Supplementary Material

Calcium, Phosphate, and Vitamin D in Children and Adolescents with Chronic Diseases: A cross-sectional study

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Table S1. Significant correlations between serum calcium intake, serum calcium, phosphorus, and calcium/phosphorus ratio with nutritional indicators in the whole series (n = 78).

Correlations	Serum Vitamin D		Calcium intake		Serum calcium		Serum phosphorus		Serum Ca/P ratio	
	r	*p-value*	*r*	*p-value*	*r*	*p-value*	*r*	*p-value*	*r*	*p-value*
Age (years)	-0.292**	0.010	-0.295**	0.009	-0.368**	0.001	-0.541**	<0.001	0.464**	<0.001
Weight-for-age (kg)	-0.286*	0.012	-0.268*	0.018	-0.379**	<0.001	-0.414**	<0.001	0.314**	0.006
Weight-for-age Z-score	-0.290*	0.011	-0.264*	0.020	-0.279*	0.015				
Height-for-age (cm)	-0.303**	0.007	-0.272*	0.017	-0.405**	<0.001	-0.439**	<0.001	0.321**	0.005
Age-for-50ºHeight	-0.273*	0.016			-0.368**	0.001	-0.404**	<0.001	0.298**	0.009
Weight-for-Height Z-score	-0.296**	0.009			-0.259*	0.024				
Cephalic circumference (cm)	-0.299**	0.008			-0.453**	<0.001	-0.381**	<0.001	0.236*	0.040
Wrist circumference (cm)	-0.303**	0.009			-0.290*	0.013				
Waist circumference (cm)	-0.300**	0.010			-0.290*	0.013	-0.318**	0.006	0.250*	0.034
Waist circumference Z-s	-0.279*	0.017			-0.280*	0.017				
Hip circumference (cm)	-0.312**	0.007	-0.291*	0.012	-0.315**	0.007	-0.396**	<0.001	0.317**	0.006
Hip circumference Z-score	-0.283*	0.015			-0.279*	0.017				
MUAC (cm)	-0.258*	0.023			-0.334**	0.003	-0.271*	0.018		
MUAC Z-score	-0.256*	0.025			-0.263*	0.022				
Bicipital skinfold Z-score	-0.267*	0.019								
Triceps skinfold Z-score			-0.239*	0.036			-0.307**	0.007	0.280*	0.014
Subscapular skinfold Z-score	-0.264*	0.020								
Sum of skinfolds (mm)	-0.259*	0.023								
Body mass index	-0.257*	0.024			-0.277*	0.015	-0.280*	0.014		
Body mass index Z-score	-0.264*	0.020								
Nutritional index	-0.260*	0.022			-0.255*	0.026				
Waterlow I (%)	-0.247*	0.030			-0.237*	0.039				
Waterlow II (%)	-0.229*	0.045			-0.267*	0.020				
Body fat percentage	-0.281*	0.013	-0.259*	0.023	-0.243*	0.035	-0.268*	0.019		
Fat mass index	-0.272*	0.017	-0.228*	0.046	-0.254*	0.027	-0.278*	0.015		
Fat free mass index	-0.227*	0.047			-0.288*	0.012	-0.252*	0.028		
Fat mass by A	-0.281*	0.013	-0.259*	0.023	-0.242*	0.035	-0.268*	0.019		
Fat mass kg by A	-0.267*	0.019	-0.265*	0.020	-0.313**	0.006	-0.360**	0.001	0.288*	0.012
Fat free mass by A	0.281*	0.013	0.259*	0.023	0.242*	0.035	0.268*	0.019		
Fat free mass kg by A	-0.282*	0.013	-0.254*	0.026	-0.404**	<0.001	-0.428**	<0.001	0.313**	0.006
Fat mass by BIA	-0.279*	0.019	-0.313**	0.008	-0.301*	0.012	-0.351*	0.003	0.304*	0.011
Fat free mass by BIA	-0.300*	0.012					-0.326**	0.006		

