

Hypovitaminosis D and Cardiometabolic Risk Factors among Non-obese Youth

Research Article

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Received 9 March 2010; Accepted 2 June 2009

Abstract: Hypovitaminosis D and increased cardiometabolic risk have been well established in adults. This study aims to determine whether or not vitamin D also influences cardiometabolic risk in children and adolescents. To test this hypothesis, we recruited 186 boys (mean age 12.4 ± 3.7 years) and 114 girls (11.6 ± 3.7) in a cross-sectional observational study. Anthropometrics were obtained and morning fasting blood samples were collected. Serum glucose and lipid profile were determined using routine methods. Serum 25-hydroxyvitamin D was quantified using an enzyme-linked immunosorbent assay. In our population, approximately 10% of subjects had severe 25-hydroxyvitamin D deficiency (< 12.5 nmol/L), while 50% of the boys and 40% of the girls had mild vitamin D deficiency (12.5 – 24.9 nmol/L). Circulating 25-hydroxyvitamin D concentrations were inversely correlated with age, body mass index (BMI), blood pressure, waist and hip circumferences and serum triglyceride concentrations, and positively associated with HDL-cholesterol. Age and systolic blood pressure were significant predictors of 25-hydroxyvitamin D, explaining about 30% of the variance ($p = 0.0005$). In conclusion, significant associations between serum 25-hydroxyvitamin D and cardiometabolic parameters support promising cardioprotective benefits from vitamin D sufficiency at an early age. Follow-up with prospective clinical intervention studies are needed to validate this hypothesis.

Keywords: 25-Hydroxycholecalciferol • Hypovitaminosis D • Children

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1. Introduction

Cardiovascular disease (CVD) consistently leads the roster of non-communicable chronic diseases as the most common cause of human mortality in the modern world, with coronary heart disease expected

to account for 14% of deaths in 2030 [1]. In the kingdom of Saudi Arabia, several epidemiologic studies point to increased incidence of high risk factors for cardiovascular disease. More than one-fourth of the Saudi adult population is hypertensive [2]; 40% of the same cohort has hypertriglyceridemia (≥ 1.69 mmol/L)

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Table 1. Clinical Profile of Boys and Girls Included in the Study.

Parameter	Boys	Girls	p-Value
N	186	114	
Age (years)	12.4 ± 3.7	11.6 ± 3.7	0.1
BMI (kg/m ²)	19.8 ± 5.7	18.9 ± 4.3	0.2
Waist circumference (cm)	67.2 ± 19.3	61.7 ± 17.7	0.03
Hip circumference (cm)	76.7 ± 21.9	78.3 ± 14.6	0.5
Systolic BP (mmHg)	104.2 ± 13.7	105.2 ± 12.6	0.6
Diastolic BP (mmHg)	66.7 ± 10.6	68.1 ± 7.7	0.3
Glucose (mmol/L)	5.2 ± 0.8	5.0 ± 0.9	0.08
Triglycerides (mmol/L)	0.92 ± 0.5	0.91 ± 0.7	0.8
Total Cholesterol (mmol/L)	4.2 ± 0.7	4.2 ± 0.76	0.4
LDL-Cholesterol (mmol/L)	3.0 ± 0.6	2.9 ± 0.7	0.2
HDL-Cholesterol (mmol/L)	0.79 ± 0.3	0.82 ± 0.3	0.3
25-Hydroxyvitamin D (nmol/L)	28.2 ± 16.2	23.4 ± 10.8	0.007

[3] and 39% harbors the complete metabolic syndrome [4]. Studies done in Saudi children, on the other hand, reveal increased incidence of obesity due to improved nutrition [5], sedentary lifestyle [6] and poor sleeping habits [7]. Taken together, these morbidities could potentially overwhelm the already burdened public health system if left ignored. Fortunately, much of the advancements in preventive cardiology have focused on cardiometabolic risk factor clustering, which is predictive of future cardiovascular disease [8]. Furthermore, the emergence of biomarkers such as C-reactive protein [9] and homocysteine [10], whose increased levels translate to increased risk of cardiovascular events, have somewhat contributed to the early detection and potential prevention of cardiovascular disease.

Although there is a multitude of potential biomarkers that are equally promising in terms of predictive and diagnostic value, one essential micronutrient, vitamin D, recently gained considerable interest because of the increased prevalence of its deficiency worldwide and its newly described link to cardiometabolic morbidity [11,12]. Vitamin D has been known primarily for its pivotal roles in calcium absorption and bone metabolism. Accumulating evidence, however, points to pleiotropic actions, with possible roles in the pathogenesis of certain chronic non-communicable diseases, including those related to insulin resistance [13]. This study aims to determine cross-sectional associations between serum 25-hydroxyvitamin D levels and cardiometabolic risk factors in normal, non-obese Arab children and adolescents from the community and to elucidate the prevalence and severity of hypovitaminosis D.

2. Material and Methods

2.1. Subjects

A total of 118 (53 boys and 65 girls) children and adolescents aged 5-17 years participated in this cross-sectional observational study. They were randomly selected from four Primary Health Care Centers (PHCC) in Riyadh, Saudi Arabia. A general questionnaire was given to all participants, aimed to obtain demographic information and past and current medical history. Furthermore, children who were medically unstable and/or had a chronic diseases (e.g. asthma, type 1 diabetes mellitus, etc.), with known hepatic and/or renal dysfunction, and all those who declared taking vitamin D supplements were excluded. Written consents were obtained from the parents and oral assents from the children. Ethical approval was granted by the Ethics Committee of the College of Science Research Center, King Saud University, Riyadh, Saudi Arabia.

2.2. Anthropometric Data and Blood Collection

Participating subjects were requested to return to their respective PHCCs in a morning fasted state (> 10 hours) for anthropometric measurements and blood drawing by the assigned research nurse and physician, respectively. Anthropometric data included height (cm), weight (kg), waist and hip circumferences (cm), and mean systolic and diastolic blood pressure (mmHg) (average of 2 readings). Body mass index (BMI) was calculated as the value of weight divided by the squared value of height. Waist-to-hip-ratio (WHR) was defined as the ratio between waist and hip circumference. Venous blood was extracted once from the left antecubital vein unless otherwise specified. Blood (≈ 10cc) was