



# RESPONSE TO VITAMIN D REPLACEMENT IS DETERMINED BY BODY SURFACE AREA IN CHILDREN WITH VITAMIN D DEFICIENCY



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## Back ground and Objectives

- Back ground: The serum 25-hydroxyvitamin D (25OHD) levels are known to be lower in obese children, probably due to sequestration of vitamin D in the adipose tissue. However, there is no consensus on the dose adjustment for vitamin D supplementation in obese children with vitamin D deficiency (VDD).
- Objectives: To compare the response to vitamin D replacement in normal weight vs. overweight children with VDD, and to investigate the determinant for increment of 25OHD level ( $\Delta$ 25OHD) after vitamin D replacement.

## Methods

- Participants were 65 Korean children between 8 to 15 years of age diagnosed with VDD between Dec 2013 and Feb 2014.
- VDD was defined as serum 25OHD <20 ng/mL and vitamin D sufficiency as 25OHD  $\geq$ 30 ng/mL.
- Overweight was defined as body mass index (BMI)  $\geq$ 85<sup>th</sup> percentile (n=20), and normal weight as BMI 5<sup>th</sup> to 84<sup>th</sup> percentile (n=45).
- All participants received vitamin D<sub>3</sub> supplementation (2000 IU/d) for 8 weeks. The levels of 25OHD and biochemical parameters were measured before and after treatment. Body fat was measured by bioelectrical impedance analysis.

## Results

- After 8 weeks of treatment, 33.3% of overweight children and 68.9% of normal weight children attained vitamin D sufficiency (P=0.02, Fig.1).
- The  $\Delta$ 25OHD was higher in normal weight group than in overweight group (20.6 $\pm$ 7.2 vs. 15.0 $\pm$ 7.6 ng/mL, P=0.006, Fig.2).
- Calcium creatinine ratio was lower than 0.2 in all participants before and after vitamin D replacement.
- Body surface area (BSA) was the determinant of  $\Delta$ 25OHD ( $\beta$ =-0.644, P=0.034) in a regression model including BSA, age, gender, body fat, and being overweight (R<sup>2</sup>=0.219, Table 3).

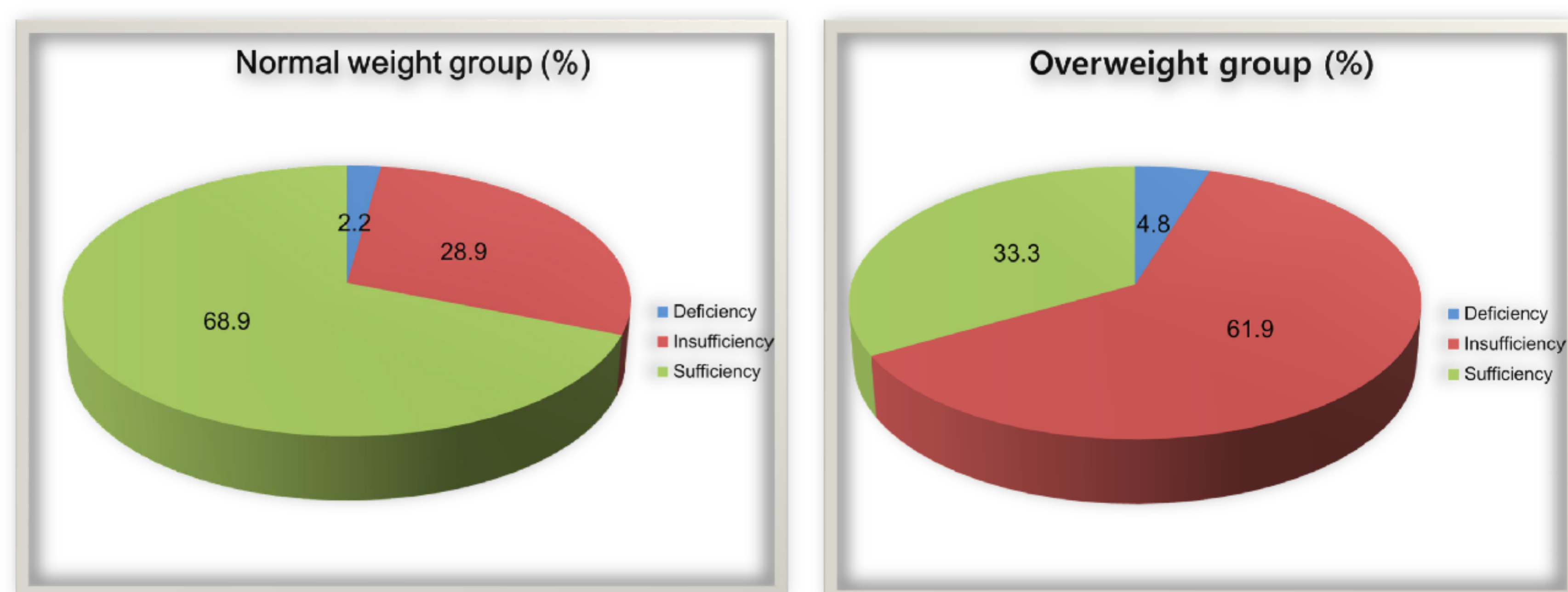


Fig. 1. The vitamin D status of each group after vitamin D replacement.

