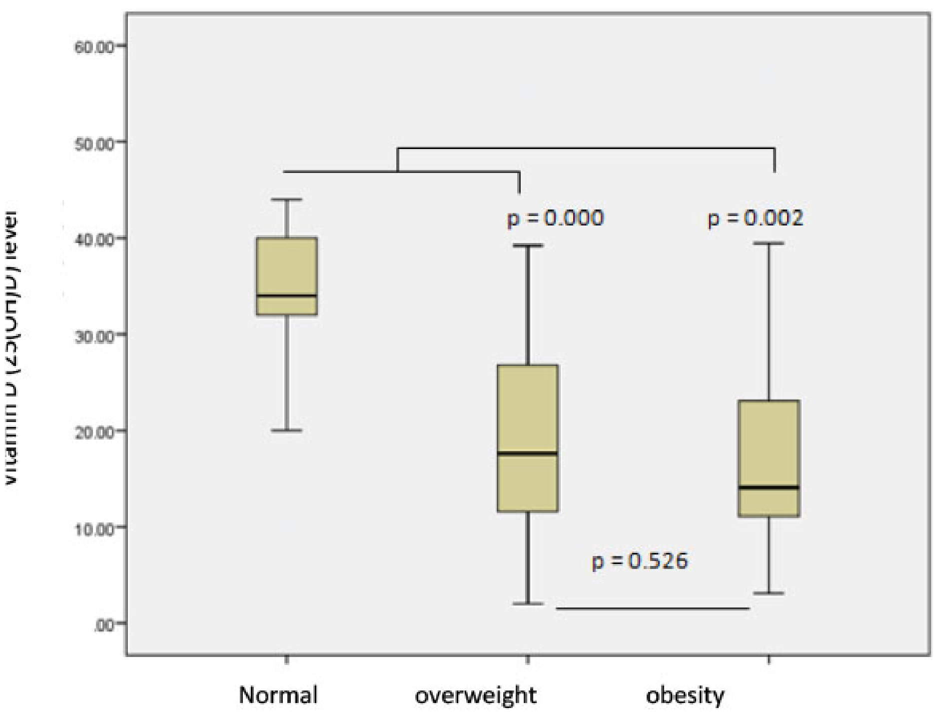

Figure 1. Comparison of vitamin D levels in various anthropometric subjects.

RESULTS

Characteristics of subjects

The study subjects' demographic, clinical, and laboratory characteristics are shown in Table 1. The number of research subjects was 75 pediatric patients with good nutrition, overweight, and obesity in Saiful Anwar General Hospital. Based on the data on the subject's characteristics, it is known that male respondents are more dominant (53.3%) than female respondents (46.7%), with a median value of children around 8 years. Based on body weight, it is known that the average obtained is 40.15 kg, height is about 125.74 cm, and BMI is 20.8, while in the arm circumference variable, the median value is 22 cm.

Differences in vitamin D (25(OH)D) levels based on nutritional status

The data were examined using the Kruskal Wallis test to demonstrate that children with overweight and obese status have lower vitamin D levels than children who consume a regular diet (Table 2). Children with overweight and obesity had a very considerably lower median value than children with adequate nutrition, according to the findings of a test of various levels of vitamin D (25(OH)D) dependent on nutritional status. With a p-value of 0.001, the Kruskal Wallis test findings revealed a very statistically significant difference. The Mann-Whitney test findings are shown in Figure 1 as differences between groups. Lower

Table 3. Relationship between vitamin D levels and nutritional status

Independent Variable	Dependent variable	p	Correlation coefficient (r)	Results
Nutritional status	Vitamin D levels	0.003	-0.335	Negative, Significant (Weak)

