Prevalence of Dyslipidemia in Thai Schoolchildren

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Objective: *To evaluate the prevalence and risk factor of dyslipidemia in Thai schoolchildren.*
Material and Method: *A cross-sectional study of 348 schoolchildren aged 6-17.8 years in Nakorn Nayok province, Thailand, between May and June 2009 was conducted. Total cholesterol and triglyceride were measured from a 10-hour fasting blood. Dyslipidemia (hypercholesterolemia and/or hypertriglyceridemia) was defined according to the American Academy of Pediatrics (AAP) guidelines. Demographic and anthropometric data were recorded. Odds ratio and 95% confidence interval were used to compare the prevalence of dyslipidemia.*
Results: *The prevalence of hypercholesterolemia and hypertriglyceridemia were 1.2% and 10.6%, respectively, with none of the children who simultaneously had high cholesterol and triglyceride levels. Overweight, obesity and thinness were defined in 34 (9.8%), 34 (9.8%) and 25 (7.2%) children, respectively. Odds ratio of having dyslipidemia in overweight and/or obese children compared to non-obese children was 4.0 (95% CI 2.0-8.0). Odd ratios of having dyslipidemia were not significant differences by other risk factors such as gender [1.2 (0.6-2.2)], age [1.3 (0.7-2.5)], hypertension [0.9 (0.2-4.2)], family history of dyslipidemia [2.4 (0.6-8.0)], family history of diabetes mellitus [0.5 (0.1-2.1)], presence of a smoker in the family [1.5 (0.8-3.1)] and different ABO blood types.*
Conclusion: *The overall prevalence of dyslipidemia in Thai schoolchildren was 11.8%. Overweight and/or obesity were the sole risk factor for dyslipidemia in Thai schoolchildren aged 6-17.8 years.*

Keywords: *Dyslipidemia, Children, Thai, Cholesterol, Triglycerides, Cardiovascular disease*

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Cardiovascular disease is a main cause of morbidity and mortality worldwide[1]. In cardiovascular disease genesis, atherosclerosis plays a fundamental role[2]. This process begins in childhood and progressively continues during the whole life span[3-6]. Levels of triglyceride, LDL cholesterol, and HDL cholesterol are the biochemical parameters kept in account to evaluate the risk of atherosclerosis and cardiovascular disease since childhood[5,6]. Indeed, some evidences indicate that cholesterol level, even if it changes with age[7] and sex[8], reaches a concentration similar to young adults approximately at 2 years of age and the_percentile ranking of lipid concentration is usually constant over time since childhood[9-11]. For instance, in Bogalusa Heart Study, almost 70% of children with high cholesterol levels continue to have elevated cholesterol in early adulthood[11]. All these data suggest that screening in children may help to predict or early detect CVD risk.

The American Academy of Pediatrics releases new recommendations for lipid screening in childhood[12] that replaces its 1998 policy statement[13]. The new guideline includes sex and age as fundamental criteria and proposes a wide screening recommended every 3 to 5 years. It optimally begins at 2 years or no later than 10 years for children with positive family histories of dyslipidemia or premature CVD, unknown family history, or CVD risk factors (overweight or obesity, hypertension, cigarette smoking, or diabetes). Considering criteria such as weight, family history, and CVD risk factor, the majority of children are qualified for the screening. There are few data about lipid levels in Thai children and none of it considers age and gender cut points as required in the new guideline. Up to date, the lipid screening is not recommended for Thai children. The present study aims to investigate the prevalence of dyslipidemia in Thai children in order to evaluate the risk factors of

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future atherosclerosis and cardiovascular disease arising.

Material and Method

A cross-sectional study was conducted in all schoolchildren of one primary school in Nakorn Nayok province, Thailand, between May and June 2009. The research protocol was approved by the Ethics Committee of Faculty of Medicine, Srinakharinwirot University. Ethics committee approved informed consent was obtained from the parents and assent was obtained from the children.

