Relationship between 25-hydroxyvitamin D with adiposity assessed by body mass index, serum glucose and lipids levels in Korea : a cross-sectional analysis

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Introduction

- 25-hydroxyvitamin D [25(OH)D, Vitamin D] deficiency
  - Vitamin D play role in the regulation of calcium and bone metabolism, the implication/regulation of the immune system, endocrine pancreas, liver, skeletal muscle, and adipocytes.

- Low 25(OH)D levels have also been shown to be associated with low high-density lipoprotein (HDL) cholesterol levels.

- Low vitamin D circulating levels in children and adolescent are related to fat mass and obesity.
  - Fat soluble vitamin D usually is retained by adipose tissue.
  - 25(OH)D at peripheral level affects lipolysis and adipogenesis in adipocytes.

Objectives

- The aim was to investigate the associations between 25(OH)D with adiposity assessed by body mass index(BMI), fasting glucose and lipid levels on schoolchildren.

Methods

- From April 2015 to July 2018, 822 patients aged 6 to 18 years who visited the pediatrics outpatient clinics for adolescent developmental evaluation were included.

- Of the 822 patients, 255 male (31.0%) and 567 female (69.0%) were assessed. According to the vitamin D status, the patients should be divided into three groups: under 10 ng/ml, 11 to 20 ng/ml, and over 20 ng/ml, and classified each group into deficiency, insufficiency, and normal group.

- The correlation in 25(OH)D and BMI was assessed using Pearson analysis according to sex and puberty. Logistic regression was used to measure associations between 25(OH)D with BMI, serum glucose and lipids levels.

Results

Demographic findings

Characteristic	Prepubertal (mean ± SD)			Pubertal (mean ± SD)		
	male (n=107)	female (n=163)	p-value	male (n=58)	female (n=265)	p-value
Age (yr)	9.1±2.1	8.7±1.4	0.06	13.5±2.0	9.5±1.7	<0.01
Height (cm)	125.5±13.4	128.8±9.4	0.02	153.1±10.2	134.8±9.1	<0.01
Mean height SDS	-1.3	-0.1		-0.6	0.2	
Weight (kg)	29.3±14.6	28.8±6.7	0.70	48.5±10.9	32.1±7.5	<0.01
Mean weight SDS	-0.9	-0.1		-0.3	0.2	

Characteristic	Prepubertal (mean ± SD) (n=270)	Pubertal (mean ± SD) (n=323)	p-value
Age (yr)	8.9±1.7	10.3±2.3	<0.01
Height (cm)	127.4±11.2	138.5±11.6	<0.01
Mean height SDS	-0.6	0.0	
Weight (kg)	29.0±10.6	35.2±10.3	<0.01
Mean weight SDS	-0.1	0.0	

Characteristic	Prepubertal (mean ± SD)			Pubertal (mean ± SD)		
	male (n=107)	female (n=163)	p-value	male (n=58)	female (n=265)	p-value
25(OH)D (ng/mL)	22.2±8.5	21.1±7.7	0.27	19.6±8.2	19.2±7.2	0.70

Characteristic	Prepubertal (mean ± SD) (n=270)	Pubertal (mean ± SD) (n=323)	p-value
25(OH)D (ng/mL)	21.5±8.1	19.3±7.4	<0.01

Clinical characteristics

Characteristic	Prepubertal (mean ± SD)			Pubertal (mean ± SD)		
	male (n=107)	female (n=163)	p-value	male (n=58)	female (n=265)	p-value
Glucose (mg/dL)	97.3±10.8	95.4±13.2	0.21	97.8±8.6	94.5±9.5	0.01
Total cholesterol (mg/dL)	168.6±24.0	168.2±25.8	0.89	159.1±29.9	163.0±25.6	0.30
Triglycerides (mg/dL)	102.0±57.0	116.4±58.2	0.04	117.8±95.3	110.2±59.9	0.43
HDL-cholesterol (mg/dL)	55.3±10.2	54.8±9.8	0.68	53.0±7.6	54.4±9.7	0.30
LDL-cholesterol (mg/dL)	96.4±23.4	99.9±23.4	0.23	96.9±23.4	96.1±24.7	0.82

25(OH)D, 25-hydroxyvitamin D; LDL, low-density lipoprotein; HDL, high-density lipoprotein

Characteristic	Prepubertal (mean ± SD) (n=270)	Pubertal (mean ± SD) (n=323)	p-value
Glucose (mg/dL)	96.1±12.3	95.1±9.5	0.26
Total cholesterol (mg/dL)	168.3±25.1	162.3±26.4	0.01
Triglycerides (mg/dL)	112.8±58.1	111.4±66.5	0.78
HDL-cholesterol (mg/dL)	54.9±9.9	54.1±9.4	0.31
LDL-cholesterol (mg/dL)	99.0±23.4	96.3±24.4	0.17

