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Association between Type II Diabetes Mellitus and Pre-DM with the Triglyceride-to-HDL-Cholesterol Ratios in Korean Older Adults: KNHANES VIII-1

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ABSTRACT

The prevalence of type 2 diabetes mellitus (T2DM) has increased over the past 50 years, along with the aging of the population. The occurrence and development of pre-DM and T2DM are all closely related to non-traditional lipid parameters like the THR (triglycerides to high-density lipoprotein cholesterol ratio), in addition to traditional lipid parameters like TG, TC, HDL-C, and LDL-C. In older Korean individuals, the precise association between THR and pre DM, and T2DM has not yet been firmly established. The purpose of this study was to investigate the relationship between THR and pre-DM and Type2DM in elderly Koreans. A total of 3,192 elderly subjects (age ≥ 65 years; age range 65-80; men: n=1,379; women: n=1813) from KNHANES VIII-1(2018) were examined. We conducted multi-variate logistic regression for THR in continuous form and in categorized form (Q1-Q4) for each gender. Multiple logistic regression results showed that the non-traditional lipid parameter, that is, THR (TG/HDL-C) was associated with the risk of pre-DM and T2DM. When dividing TG/HDL-C into quartile, using T1 as a reference, T4 was observe to have the highest association with both pre-DM(OR: 3.404; 95% CI: 2.514-4.610) and DM (OR: 2.308; 95% CI: 1.697-3.139). We found that stronger positive association between THR and risk of both pre-DM(OR=2.384; 95% CI: 1.558-3.647) and Type II Diabetes Mellitus (OR=3.984; 95% CI: 2.628-6.040) in female than in male (pre DM: OR: 2.795, 95% CI: 1.789-4.365; T2DM(OR=2.243, 95% CI: 1.436-3.504). In elderly populations, pre-DM and T2DM were substantially correlated with elevated non-traditional lipid parameters, particularly THR.

Keywords: TG/HDL-C Ratio; Type 2 Diabetes Mellitus; Korean Elders

Abbreviations: T2DM: Type 2 Diabetes Mellitus; DM: Diabetes Mellitus; CV: Cardiovascular

Introduction

Older persons are more likely to have diabetes mellitus and continued trends in this direction are expected in the upcoming decades. According to Sesti, et al [1], 51% of older persons (over 65) in the US have prediabetes and over 25% have diabetes. In South Korea, three of ten people over 65 had diabetes mellitus with inadequate glycemic and risk factor management (Jung, et al. [2,3]). For a number of reasons, diabetes mellitus is especially significant among the elderly population. First, as people age, diabetes becomes more common. Diabetes is more common in older adults, and as people age, their risk increases (Sesti, et al. [1]). Second, diabetes can result in a number of complications, including kidney disease, nerve damage, heart disease, stroke, and visual issues (Sinclair et al. [4]). Diabetes can increase the chances of certain conditions that older people may already be more susceptible to. Third, diabetes is not the only health issue that older persons frequently have. Effective diabetes management becomes crucial for maintaining general health and preventing additional health issues. Forth, there is evidence suggesting a possible connection between diabetes and cognitive deterioration. Older adults with diabetes may put them more vulnerable to illnesses like dementia. Taking proper care of one's diabetes can help preserve cognitive abilities. Fifth, In order to preserve physical function and avoid handicap in older persons, diabetes care is essential. In the group of frail older persons, diabetes is associated with premature death, multiple comorbidities, and functional impairment.

Valid and accurate risk factors are crucial to lowering the burden of diabetes in the elderly population since good diabetes treatment can dramatically improve the quality of life for these individuals. Although unhealthy diets, physical inactivity, and being overweight or obese have all been linked to the development of diabetes, a recent study found that non-traditional lipid parameters, such as the ratio of triglycerides to high-density lipoprotein cholesterol (THR), as well as traditional lipid parameters, such as TG, TC, HDL-C, and LDL-C, are also closely linked to the development of diabetes. Numerous research investigations have reported that THR is indicative of insulin resistance. (Yang, et al. [5,6]) and associated with ischemic heart disease (Bertsch, et al. [7]), and incidence of type 2 diabetes in a cohort of men (Vega, et al. [8]). Overall, the TG/HDL-C cut-offs for men and women are approximately >3.5 and >2.5, respectively. Nonetheless, the majority of research examining these associations has been carried out mostly on younger or Caucasian populations. Research on the connection between TG/HDL-C and the risk of diabetes mellitus (DM), especially in the senior Asian population, however, has not been thoroughly studied yet. The purpose of this study was to examine the association between THR and Type 2 DM and pre-DM in the elderly Korean population.

Method

Study Population

This research represents the second analysis of the aquaire data from KNHANES VIII-1, 2018. The KNHANES has been used since 1998 to assess the nutritional and general health of the Korean people. A multistage, intricate, stratified, probability cluster survey was employed in this study, which included a representative sample of South Korea's non-institutionalized population. About 10,000–12,000 people make up the survey's yearly sample, and 4600 houses are chosen from a panel and polled. The nutrition survey, health exam, and health interview survey make up the KNHANES VII-I. We used data from 3,192 people over 65 who had triglyceride, HDL-C, and diabetes out of 16,489 people who completed the KNHANES VII-I (Figure 1).