After a 10-hour overnight fast, blood samples were collected from finger prick into heparinized hematocrit tube. Total cholesterol (TC) and triglyceride (TG) were measured by enzymatic cleavage methods using Accutrend Cholesterol and Accutrend Triglyceride (Roche Diagnostics GmbH, Germany), respectively. From AAP guidelines[12], TC and TG that excess the 95th percentile for their age and gender were defined as hypercholesterolemia and hypertriglyceridemia, respectively. Dyslipidemia arose when hypercholesterolemia and/or hypertriglyceridemia were presented. Blood group testing was performed by slide hemagglutination method using anti-A, anti-B and anti-AB blood grouping reagents (TECO diagnostics, Anaheim, USA).

Demographic characteristics and anthropometric parameters were recorded by trained nurses. In particular, self-reported parent history of dyslipidemia, premature cardiovascular diseases (CVD) before the age of 55 for men and 65 for women, household smokers were recorded. Body weight was measured to the nearest 0.1 kg and height was measured to the nearest 0.1 cm. The body mass index (BMI) was calculated as weight divided by squared height [kg/m^2]. Overweight and obesity were defined, according to WHO criteria, when BMI was higher than 1 SD and 2 SD, respectively[14]. Children whose BMI was lower than 2 SD were considered thin.

Blood pressure was measured by standard mercury sphygmomanometer with proper cuff sizes. According to the National High Blood Pressure Education Program (NHBPEP) guideline[15], hypertension was diagnosed in children when systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) were greater than the 95th percentile for gender and age.

Demographic characteristics were reported as mean and standard deviation, separately considering boys and girls. Chi-square test was used to compare the differences in categorical variables. Continuous variables were analyzed by Student's t-test. Odds ratio and 95% confidence interval (95% CI) were employed to compare the prevalence of hypercholesterol, hypertriglyceridemia and dyslipidemia. Statistical analysis was performed using SPSS 11.0 software package (SPSS Inc., Chicago, IL, USA). A p-value < 0.05 was considered as statistically significant.

Results

Four hundred twenty six schoolchildren were asked to have blood examination. Seventy-eight children refused, while 348 were enrolled in this population study. Mean age was 10.2 years (range 6.08 to 17.8 years) and 189 (54.3%) were boys. Demographic and anthropometric characteristics are reported in Table 1. There were no significant differences between genders in terms of age, weight, height, BMI, nutritional status, blood pressure, prevalence of hypertension, family history of metabolic associated syndromes and smoker. The percentage of blood groups A, B, AB and O in the present study was found to be 14.3%, 36.8%, 7.5% and 41.4%, respectively. There was no significant difference between genders. Hypertension was detected in 18 (5.2%) children. According to WHO criteria, 34 (9.8%), 34 (9.8%) and 25 (7.2%) of the study population were classified as overweight, obese and thin, respectively.

Table 2 shows the prevalence of hypercholesterolemia, hypertriglyceridemia and dyslipidemia. Hypercholesterolemia and hypertriglyceridemia were found in four (1.2%) and 37 (10.6%) children. None of the children simultaneously had high cholesterol and triglyceride levels. Based on these data, there were no significant differences in risk of dyslipidemia between genders, age groups, presence of hypertension, family history of dyslipidemia, diabetes mellitus, and presence of a smoker in the family. In accordance to AAP guideline[12], the age risk of dyslipidemia was graded into three groups, 5-9 years, 10-14 years, and 15-19 years. Overweight and/or obese children had higher risk of dyslipidemia compared to non-obese children (OR 4.0, 95% CI 2.0-8.0). The percentage of dyslipidemia in blood group AB children was slightly higher than other blood groups, but this difference did not reach statistical significance (OR 1.9, 95% CI 0.7-5.2).