25(OH)D, 25-hydroxyvitamin D; LDL, low-density lipoprotein; HDL, high-density lipoprotein

Correlation with 25(OH)D

|	r	p-value
BMI	-0.14	<0.01
Glucose (mg/dL)	-0.04	0.21
Total cholesterol (mg/dL)	0.02	0.50
Triglycerides (mg/dL)	-0.13	<0.01
HDL-cholesterol (mg/dL)	0.06	0.12
LDL-cholesterol (mg/dL)	0.08	0.04

25(OH)D, 25-hydroxyvitamin D; BMI, body mass index; LDL, low-density lipoprotein; HDL, high-density lipoprotein

BMI r=-0.14 p<0.01   TG r=-0.14 p<0.01   LDL r=+0.08 p=0.04
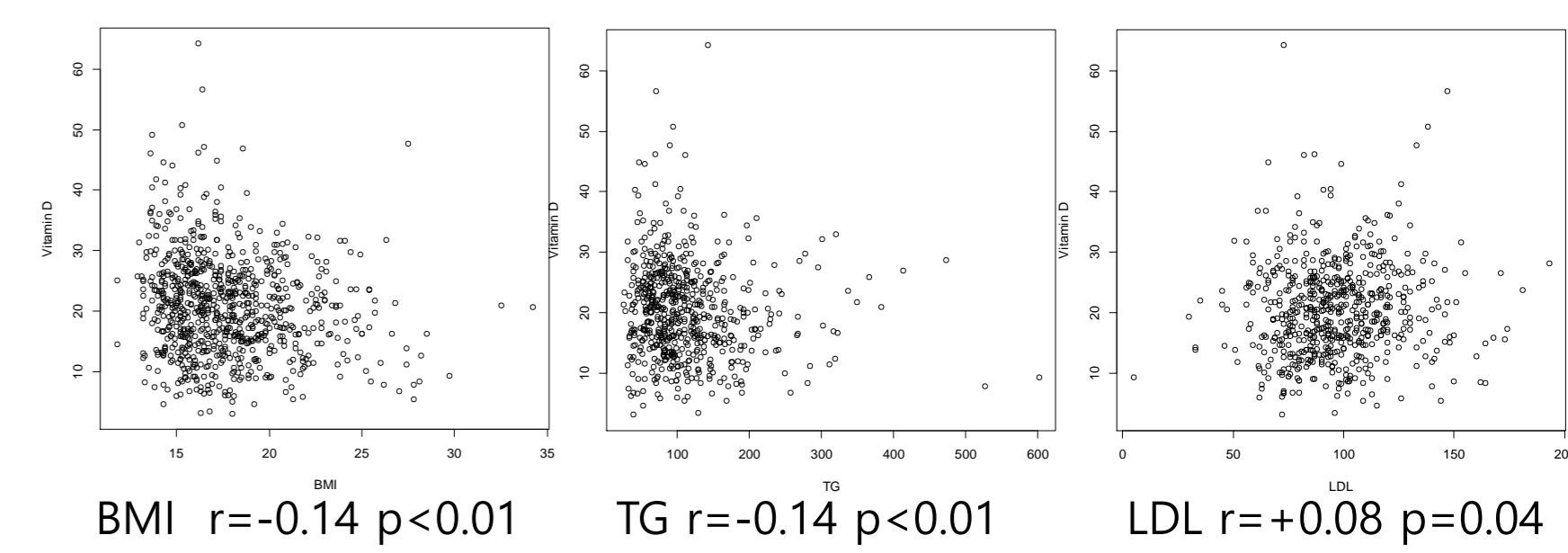
Correlation with 25(OH)D according to puberty

	Prepubertal		Pubertal	
	r	p-value	r	p-value
BMI	-0.07	0.22	-0.14	0.01
Glucose (mg/dL)	-0.09	0.15	-0.06	0.28
Total cholesterol (mg/dL)	0.08	0.17	0.00	0.96
Triglycerides (mg/dL)	-0.14	0.04	-0.09	0.14
HDL-cholesterol (mg/dL)	0.02	0.76	0.09	0.14
LDL-cholesterol (mg/dL)	0.07	0.32	0.03	0.56

25(OH)D, 25-hydroxyvitamin D; BMI, body mass index; LDL, low-density lipoprotein; HDL, high-density lipoprotein