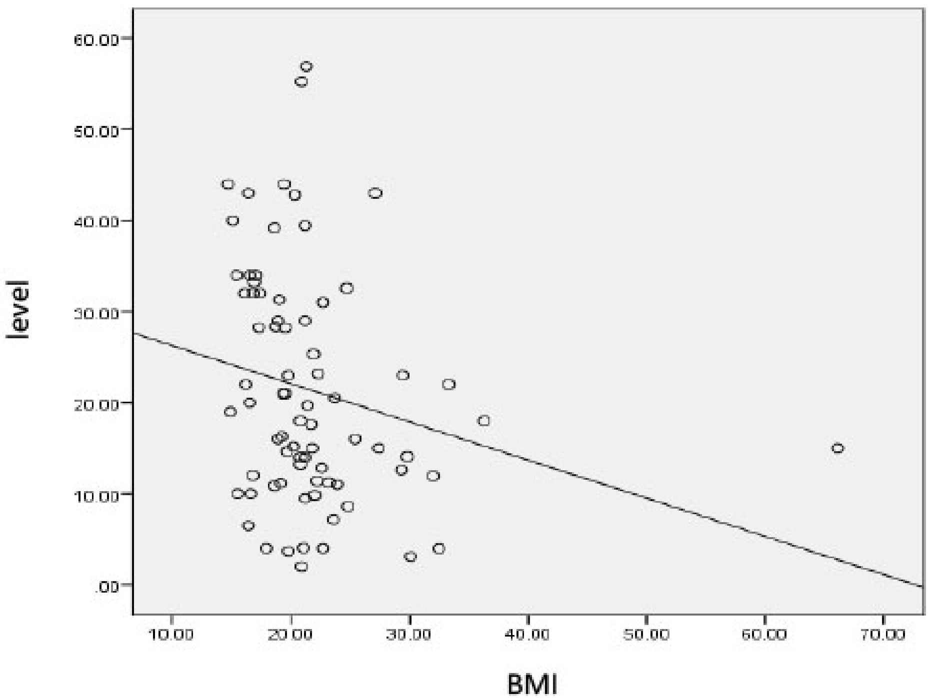

Figure 2. Relationship of vitamin D levels with overweight and obesity in children. Higher BMI correlated with lower vitamin D levels in children.

blood vitamin D levels in children with overweight and obesity status support the study's premise, which was supported by differences in vitamin D levels between normal-overweight and normal-obese groups (p=0.000 and 0.002, respectively). In contrast, there was no change in the group of people who were overweight or obese (p = 0.526).

Relationship (correlation) levels of vitamin D (25(OH)D) based on the nutritional status

The data was examined using the Spearman correlation test to demonstrate the connection between vitamin D levels and children who are overweight or obese (Table 3). The association between vitamin D levels and nutritional status obtained a p-value of 0.003 ($p<0.05$) based on the findings of the Spearman correlation test, showing a significant correlation. Since the link is known to be negative in direction, pediatric patients who consume more food and even those who are obese tend to have lower levels of vitamin D. Despite being substantial, the correlation's findings are classified as having a weak association. The data distribution that demonstrates the correlation between children's BMI and vitamin D levels is shown in Figure 2.

DISCUSSION

A limited study conducted in Indonesia evaluates vitamin D levels based on the nutritional status of children. This cross-sectional design study involved 75 study subjects who met the inclusion criteria, and the patient's parents were willing to sign the informed consent. Research subjects were divided into 3 groups based on nutritional status, namely normal nutrition, overweight, and obesity, then checked for vitamin D levels. Research subjects have met a minimum sample size of 75 patients. Distribution based on sex found that boys had a greater prevalence, with a sex ratio of 40 patients (53.3%) male and 35 female (46.7%).

In this study, vitamin D levels in male patients were obtained on average 24.04 ng/ml higher than in female patients, namely 18.22 ng/ml. In this study, the mean age of the research subjects was 8 years (0.25 – 17 years). In this study, it was found that patients aged 12-18 years were also dominantly deficient. The patient's average weight was 40.15±21.19 kg, and height was 125.74±27.67 cm, with an average BMI of 20.8 (14.7-66.1) kg/m^2. In this study, it was found that vitamin D levels were lower in children with more nutrition (median 17.6 ng/ml) and obesity (median 14.08 ng/ml) compared to well-nourished children (median 34 ng/ml).