Far free mass kg by BIA	-0.289*	0.044					-0.380**	0.008	0.303*	0.037
Arm area	-0.276*	0.016			-0.304**	0.008	-0.335**	0.003	0.265*	0.021
Arm muscle area	-0.243*	0.033			-0.360**	0.001	-0.305**	0.007		
Arm fat area	-0.272*	0.017			-0.234*	0.042	-0.333**	0.003	0.300**	0.008
MUAC							-0.290*	0.011	0.355**	0.002
Muscle area/Fat area index	-0.267*	0.019	-0.228*	0.046			-0.269*	0.019	0.275*	0.016
Muscle fat coefficient			-0.234*	0.041			-0240*	0.037	0.242*	0.035
Energy expenditure	-0.299*	0.041			-0.404**	0.006	-0.349*	0.019		
TTSPA							-0.321*	0.012	0.310*	0.015
Kilocalories (%DRI)			0.379**	<0.001	-0.332**	0.004			-0.234*	0.044
Protein (%DRI)			0.349**	0.002			0.330**	0.004	-0.379**	<0.001
Fiber (%DRI)					-0.277*	0.016	-0.271*	0.019		
Cholesterol (%DRI)							-0.239*	0.039		
Vitamin B2 (%DRI)	0.266*	0.020			0.250*	0.030				
Vitamin B6 (%DRI)	0.255*	0.026								
Calcium (%DRI)							0.241*	0.038		
Magnesium (%DRI)			0.370**	<0.001			0.266*	0.021	-0.244*	0.035
Ca/Mg intake ratio			0.538**	<0.001						
Zinc (%DRI)									-0.282*	0.014
Iron (%DRI)			0.347**	0.002						
Beta carotene (µg/L)							0.260*	0.025		
Folic acid (mg/mL)	0.243*	0.037								
Serum vitamin B12 (pg/dL)			0.438**	<0.001						
Serum vitamin C (mg/L)	0.332**	0.005			0.238*	0.049				
Serum Ca/P ratio							-0.923**	<0.001		
Serum calcium (mg/dL)							0.492**	<0.001		
Serum phosphorus (mg/dL)			0.241*	0.038	0.492**	<0.001			-0.923**	<0.001
Serum copper (µg/dL)							0.285*	0.013	-0.255*	0.026
Serum copper/zinc ratio							0.226*	0.050		
Serum magnesium (mg/dL)	0.274*	0.019								
Serum Ca/Mg ratio					0.319**	0.006				
Serum Mg/Ca ratio					-0.344*	0.033				
Transferrin (mg/dL)					0.230*	0.049				
Ferritin (ng/mL)					-0.306**	0.008				
Glucose (mg/dL)					-0.304**	0.008	-0.303**	0.008	0.256*	0.026
Creatinine (mg/dL)					-0.327**	0.004	-0.428**	<0.001	0.343**	0.002
Total protein					0.345**	0.002				
Albumin (mg/dL)					0.294*	0.014				
Triglycerides (mg/dL)	0.332**	0.003								
Total bilirubin (mg/dL)							-0.257*	0.034		
AST (U/L)	0.305*	0.011			0.310*	0.010	0.424**	<0.001	0.346**	0.004
ALT (U/L)					-0.275*	0.023				
MCV (µg/m³)					-0.256*	0.026				
Leucocytes (cell/mm³)	0.284*	0.012	0.301**	0.008	0.379**	<0.001	0.407**	<0.001	-0.297**	0.009
Lymphocytes (cell/mm³)			0.353**	0.002	0.459**	<0.001	0.459**	<0.001	-0.316**	0.005
Platelets (cell/mm³)					0.250*	0.029	0.363**	0.001	-0.278*	0.015
IgG3 (mg/dL)	0.303*	0.021								
IgA (mg/dL)							-0.276*	0.027		
CD16+56 T-lymphocytes			-0.314*	0.011						
IGF-1 (ng/mL)			-0.228*	0.050			-0.287*	0.012		
Disease duration									0.233*	0.043

Legend: Ca: calcium. P: phosphorus. A: anthropometry. BIA: bioelectric impedance analysis. MUAC: mid upper-arm circumference. MAMC: mid arm muscle circumference. %DRI: dietary reference intake. Mg: magnesium. AST: aspartate aminotransferase. ALT: alanine aminotransferase. MCV: Mean corpuscular volume. IGF-1: insulin-like growth factor-1. * $p < 0.05$** $p < 0.01$ (2 tailed).

Table S2. Correlations between serum vitamin D, serum calcium, dietary calcium intake, serum phosphorus and serum calcium/phosphorus ratio with nutritional indicators by body mass index groups (n = 78), ** p < 0.01 (2 tailed).