Discussion

This population study offers an overview about the risk of dyslipidemia in Thai children. The major finding from the present results is that overweight

Table 1. Demographic characteristics and anthropometric data of subjects

	Boys (n = 189)	Girls (n = 159)	Total (n = 348)
Age (yr)	10.3 (2.4)[1]	10.2 (2.4)	10.2 (2.4)
Weight (kg)	34.7 (12.5)[1]	34.6 (13.3)	34.7 (12.8)
Height (cm)	139.0 (14.9)[1]	138.8 (14.0)	138.9 (14.5)
Body mass index (kg/m^2)	17.5 (3.7)[1]	17.4 (4.0)	17.5 (3.8)
Systolic blood pressure (mmHg)	99.0 (17.4)[1]	96.6 (16.4)	97.9 (17.0)
Diastolic blood pressure (mmHg)	62.6 (12.4)[1]	62.8 (11.5)	62.7 (12.0)
Nutritional status			
Thinness[3]	11 (5.9)[2]	14 (8.8)	25 (7.2)
Normal	138 (73.0)	117 (73.6)	255 (73.3)
Overweight[4]	19 (10.0)	15 (9.4)	34 (9.8)
Obese[5]	21 (11.1)	13 (8.2)	34 (9.8)
Hypertension	11 (5.8)[2]	7 (4.4)	18 (5.2)
Family history of			
Dyslipidemia	4 (2.1)[2]	5 (3.1)	9 (2.6)
Premature CVD[6]	4 (2.1)	1 (0.6)	5 (1.4)
Dyslipidemia and/or premature CVD	8 (4.2)	6 (3.8)	14 (4.0)
Diabetes mellitus	15 (7.9)	16 (10.1)	31 (8.9)
Smoker in family	116 (61.4)[2]	101 (63.5)	217 (62.4)

[1] Present as mean (SD); [2] Present as n (%); [3] BMI < -2SD; [4] BMI range from > +1SD to +2SD; [5] BMI > +2SD; [6] CVD = cardiovascular diseases

and obese children have a four times greater risk to be affected by dyslipidemia in comparison to normal children (OR = 4.0; 95% CI 2.0-8.0). American Academy of Pediatrics suggests different cut off levels between age and sex, while NCEP criteria do not consider these parameters as important in dyslipidemia evaluation[12,16]. The authors have decided to follow AAP guidelines in order to determine the risk of dyslipidemia between sexes and in relation to age. Previous studies performed in Thailand have not used a cut point dependent on age and sex[17,18]. Sirikulchayanonta et al[17] determined the serum lipid profiles in primary school children. Overall, 40% had hypercholesterolemia with total cholesterol (TC) at ≥ 200 mg/dl and high low-density lipoprotein cholesterol (LDL-C) at ≥ 130 mg/dl. Furthermore, 5.4% had high triglyceride (TG) levels at ≥ 150 mg/dl. There was no association between lipid profiles and age, gender or nutritional status, except that higher TG levels were found among obese children than others ($p < 0.001$). Chotivittayatarakorn et al[18] performed cholesterol screening in children aged between 5 and 18 years from families with a history of premature coronary heart disease and/or parental hypercholesterolemia. Eighty-seven (52.7%) children had a non-fasting capillary blood cholesterol level ≥ 170 mg/dl, and 75 (87.2%) of these children were measured for lipoprotein analysis. Total cholesterol level ≥ 200 mg/dl, low density lipoprotein cholesterol (LDL-C) ≥ 130 mg/dl and high density lipoprotein cholesterol (HDL-C) < 35 mg/dl were found in 43 (57.3%), 50 (66.7%) and nine (12.0%) children respectively. The authors' results are in line with previously reported ones. Positive family history of dyslipidemia or premature cardiovascular disease, hypertension and diabetes mellitus are factors that tend to increase the risk of dyslipidemia, even if without any significant difference. This is probably because of the small number of individuals in each group. In addition, the blood group AB seems to be associated with an increased risk of dyslipidemia. Further investigations with larger cohorts are needed to ascertain these correlations. In conclusion, based on the evidence that overweight and/or obese children had a 4-fold increased risk of dyslipidemia compared with non-obese children, the authors recommend a lipid screening should be considered especially in overweight and obese children. Long-term follow-up studies of cardiovascular disease should be important in children that are currently affected by dyslipidemia.