Table 1. Clinical Characteristics of study population

	Before Treatment			After Treatment		
	Normal weight	Overweight	p	Normal weight	Overweight	p
Age(month)	118.8 $\pm$ 16.9	120 $\pm$ 25.3	0.85			
Height(cm)	136.6 $\pm$ 9.2	144.8 $\pm$ 13.3	0.02	138.0 $\pm$ 9.6	146.3 $\pm$ 12.8	0.01
Weight(Kg)	33.9 $\pm$ 8.0	50.1 $\pm$ 16.3	<0.01	34.2 $\pm$ 7.7	49.0 $\pm$ 14.1	<0.01
WC(cm)	62.6 $\pm$ 8.3	76.9 $\pm$ 11.0	<0.01	62.1 $\pm$ 7.6	74.9 $\pm$ 8.3	<0.01
WHtR	0.4 $\pm$ 0.2	0.51 $\pm$ 0.1	0.01	0.4 $\pm$ 0.8	0.5 $\pm$ 0.1	0.09
BMI (kg/m <sup>2</sup> )	17.8 $\pm$ 2.1	23.3 $\pm$ 3.6	<0.01	17.8 $\pm$ 2.3	22.4 $\pm$ 3.0	<0.01
BMI-z	0.002 $\pm$ 0.8	1.7 $\pm$ 0.5	<0.01	-0.07 $\pm$ 0.9	1.4 $\pm$ 0.5	<0.01
SBP (mmHg)	101.2 $\pm$ 7.3	106.6 $\pm$ 10.5	0.08	102.2 $\pm$ 9.2	110.8 $\pm$ 11.9	0.01
DBP (mmHg)	58.6 $\pm$ 7.9	61.1 $\pm$ 8.2	0.33	56.6 $\pm$ 7.8	60.3 $\pm$ 8.6	0.10

WC, waist circumference; WHtR, waist to height ratio; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure

Table 2. Laboratory results of Before and After Vitamin D replacement

	Before Treatment			After Treatment		
	Normal weight	Overweight	p	Normal weight	Overweight	p
25OHD (ng/mL)	13.2 $\pm$ 3.2	14.2 $\pm$ 2.1	0.12	33.7 $\pm$ 7.4	28.6 $\pm$ 7.1	0.01
PTH (pg/mL)	32.3 $\pm$ 9.5	39.5 $\pm$ 18.0	0.11	30.4 $\pm$ 12.6	34.4 $\pm$ 14.8	0.30
Calcium (mg/dL)	9.1 $\pm$ 0.5	9.5 $\pm$ 0.3	0.01	9.4 $\pm$ 0.3	9.5 $\pm$ 0.4	0.53
Ion Calcium (mmol/L)	1.3 $\pm$ 0.1	1.2 $\pm$ 0.2	0.38	1.4 $\pm$ 1.5	1.2 $\pm$ 0.1	0.34
Phosphorus (mg/dL)	4.9 $\pm$ 0.6	5.1 $\pm$ 0.5	0.28	4.9 $\pm$ 0.4	4.9 $\pm$ 0.4	0.88
ALP (IU/L)	303.8 $\pm$ 86.0	320.0 $\pm$ 116.8	0.58	306.8 $\pm$ 76.4	292.0 $\pm$ 106.2	0.57
CCR	0.06 $\pm$ 0.1	0.07 $\pm$ 0.1	0.67	0.08 $\pm$ 0.1	0.06 $\pm$ 0.1	0.15
T. Chol (mg/dL)	167.1 $\pm$ 24.2	167.1 $\pm$ 29.1	1.00	162.4 $\pm$ 21.0	158.1 $\pm$ 21.1	0.44
Body fat (%)	22.2 $\pm$ 6.4	32.4 $\pm$ 6.2	<0.01	21.2 $\pm$ 6.9	30.4 $\pm$ 1.2	<0.01

25OHD, 25-hydroxyvitamin D; PTH, parathyroid hormone; ALP, alkaline phosphatase; CCR, calcium-creatinine ratio; T.Chol, total cholesterol