The prevalence of vitamin D deficiency (vitamin D concentration 20 ng/mL) was found to be higher in obese people (53.8%) than in subjects of normal weight (33%), according to a study by Muscogiuri et al. Vitamin D may be stored in body fat, which lowers the vitamin's bioavailability.[6] Serum 25(OH)D levels are lower in obese and malnourished children than in children of normal weight, and serum 25(OH)D is inversely linked with body weight, BMI, and fat mass.[7] The prevalence of 25(OH)D deficit is higher in obese people, reported at 40% and 80%, respectively, and serum 25(OH)D is around 20% lower in obese people than in normal-weight people. The dispersion of 25(OH)D throughout a larger volume of bodily tissue may be the cause of the decreased serum 25(OH) D levels. Less sun exposure than those of normal weight across many different geographical locations, despite the fact that in two UK trials, sun exposure did not vary by BMI. Obese and normal weight individuals both produce vitamin D in their skin when exposed to UVB rays. Diet and sun exposure will fluctuate amongst various geographic and cultural groups and may be a factor in some populations' declining vitamin D levels. Serum, fat, muscle, the liver, and to a lesser extent other tissues all contain 25(OH)D, and all of these compartments are elevated with obesity.[8]

The amount of vitamin D produced in response to sun exposure is the same in obese and normal-weight individuals, but less of the synthesized vitamin is dispersed into the serum because of the larger volume in which it is distributed. No measures of dietary intake or solar exposure that might have an impact on the patients' vitamin D levels were done in this investigation. According to one in vitro investigation, the release of vitamin D may be reduced in adipocytes from obese, insulin-resistant people. Adipocytes produce both the 1-hydroxylase and the 24-hydroxylase, which activate and deactivate 25(OH)D, respectively. Obesity can modify enzyme activity, which may have an impact on the amount of 25(OH)D that can be released into the blood.[8]

Limitations of the study

In our study, we did not exclude patients with chronic diseases or certain clinical conditions that might affect the patient's nutritional status or vitamin D levels. In this investigation, we are mainly interested in establishing a link between pediatric patients at Saiful Anwar Hospital's vitamin D levels and their nutritional status. The number of samples used in this study will decrease if the person with the conditions we previously specified is excluded, which will also have an impact on how generalizable this study is. Thus, further study is needed on a larger scale and considering the factors that can affect nutritional status or vitamin D levels independently.

CONCLUSION

In conclusion, according to this study, children who were overweight or obese had lower serum vitamin D levels than kids who had regular diet. Vitamin D levels and the status of overweight and obese children are significantly correlated. It is advised to perform a vitamin D screening on children who are overweight or obese and to give vitamin D supplements to those who are vitamin D deficient.

ETHICAL CLEARANCE

This study was evaluated and approved by the reference Ethics Committee Faculty of Medicine, Universitas Brawijaya, Indonesia, with reference number: 400/035/K3/302/2022.

AUTHOR CONTRIBUTION

AP contributes to the design of the study concept, summarizes the associated references, collect & analyzes the data, and reviews the manuscript. HAT contributes to the design of the study concept, summarizes the associated references, and reviews the manuscript. HT contributes to collecting & analyze the data, summarize the associated references, write the manuscript.

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CONFLICT OF INTEREST

None of the authors have a conflict of interest to disclosure.

REFERENCES

1. Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor 2 Tahun 2020 Tentang Standar Antropometri Anak. Jakarta: Kementerian Kesehatan Republik Indonesia; 2020.
2. Aggarwal B, Jain V. Obesity in Children: Definition, Etiology and Approach. The Indian Journal of Pediatrics. 2018;85(6):463–71.
3. McKee C, Long L, Southward LH, Walker B, McCown J. The Role of Parental Misperception of Child's Body Weight in Childhood Obesity. J Pediatr Nurs. 2016;31(2):196–203.
4. Kumar V, Abbas AK, Aster JC. Basic Pathology. In: Robbins Basic Pathology. 10th Edition. Philadelphia: Geotar Media Publishing Group; 2018. p. 334–7.
5. Lee JY, So T-Y, Thackray J. A Review on Vitamin D Deficiency Treatment in Pediatric Patients. The Journal of Pediatric Pharmacology and Therapeutics. 2013;18(4):277–91.
6. Muscogiuri G, Barrea L, Somma C Di, Laudisio D, Salzano C, Pugliese G, et al. Sex Differences of Vitamin D Status across BMI Classes: An Observational Prospective Cohort Study. Nutrients. 2019;11(12):3034.
7. Walsh JS, Bowles S, Evans AL. Vitamin D in obesity. Current Opinion in Endocrinology & Diabetes and Obesity. 2017;24(6):389–94.
8. Mihrshahi S, Baur LA. What exposures in early life are risk factors for childhood obesity? J Paediatr Child Health. 2018;54(12):1294–8.