



## Difference in Serum Non-High-Density Lipoprotein Cholesterol Levels in terms of Sex, Age, and Physique in Children and Adolescents

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Recent studies have suggested that childhood non-high-density lipoprotein cholesterol (non-HDL-C) levels are as good as other lipoprotein measures in predicting subclinical atherosclerosis in adulthood<sup>1, 2</sup>. Kit *et al.* reported serum lipids trends among youths in the US aged 6–19 years during 1988–2010<sup>3</sup>. They documented that non-HDL-C levels varied in terms of sex, age, race/ethnicity, and study time. In addition, Srinivasan *et al.* stressed that serum non-HDL-C levels were related to both body mass index (BMI) and waist circumference<sup>4</sup>.

Recently, Shim *et al.* published an interesting paper<sup>5</sup>. They reported reference values for the triglyceride (TG)-to-high-density lipoprotein cholesterol (HDL-C) ratio and non-HDL-C in Korean children and adolescents aged 10–19 years. This paper will be useful for the study of childhood lipoprotein, but there are some concerns. In this study there were no data about the constitution of physique in the subjects. In addition, there was no information about the prevalence of obesity and leanness in the general children population in Korea. Moreover, obesity is commonly associated with a combined dyslipidemia pattern with mild elevation in total cholesterol and low-density lipoprotein cholesterol levels, moderate-to-severe elevation in TG level, and low HDL-C levels<sup>6</sup>. Therefore, there was some possibility that the serum non-HDL-C levels were affected by the differences in the subjects' physique, especially obesity. I think the serum non-HDL-C levels in normal physique subjects would be appropriate for the development of the ref-

erence values. Furthermore, I am interested in serum non-HDL-C levels in obese children among the Korean children.

We previously reported the reference ranges for the non-HDL-C levels in Japanese children and adolescents<sup>7</sup>. According to the data from the Annual Report of School Health Statistics Research in 2015, the prevalence of obese children in Japan is 9.9% (11 years of age) and 7.9% (14 years of age) in boys and 7.9% (11 years of age) and 7.1% (14 years of age) in girls. On the other hand, the prevalence of lean children in Japan is 3.2% (11 years of age) and 1.7% (14 years of age) in boys and 3.0% (11 years of age) and 2.9% (14 years of age) in girls<sup>8</sup>. Sugiura *et al.* reported the differences in serum lipid levels in lean and obese children using same subjects we previously reported<sup>9</sup>. In this study, the subjects were classified based on the percentage of overweight: lean ( $\leq -20\%$ ), normal ( $> -20\%$ ,  $< 20\%$ ), mild obesity ( $\geq 20\%$ ,  $< 30\%$ ), moderate obesity ( $\geq 30\%$ ,  $< 50\%$ ), and severe obesity ( $\geq 50\%$ ). They reported that the median values of serum non-HDL-C levels of normal physique children were U shaped according to aging. The median values of non-HDL-C levels of normal physique children were lower than those of obese children in all ages and both sexes. The median values of serum non-HDL-C levels increased according to the severity of obesity. The difference between the median values of serum non-HDL-C levels of severely obese children and those of normal physique children were approximately 20–30 mg/dl. Therefore, the impact of physique, especially obesity, needs to be considered to determine the reference ranges for non-HDL-C levels.

Shim *et al.* reported not only serum non-HDL-C levels but also TG-to-HDL-C ratio. I investigated TG-to-HDL-C ratio in Japanese children using the non-fasting serum lipid data. The age trend of TG-to-HDL-C ratio was similar to serum non-HDL-C levels in boys and girls. Di Bonito *et al.* documented that TG-to-HDL-C ratio was a better predictor of cardio-

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vascular risk or preclinical signs of organ damage than serum non-HDL-C levels<sup>10</sup>). However, non-HDL-C is more popular than TG-to-HDL-C ratio worldwide. For example, an Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents recommended that universal screening of the non-fasting non-HDL-C level and non-HDL-C  $\geq 145$  mg/dL is used to identify a dyslipidemic state in children and adolescents up to 19 years of age<sup>6</sup>). The reference values of fasting non-HDL-C levels in Korean children were similar to that of non-HDL-C levels in Japanese children, which was derived from non-fasting blood samples. Therefore, the reference values of serum non-fasting non-HDL-C levels were more useful as a screening tool than TG-to-HDL-C ratio. We strongly recommend the estimation of serum non-fasting non-HDL-C levels for childhood cholesterol screening.

### Conflict of Interest

None.

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