Acknowledgement

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Table 2. Comparison of prevalence of dyslipidemia among the risk groups

	Hypercholesterolemia (n = 4)		Hypertriglyceridemia (n = 37)		Dyslipidemia (n = 41)	
	n (%)	OR[6] (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Gender						
Boys (n = 189)	1 (0.5)	1.0	20 (10.6)	1.0	21 (11.1)	1.0
Girls (n = 159)	3 (1.9)	3.6 (0.4-35.1)	17 (10.7)	1.0 (0.5-2.0)	20 (12.6)	1.2 (0.6-2.2)
Age						
5-9 yr (n =143)	3 (2.1)	1.0	12 (8.4)	1.0	15 (10.5)	1.0
10-14 yr (n=199)	1 (0.5)	0.2 (0.0-2.3)	25 (12.6)	1.6 (0.8-3.2)	26 (13.1)	1.3 (0.7-2.5)
Body mass index						
Non-obese[3] (n = 280)	1 (0.4)	1.0	22 (7.9)	1.0	23 (8.2)	1.0
Obese[4] (n =68)	3 (4.4)	12.9 (1.3-125.8)	15 (22.1)	3.3 (0.2-4.8)	18 (26.5)	4.0[1] (2.0-8.0)
Hypertension						
No (n = 330)	4 (1.2)		35 (10.6)	1.0	39 (11.8)	1.0
Yes (n = 18)	0 (0)	-	2 (11.1)	1.1 (0.2-4.8)	2 (11.1)	0.9 (0.2-4.2)
Family history of dyslipidemia and/or premature CVD[5]						
No (n = 334)	4 (1.2)		34 (10.2)	1.0	38 (11.4)	1.0
Yes (n = 14)	0 (0)	-	3 (21.4)	2.4 (0.6-9.1)	3 (21.4)	2.4 (0.6-8.0)
Family history of diabetes mellitus						
No (n = 317)	4 (1.2)		35 (11.0)	1.0	39 (12.3)	1.0
Yes (n = 31)	0 (0)	-	2 (6.5)	0.6 (0.1-2.4)	2 (6.5)	0.5 (0.1-2.1)
Smoker in family						
No (n =131)	1 (0.8)	1.0	11 (8.4)	1.0	12 (9.2)	1.0
Yes (n = 217)	3 (1.4)	1.8 (0.2-17.7)	26 (12.0)	1.5 (0.7-3.1)	29 (13.4)	1.5 (0.8-3.1)
ABO blood group						
A (n = 50)	1 (2.0)	2.0 (0.2-19.7)[2]	3 (6.0)	0.5 (0.1-1.7)[2]	4 (8.0)	0.6 (0.2-0.8)[2]
B (n = 128)	2 (1.6)	1.7 (0.2-12.4)[2]	12 (9.4)	0.8 (0.4-1.7)[2]	14 (10.9)	0.9 (0.4-1.7)[2]
AB (n = 26)	0 (0)	-	5 (19.2)	2.2 (0.8-6.1)[2]	5 (19.2)	1.9 (0.7-5.2)[2]
O (n = 144)	1 (0.7)	0.5 (0.1-4.6)[2]	17 (11.8)	1.2 (0.6-2.4)[2]	18 (12.5)	1.1 (0.6-2.2)[2]

[1] $p < 0.05$; [2] Compared to other blood group; [3] Thinness or normal body mass index (BMI $\leq$ +1SD); [4] Overweight or obesity (BMI > +1SD); [5] CVD = cardiovascular diseases; [6] OR = odd ratio

Potential conflicts of interest

None.