TG r=-0.14 p=0.04   BMI r=-0.14 p=0.01
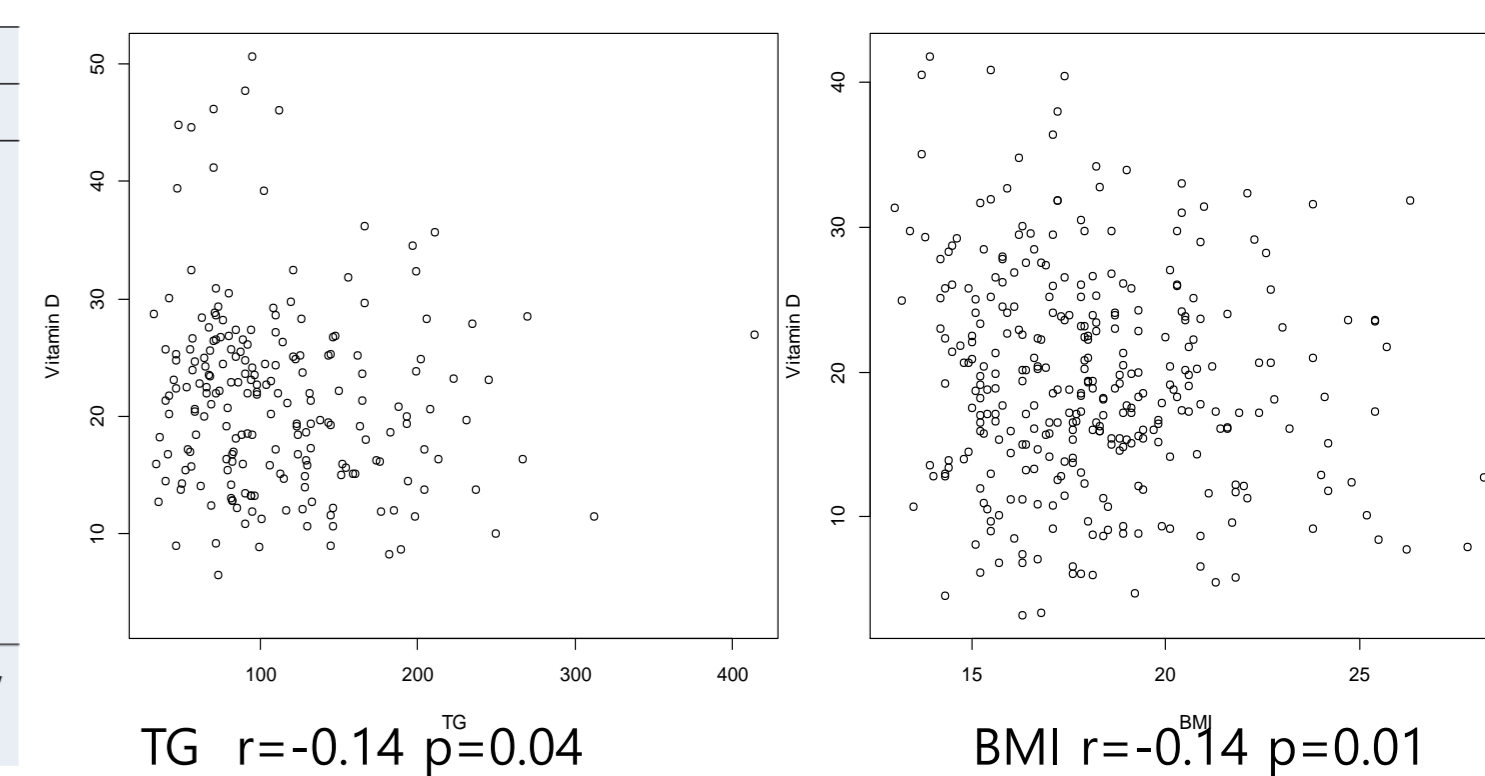
Conclusions

- 25(OH) D levels in children showed a weak negative linear correlation with a lower BMI, but the effect of vitamin D on blood glucose and cholesterol levels was not significant.

- It also seem no effect on sex and pubertal changes. Longitudinal studies are needed to explore whether vitamin D deficiency affect hyperglycemia, hyperlipidemia, insulin resistance and diabetes.

Discussion

- Daily Calcium and Vitamin D intake and amount of sunshine are required in our geographic localization, season, and physical activity.

- Follow-up observation of changes before and after taking vitamin D is required.

- The long term follow-up of association of vitamin D status with lipids and measures of insulin resistance is needed.

- Long-term prospective studies regarding the development of diseases such as hyperlipidemia and diabetes are needed after puberty change.

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