	Serum Vitamin D		Serum Calcium	
Obese	*r*	*p-value*	*r*	*p-value*
Waist/hip ratio	-0.543**	0.009		
Ferritin (ng/mL)	-0.552**	0.006		
CD8 T-Lymphocytes			0.610**	0.009
Undernutrition				
Serum phosphate (mg/dL)			0.618**	<0.001
Transferrin (mg/dL)			0.483**	0.008
Medium corpuscular volume (µg/m3)			-0.487**	0.006
CD16+56 T Lymphocytes	-0.515**	0.007		
Eutrophic				
Height-for-age Z-score	-0.585**	0.003		
Waterlow II (%)	-0.606**	0.002		
Insulin-like growth factor-binding protein-3 (mg/L)	-0.592**	0.003		
Complement C3			0.596**	0.006

	Calcium Intake		Serum P		Serum Ca/P	
Obese	*r*	*p-value*	*r*	*p-value*	*r*	*p-value*
Age (years)			-0.699**	<0.001	0.636**	0.001
Weight-for-age (kg)			-0.606**	0.002		
Height-for-age (cm)			-0.595**	0.003		
Head circumference (cm)			-0.563**	0.005		
Waist circumference (cm)			-0.583**	0.006	0.566**	0.008
Hip circumference (cm)			-0.667**	<0.001	0.620**	0.002
Suprailiac skinfold (mm)					0.528**	0.010
Triceps skinfold (mm)					0.592**	0.003
Mid upper-arm circumference (cm)			-0.557**	0.006		
Fat mass kg Anthropometry			-0.632**	0.001	0.576**	0.004
Fat free mass kg Anthropometry			-0.641**	<0.001		
Fat mass Bioelectric Impedance Analysis	-0.587**	0.003	-0.701**	<0.001	0.659**	<0.001
Fat mass kg Bioelectric Impedance Analysis	-0.705**	<0.001	-0.584**	0.007	0.670**	0.001
Fat free mass Bioelectric Impedance Analysis			-0.559**	0.006		
Fat free mass kg Bioelectric Impedance Analysis			-0.594**	0.006		
Arm area			-0.544**	0.007		
Fat area arm			-0.572**	0.004	0.604**	0.002
Mid arm muscle circumference			-0.579**	0.004		
Body mass index			-0.539**	0.008		
Fat mass index			-0.485*	0.019	0.450*	0.031
Fat free mass index			-0.498*	0.016		
Vitamin B12 (%Dietary Reference Intake)	0.608**	0.002				
Magnesium (%Dietary Reference Intake)	0.585**	0.003	0.633**	0.001	-0.596**	0.003
Iron (%Dietary Reference Intake)	0.698**	<0.001			-0.548**	0.007
Zinc (%Dietary Reference Intake)			0.565**	0.005	-0.646**	<0.001
Beta-carotene (µg/L)			0.527**	0.010		
Copper (µg/dL)			0.729**	<0.001	-0.612**	0.002
Serum Calcium/Phosphorus ratio			-0.913**	<0.001		
Serum Copper/Zinc ratio			0.590**	0.003	-0.576**	0.004
Serum Zinc/Copper ratio			-0.594**	0.003	0.578**	0.004
Prealbumin (mg/dL)			-0.555**	0.009		
Creatinine (mg/dL)			-0.706**	<0.001	0.642**	<0.001
Leucocytes (cell/mm3)	0.573**	0.003				
Lymphocytes (cell/mm3)	0.560**	0.004				
Undernutrition						
Age (years)	-0.369*	0.045	-0.476**	0.008	0.401*	0.028
Arm fat area			-0.495**	0.005	0.500**	0.005
Body mass index Z-score	0.535**	0.003				