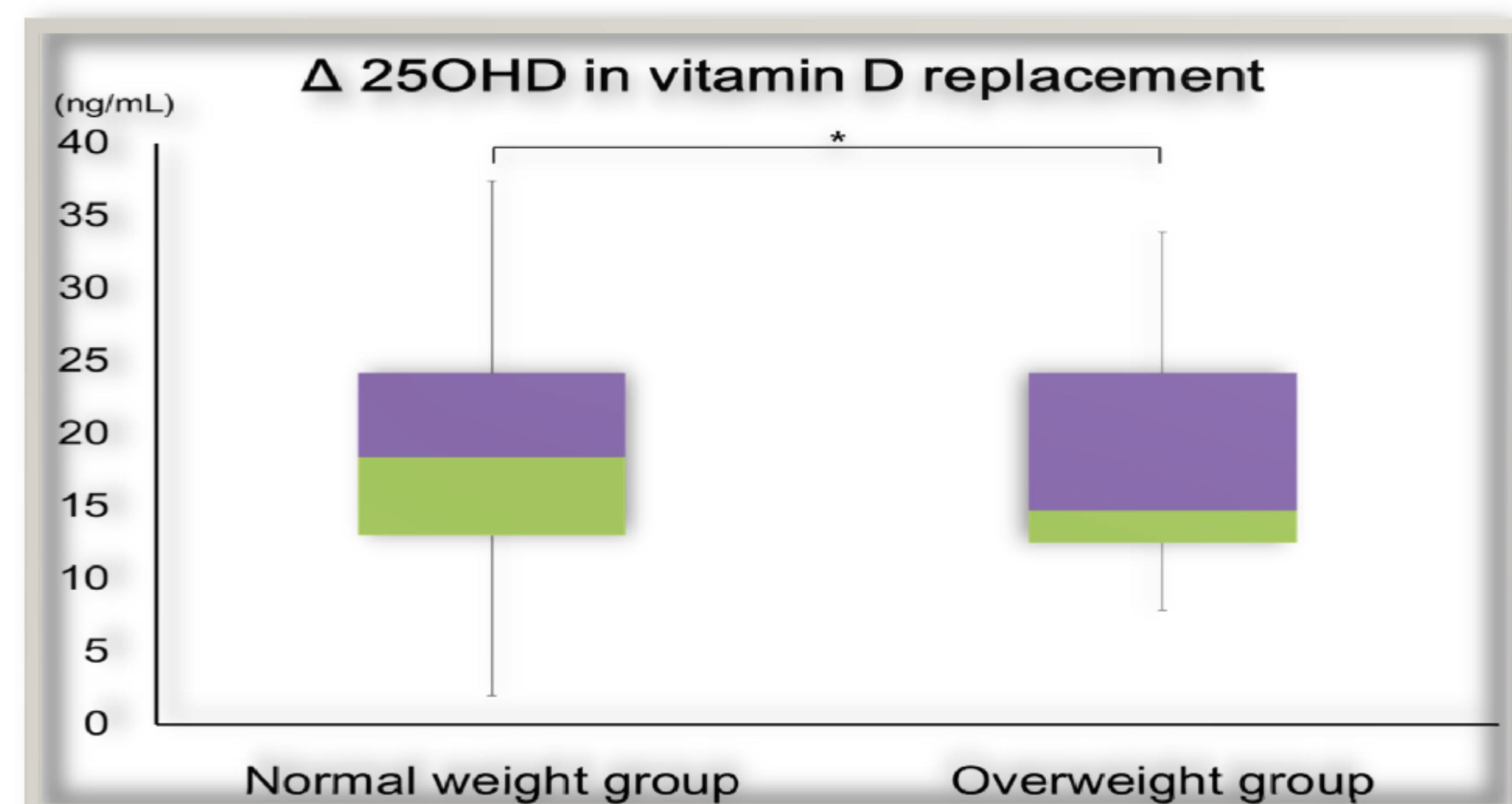


Fig.2.  $\Delta$ 25OHD in vitamin D replacement in normal and overweight groups.

Table 3. Factors associated with  $\Delta$ 25OHD in regression analysis

	$\beta$	P
BSA	-0.64	0.03
Age	0.38	0.14
Gender	0.14	0.26
Body fat (%)	0.01	0.95
Being obese	0.02	0.07

25OHD, 25-hydroxyvitamin D; BSA, body surface area

## Conclusions

- The response to vitamin D replacement seems to be influenced by the size of the body rather than adiposity.
- To achieve vitamin D sufficiency, dose adjustment for vitamin D supplementation is required according to the patient's BSA.
- This study was supported by FND net Co. Ltd.

## References

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