Exogenic and endogenic factors affecting the supply of vitamin D in healthy children and adolescents of the south of Russia in winter-spring periods

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Objective. To analyze the influence of exogenous and endogenous factors on the supply of vitamin D in children and adolescents living in southern Russia in the winter-spring period.

Methods. The study included 27 healthy children and adolescents, aged 3 months to 16 years, living in Stavropol (45°02′ N 41°58′E). Children under 3 years old were 9 (33.3%), 4 to 7 years old — 5 (18.5%), 8 to 11 years old — 6 (22.3%), 12 to 16 years old — 7 (25.9%) people. Blood sampling was performed in February-March 2018. Vitamin D provision was assessed by the serum calcidiol level. Satisfactory supply was diagnosed at a level of 25 (OH) D 30–100 ng/ml, insufficiency — 20 to 30 ng/ml, deficiency — less than 20 ng/ml.

Results. The study of polymorphism of biotransformation genes was carried out by PCR and subsequent RFLP analysis. Polymorphisms selected for study included *CYP2C9*2* (430C > T; R144C), *CYP2C9*3* (1075A > C; I359L), *CYP2D6*4* (1846G > A), *CYP3A4*1B* (–392C > T).

Median vitamin D availability was 34.6 [23.5–44.6] ng/ml. Vitamin D deficiency was detected in 5 (18.5%) children, deficiency was also found in 5 (18.5%) children, satisfactory provision was revealed in 17 (63.0%) children.

There is a negative correlation between the age of children and the level of 25(OH)D: $r = -0.69$, $p = 0.0001$, as well as between body weight and calcidiol level $r = -0.64$, $p = 0.0004$.

Direct correlation was found between the dose of cholecalciferol products and serum 25(OH)D level, $r = -0.60$, $p = 0.001$.

With CC polymorphism (*CYP2C9*2*) 25(OH) D < 30 ng/ml was detected in 8 (80.0%) children, and more than 30 ng/ml — in 2 (20.0%), with CT — in 2 (20.0%) and in 2 (11.8%) respectively. With polymorphism AA (*CYP2C9*3*) 25(OH) D < 30 ng/ml was in 9 (90.0%) children, more than 30 ng/ml — in 15 (88.2%), with CA — in 1 (10.0%) child and in 2 (11.8%) children respectively. With TT polymorphism (*CYP3A4*1B*) 25(OH) D < 30 ng/ml was detected in 9 (90.0%) children, and more than 30 ng/ml — in 16 (94.1%) children, with TC — in 1 (10.0%) and in 1 (5.9%) respectively. With polymorphism GG (*CYP2D6*4*) 25(OH)D < 30 ng/ml was detected in 7 (70.0%) children, and more than 30 ng/ml — in 13 (76.5%) children, with GA 25(OH)D < 30 ng/ml was in 2 (20.0%), more than 30 ng/ml — in 4 (23.5%), AA was only in 1 (10.0%) child with vitamin D less than 30 ng/ml.

Conclusion. Insufficient vitamin D levels were found in 37.0% of healthy children and adolescents living in the Southern Russia. The serum calcidiol level depends on age; the older is the child, the higher is the likelihood of hypovitaminosis D. Intake of cholecalciferol product is an effective way to prevent vitamin D deficiency and insufficiency, while hypovitaminosis D was not convincingly associated with any of the studied polymorphisms of biotransformation genes: *CYP2C9*2*, *CYP2C9*3*, *CYP2D6*4*, *CYP3A4*1B*.