	r (col1)	p (col1)	r (col2)	p (col2)	r (col3)	p (col3)
Body fat percentage			-0.429*	0.018	0.434*	0.016
Fat mass index			-0.395*	0.031	0.381*	0.038
Kilocalories (%Dietary Reference Intake)	0.527**	0.003				
Protein (%Dietary Reference Intake)	0.535**	0.003			-0.551**	0.002
Carbohydrates (%Dietary Reference Intake)	0.537**	0.003				
Vitamin A (%Dietary Reference Intake)	0.484**	0.008	0.522**	0.004	0.521**	0.004
Magnesium (%Dietary Reference Intake)	0.478**	0.009				
Iron (%Dietary Reference Intake)	0.596**	<0.001				
Iodine (%Dietary Reference Intake)	0.544**	0.002				
Serum phosphate (mg/dL)	0.500**	0.006				
Serum Calcium/Phosphorus ratio	-0.477**	0.009	-0.909**	<0.001		
Leucocytes (cell/mm^3)			0.475**	0.008	-0.481**	0.007
Lymphocytes (cell/mm^3)			0.523**	0.003	-0.484**	0.007
Eutrophic						
Age (years)			-0.432*	0.026	0.423*	0.044
Fat mass kg BIA					0.581**	0.009
Fat mass index			-0.456*	0.029	0.458*	0.028
Fat free mass index			-0.575**	0.004	0.555**	0.006
Carbohydrates (%Dietary Reference Intake)			0.562**	0.005		
Serum Calcium/Phosphorus ratio			-0.945**	<0.001		
Albumin (mg/dL)	-0.564**	0.005				
Aspartate aminotransferase (U/L)			0.567**	0.006	-0.538**	0.010
Monocyte (%)			0.556**	0.006		

Table S3. Regression analysis between serum and dietary calcium and vitamin D intake, serum phosphorus, serum calcium/phosphorus ratio and nutritional parameters by body mass index groups ($n = 78$).

