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Urinary Excretion of Water-Soluble Vitamins (C, B₁, B₂, and B₆) in Healthy Children of Preschool and School Age: A Cross-Sectional Study

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Background. Children of preschool and school age are at risk of developing vitamin deficiency. Screening of the vitamin provision of children remains an urgent problem of pediatrics. **Objective.** Our aim was to determine the prevalence of low excretion of water-soluble vitamins among healthy preschool and school-age children. **Methods.** The study was conducted in March–April 2017. We determined the urinary excretion (fasting morning portion collected during 30–120 min after night-time urination) of metabolites of vitamins C, B₁, B₂ and B₆ in healthy children. Riboflavin (vitamin B₂ metabolite) was determined spectrophotometrically by titration with a riboflavin-binding apoprotein; 4-pyridoxyl acid (vitamin B₆ metabolite) and thiamine (vitamin B₁ metabolite) — by fluorescent method, ascorbic acid (vitamin C metabolite) — by visual titration with Tillman's reagent. The excretion considered to be low (equivalent to vitamin deficiency) when thiamine excretion was <7, 10, 11 and 12 µg/h and riboflavin 6, 9, 10 and 13 µg/h in children aged 3–5, 6–8, 9–11 and above 12 years, respectively; 4-pyridoxyl acid — <40, 60 and 70 µg/h in children aged 3–5, 6–8 and ≥9 years, ascorbic acid — <0.2 and 0.4 mg/h in children aged 3–11 and ≥12 years, respectively. **Results.** Metabolites were excreted in 39 children (20 girls), 14 of them aged 4–6 years and 25 children aged 7–14 years. A low level of ascorbic acid excretion was found in 13 (33%) children, of thiamine — in 24 (62%), of riboflavin — in 16 (41%), of 4-pyridoxyl acid — in 26 (67%). Low excretion of at least one vitamin metabolite was detected in 30 (77%) children, of 3 or more metabolites simultaneously — in 15 (39%). **Conclusion.** A low level of urinary excretion of metabolites of at least one water-soluble vitamin (C, B₁, B₂, and B₆) occurs in most preschool and school-age children.

Key words: children, water-soluble vitamins, metabolites, excretion, urine, deficiency, screening. **(For citation:** Makarova Svetlana G., Vrzhesinskaya Oksana A., Kodentsova Vera M., Pereverzeva Olga G., Leonenko Svetlana N., Turti Tatiana V., Yasakov Dmitry S. Urinary Excretion of Water-Soluble Vitamins (C, B₁, B₂, and B₆) in Healthy Children of Preschool and School Age: A Cross-Sectional Study. *Voprosy sovremennoi pediatrii — Current Pediatrics*. 2018; 17 (1): 70–75. doi: 10.15690/vsp.v17i1.1857).

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Table 1. One-hour urinary excretion of metabolites of vitamin C and B vitamins in children

Indicator	Values		Low urinary excretion, abs. (%)
	Median (25th; 75th percentile)	min–max	
Ascorbic acid, mg/h	0.37 (0.20; 0.68)	0.01–1.80	13 (33)
Thiamine, µg/h	8.2 (4.9; 23.8)	0.4–35.2	24 (62)
Riboflavin, µg/h	12.2 (7.0; 13.9)	0.6–64.6	16 (41)
4-pyridoxy acid, µg/h	37.5 (28.2; 62.6)	1.9–119	26 (67)

Table 2. Low urinary excretion of metabolites of vitamin C and B vitamins in preschool and school age children

Indicator	Children 4-6 years old n = 14	Children 7-14 years old n = 25	p
Ascorbic acid, abs. (%)	5 (36)	8 (32)	1.000
Thiamine, abs. (%)	6 (43)	18 (72)	0.095
Riboflavin, abs. (%)	4 (29)	12 (48)	0.317
4-pyridoxyl acid, abs. (%)	9 (64)	17 (68)	1.000
Low excretion			
Of at least one metabolite, abs. (%)	4 (29)	5 (20)	0.696
Of 1-2 metabolites simultaneously, abs. (%)	3 (23)	9 (36)	0.477
Of ≥ 3 metabolites simultaneously, abs. (%)	4 (29)	11 (44)	0.496

Note. Criteria for low excretion for each metabolite of vitamins, taking into account the age of children, are presented in the METHODS section («Methods for registering study outcomes»).