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ความชุกของระดับไขมันในเลือดผิดปกติในเด็กนักเรียนไทย

สงวนศักดิ์ ฤกษ์ศุภผล, ลัคนา ฤกษ์ศุภผล

วัตถุประสงค์*: เพื่อประเมินความชุกและปัจจัยเสี่ยงของภาวะไขมันผิดปกติในเด็กนักเรียนไทย*

วัสดุและวิธีการ*: การศึกษาภาคตัดขวางของเด็กนักเรียนอายุ 6-17.8 ปี จำนวน 348 คน ในจังหวัดนครนายก ประเทศไทย ระหว่างเดือนพฤษภาคมและมิถุนายน พ.ศ. 2552 โดยได้ดำเนินการตรวจวัดระดับไขมันคอเลสเตอรอลรวมและไตรกลีเซอไรด์จากเลือดที่เจาะเก็บภายหลังงดอาหารเป็นเวลา 10 ชั่วโมง การวินิจฉัยภาวะไขมันในเลือดสูง (ไขมันคอเลสเตอรอลรวม และ/หรือไขมันไตรกลีเซอไรด์สูง) โดยอ้างอิงเกณฑ์วินิจฉัยตามกำหนดของวิทยาลัยกุมารแพทย์แห่งสหรัฐอเมริกา (American Academy of Pediatrics; AAP) ได้ทำการบันทึกข้อมูลประชากร และข้อมูลการวัดขนาดร่างกายของเด็กที่เข้าร่วมโครงการ การเปรียบเทียบความชุกของภาวะไขมันผิดปกติโดยใช้ odds ratio และค่าช่วงความเชื่อมั่นร้อยละ 95*

ผลการศึกษา*: ความชุกของภาวะไขมันคอเลสเตอรอลรวมในเลือดสูง และภาวะไขมันไตรกลีเซอไรด์ในเลือดสูงพบได้ร้อยละ 1.1 และ 10.6 ตามลำดับโดยไม่พบเด็กคนใดที่มีภาวะไขมันในเลือดทั้ง 2 ชนิดสูง การศึกษานี้พบเด็กที่มีน้ำหนักตัวเกิน 34 คน (คิดเป็นร้อยละ 9.8) เด็กโรคอ้วน 34 คน (คิดเป็นร้อยละ 9.8) และเด็กผอม 25 คน (คิดเป็นร้อยละ 7.2) อัตราเสี่ยงของการมีไขมันในเลือดสูงในเด็กที่มีภาวะน้ำหนักเกิน และ/หรือเด็กโรคอ้วนเมื่อเทียบกับเด็กที่ไม่อ้วนเท่ากับ 4.0 (ค่าช่วงความเชื่อมั่นร้อยละ 95 ที่ 2.0-8.0) ไม่พบการเพิ่มอัตราเสี่ยงของการมีไขมันในเลือดสูงอย่างมีนัยสำคัญในปัจจัยเสี่ยงอื่น ๆ เช่น เพศ [1.2 (0.6-2.2)] อายุ [1.3 (0.7-2.5)] ความดันโลหิตสูง [0.9 (0.2-4.2)] ประวัติบุคคลในครอบครัวมีโรคไขมันในเลือดสูง [2.4 (0.6-8.0)], ประวัติบุคคลในครอบครัวเป็นโรคเบาหวาน [0.5 (0.1-2.1)] และการมีบุคคลในครอบครัวสูบบุหรี่ [1.5 (0.8-3.1)] และความแตกต่างกันของหมู่เลือดระบบเอบีโอ*

สรุป*: ความชุกโดยรวมของภาวะไขมันผิดปกติในเด็กนักเรียนไทยพบได้ร้อยละ 11.8 ภาวะน้ำหนักตัวเกิน และ/หรือโรคอ้วนเป็นปัจจัยเสี่ยงแต่เพียงชนิดเดียวของภาวะไขมันในเลือดสูงในเด็กนักเรียนไทยอายุ 6-17.8 ปี*