Obesity (n = 24)		Undernutrition (n= 30)		Eutrophic (n = 24)	
Serum vitamin D	**Vitamin D intake**	**Serum vitamin D**	**Vitamin D intake**	**Serum vitamin D**	**Vitamin D intake**
Linear	*Regression*	*Analysis*			
Waist/hip ratio $R^2 = 0.317, p = 0.008$ Serum vitamin C $R^2 = 0.247, p = 0.016$		FFM kg BIA $R^2 = 0.600, p = 0.024$ Serum vitamin C $R^2 = 0.183, p = 0.037$ Triglycerides $R^2 = 0.345, p = 0.001$		Height-for-age Z-s $R^2 = 0.273, p = 0.011$ Waterlow II $R^2 = 0.316, p = 0.005$ Serum magnesium $R^2 = 0.271, p = 0.022$ IGFBP3 $R^2 = 0.247, p = 0.016$	
Multilinear	*Regression*	*Analysis*			
		IgG3 and CD16+56 T-lymphocytes $R^2 = 0.629, p = < 0.001$			
Serum calcium	**Calcium intake**	**Serum calcium**	**Calcium intake**	**Serum calcium**	**Calcium intake**
Linear	*Regression*	*Analysis*			
MAMC $R^2 = 0.216, p = 0.026$ Serum Mg/Ca ratio $R^2 = 0.317, p = 0.005$	FM by BIA $R^2 = 0.375, p = 0.003$ Serum vitamin B12 $R^2 = 0.271, p = 0.011$	Transferrin $R^2 = 0.218, p = 0.016$	FA/MA index $R^2 = 0.254, p = 0.017$ Lymphocytes $R^2 = 0.229, p = 0.016$	Head circumference $R^2 = 0.182, p = 0.042$	Hip circumference $R^2 = 0.173, p = 0.043$ Albumin $R^2 = 0.219, p = 0.024$ Serum vitamin B12 $R^2 = 0.213, p = 0.030$ Complement C3 $R^2 = 0.199, p = 0.049$
Multilinear	*Regression*	*Analysis*			
CD8 T-Lymphocytes and lymphocytes $R^2 = 0.664, p = 0.001$	Mg, and Ca/Mg ratio (%DRI) $R^2 = 0.795, p = < 0.001$	Serum phosphorus and Mg/Ca ratio $R^2 = 0.590, p = < 0.001$ CD8 T-Lymphocytes and MCV $R^2 = 0.480, p = 0.001$	BMI Z-score and FMI $R^2 = 0.288, p = 0.012$ Iron, Mg and Ca/Mg ratio (%DRI) $R^2 = 0.835, p = < 0.001$ Serum phosphorus and vitamin B12 $R^2 = 0.324, p = 0.006$	Glucose and creatinine $R^2 = 0.440, p = 0.005$	Mg, and Ca/Mg ratio (%DRI) $R^2 = 0.869, p = < 0.001$ CD16+56 T-lymphocytes and leucocytes $R^2 = 0.473, p = 0.002$
Serum phosphorus	**Serum Ca/P ratio**	**Serum phosphorus**	**Serum Ca/P ratio**	**Serum phosphorus**	**Serum Ca/P ratio**
Linear	*Regression*	*Analysis*			
Age (years) $R^2 = 0.699, p = < 0.001$ Hip circumference $R^2 = 0.422, p = 0.001$ Body mass index $R^2 = 0.312, p = 0.006$ Energy expenditure $R^2 = 0.255, p = 0.023$ IGF-1 $R^2 = 0.214, p = 0.026$ Creatinine $R^2 = 0.301, p = 0.028$	Age (years) $R^2 = 0.636, p = 0.001$ Hip circumference $R^2 = 0.304, p = 0.010$ Fat mass index $R^2 = 0.202, p = 0.031$ MAMC $R^2 = 0.396, p = 0.003$ Serum phosphorus $R^2 = 0.853, p = < 0.001$ Protein (%DRI) $R^2 = 0.272, p = 0.011$	Age (years) $R^2 = 0.401, p = 0.028$ Head circumference $R^2 = 0.171, p = 0.029$ Body fat percentage $R^2 = 0.184, p = 0.018$ Arm area $R^2 = 0.523, p = 0.043$ Vitamin A (%DRI) $R^2 = 0.242, p = 0.007$ AST $R^2 = 0.159, p = 0.044$ Lymphocytes $R^2 = 0.290, p = 0.005$	Age (years) $R^2 = 0.699, p = < 0.001$ Body fat percentage $R^2 = 0.189, p = 0.016$ TTSPA $R^2 = 0.204, p = 0.040$ Leucocytes $R^2 = 0.600, p = 0.024$ Serum phosphorus $R^2 = 0.200, p = 0.008$ Protein (%DRI) $R^2 = 0.215, p = 0.011$ Creatinine $R^2 = 0.170, p = 0.029$	Age (years) $R^2 = 0.462, p = 0.026$ Carbohydrates (%DRI) $R^2 = 0.354, p = 0.003$ Glucose $R^2 = 0.358, p = 0.004$ Monocytes $R^2 = 0.280, p = 0.016$	Age (years) $R^2 = 0.423, p = 0.044$ Triceps Z-score $R^2 = 0.331, p = 0.004$ Fat free mass index $R^2 = 0.308, p = 0.006$ Arm fat area $R^2 = 0.414, p = 0.004$ Serum phosphorus $R^2 = 0.890, p = < 0.001$ Kilocalories (%DRI) $R^2 = 0.245, p = 0.016$ Glucose $R^2 = 0.296, p = 0.009$
Multilinear	*Regression*	*Analysis*			
FFM by A, MAMC $R^2 = 0.438, p = 0.007$ Mg and fiber (%DRI) $R^2 = 0.470, p = 0.002$ Serum Ca/P ratio and calcium $R^2 = 0.985, p = <0.001$		Serum Ca/P ratio and calcium $R^2 = 0.978, p = < 0.001$		WA and HA $R^2 = 0.417, p = 0.005$ BMI and BF% $R^2 = 0.547, p = < 0.001$ AFA and FFM by A $R^2 = 0.500, p = 0.006$ Serum Ca/P ratio and calcium $R^2 = 0.988, p = < 0.001$ MCV and monocytes $R^2 = 0.467, p = 0.016$	

Legend: FFM: fat free mass. FM: fat mass. BIA: bioelectrical impedance analysis. Z-s: Z-score. IGFBP3: insulin-like growth factor-binding protein 3. Ig: immunoglobulin. MAMC: mid arm muscle circumference. FA: fat area. MA: muscle area. Mg: magnesium. Ca: calcium. P: phosphorus. BMI: Body mass index. FMI: fat mass index. DRI: Dietary Reference Intake. MCV: Mean corpuscular volume. TTSPA: Total time spent on physical activity. IGF-1: insulin-like growth factor-1. AST: Aspartate aminotransferase. WA: weight-for-age. HA: height-for-age. BF%: body fat percentage. AFA: arm fat area.