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The Association between Persistent Hypertriglyceridemia and the Risk of Diabetes Development: The Kangbuk Samsung Health Study (*Endocrinol Metab* 2018;33:55-61, Yu Hyun Kwon et al.)

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Hypertriglyceridemia is a common lipid abnormality in persons with visceral obesity, metabolic syndrome, and type 2 diabetes [1]. Hypertriglyceridemia typically occurs in conjunction with low high-density lipoprotein levels and atherogenic, small, dense low-density lipoprotein particles, and is associated with increased cardiovascular risk [1]. Severe and very severe hypertriglyceridemia increase the risk for pancreatitis, whereas mild or moderate hypertriglyceridemia may be a risk factor for cardiovascular disease (CVD) [2]. Elevated triglyceride levels usually are seen with other metabolic abnormalities associated with increased CVD risk. The factors contributing to elevated serum triglycerides are overweight, physical inactivity, excess alcohol intake, the presence of metabolic syndrome or type 2 diabetes mellitus, and certain genetic disorders [2]. Thus, the Endocrine Society Clinical Guidelines recommend that patients with primary hypertriglyceridemia be assessed for other cardiovascular risk factors, such as central obesity, hypertension, abnormalities of glucose metabolism, and liver dysfunction [2]. According to the 2018 fact sheet on dyslipidemia in Korea from the Korean Society of Lipid and Atherosclerosis, the prevalence of hypertriglyceridemia among adults aged 30 years or older is 17.5%, and the proportion of men in their 40s with hypertriglyceridemia is four times higher than those of women within the same age group.

Kwon et al. [3] investigated the association between persistent hypertriglyceridemia and the risk of diabetes development in non-diabetic participants. I read this article with interest. They reported that a higher risk of diabetes development was observed in individuals with persistent hypertriglyceridemia (defined as hypertriglyceridemia that was present at an index examination and when assessed after a 2-year interval) than the reference group, even after adjusting for confounding factors [3]. When they further adjusted for body mass index (BMI), a reduction in the risk was observed, which might have been due to the positive correlation between BMI and triglyceride levels. They acknowledged the limitation that the follow-up period was 4 years, which may not have been a long enough period. Extending the length of the follow-up period may result in different outcomes [3]. Nevertheless, this study was valuable in that it was the first large population-based study in Korea to investigate the relationship between the risk of diabetes development and changes or persistence of serum triglyceride levels over time.

Recently, a rural Chinese cohort study (12,086 participants)

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was conducted with a median follow-up of 6 years. This study found that transformation from a baseline hypertriglyceridemic-waist phenotype to a normal waist circumference and a normal triglyceride level at follow-up, compared with maintaining the hypertriglyceridemic-waist phenotype, reduced the risk of developing type 2 diabetes by 75% and 78% for males and females, respectively [4]. In a 96-male-rat model of diet-induced type 2 diabetes with a follow-up of 48 weeks, postprandial hypertriglyceridemia predicted the development of insulin resistance, glucose intolerance, and type 2 diabetes [5]. Kwon et al. [3] showed that the risk of type 2 diabetes was associated with changes in triglyceride levels during a mean follow-up of 4 years. In the National Health and Nutrition Examination Survey, 1999 to 2004, 33% of the nearly 6,000 participants (37% of men, 30% of women) had serum triglyceride levels of at least 150 mg/dL. Of the subjects, approximately 14% had mild hypertriglyceridemia (150 to 200 mg/dL), whereas 16% had triglyceride levels of 200 to 500 mg/dL (defined as moderate hypertriglyceridemia), and roughly 2% had levels above 500 mg/dL (defined as severe hypertriglyceridemia) [2,6].

In the study of Kwon et al. [3], the mean triglyceride level was about 120 mg/dL; serum triglyceride levels <150 mg/dL were defined as normal, while serum triglyceride levels ≥150 mg/dL were defined as abnormal. The participants were divided into four groups based on their baseline triglyceride levels at the baseline (2010) and 2 years later (2012) [3]. A future study comparing individuals with normal triglyceride levels to those with mild, moderate, and severe hypertriglyceridemia would be informative. In a prospective study of 26,509 initially healthy United States women with a median follow-up of 11.4 years, with analyses stratified by time since the participants' last meal, triglyceride levels measured 2 to 4 hours postprandially had the strongest association with cardiovascular events, and this association progressively decreased with longer periods of fasting [7]. Thus, further studies are needed to address the association of postprandial hypertriglyceridemia with the risk of type 2 diabetes.

In conclusion, this study is valuable and provides important insights into the relationship between changes in hypertriglyceridemia and the risk of future diabetes in Koreans. Nonetheless, more detailed investigations, with longer follow-up periods, of the relationships of changes in specific types of lipoproteins, persistent hypertriglyceridemia, and the risk of diabetes would help elucidate the cause-effect relationship.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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