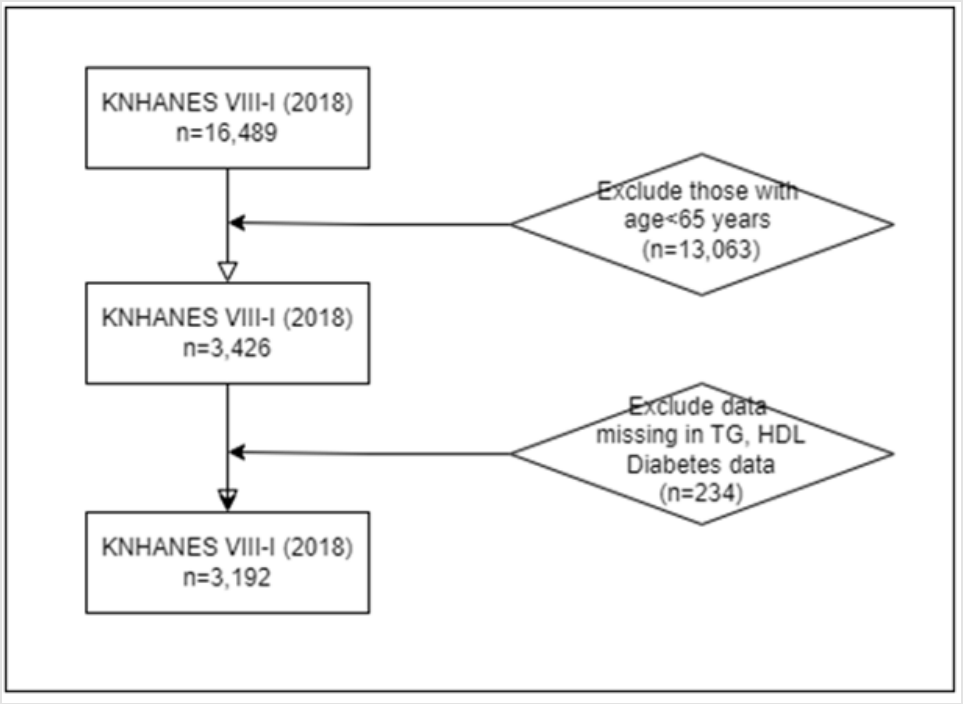

Figure 1: Selection diagram for research participants.

Ethics Statement and Data Access

The Korea Center for Disease Control and Prevention granted permission for access to the KNHANES VIII-I data. This study was exempt from IRB approval because it is a secondary analysis that used and evaluated 2018 KNHANES, VIII-I data that was collected.

Data Collection

The data for this study comprises participants in the KNHANES VIII-1 2018. Age, gender, education level, household income, marital status, and frequency of exercise are examples of sociodemographic characteristics. A person's education was categorized as finished elementary school, middle school (less than nine yr), high school

(10–12 yr), or college (more than thirteen yr). The monthly income of a household was quantified by dividing it by the total number of family members and classified into quartiles. For marital status, those who were married were classified as "with the spouse," singles who had recently divorced as "divorced," widowers as "widow/widower," and those who were single before being married as "widow/widower." Based on their fasting glucose value and a history of DM, participants were classified into three groups. Impaired fasting glucose was defined as 1) normoglycemic (NG) (fasting glucose value<100mg/dL(5.6mmol/L)), 2) Pre-Diabetes Mellitus (Pre-DM) (fasting glucose value: 100-125mg/dL (5.6-6.9mmol/L)), and 3) Diabetes mellitus (DM) (fasting glucose value ≥ 126mg/dL(7.0mmol/L)) or a history of DM. Weight in kilograms divided by the square of height in meters (kg/m^2) generates the body mass index (BMI), the Asian-Pacific cutoff points (Pan, et al. [9]). BMI is divided into four categories: obese (over 25 kg/m^2), overweight (23-24.9 kg/m^2), normal (18.5-22.9 kg/m^2), and underweight (18.5 kg/m^2).

Data Analysis

SPSS 24.0 (IBM Corp. Armonk, NY: IBM Corp.) was utilized to analyze the data. The TG/HDL-C quartiles were used to stratify the subjects. The mean and standard deviations were used to represent continuous values, and frequency or percentage were used to represent categorical variables. The chi-square test, one-way ANOVA, or Kruskal Wallis H testa were performed to identify any significant differences between the proportional groups and means. Multivariate Logistic regression analysis for THR in categorized form (Q1 to Q4) were conducted at the 5% (p<.05) level, statistical significance was considered to exist.

Results

Table 1 displays the demographic characteristics of the baseline participants. A total of 3,192 (men: 1,379, women: 1,813, mean) were included in the analysis, the mean age of the population was 72.83±5.04 years old. Participants in NG, Pre-DM and DM were 45.52% (n=1453), 37.69% (n=1203) and 16.79%(n=536), respectively. The mean TG/HDL-C was 3.19±3.11, and mean fasting plasma glucose and BMI were 109.19 ±27.91 and 24.22±3.19kg/m^2, respectively. We found that age, gender, systolic blood pressure were not affect senior's diabetes status. Participants who had lower household income, higher number of waist circumference, higher BMI, diagnosed hypertension, hyperlipidemia, hypercholesterolemia are more likely to be in Pre-DM or DM. Further, we found the highest TG/HDL-C group are more likely to have pre-DM or DM. After adjusting for the full model (adjusted age, BMI, DBP, household income, waist circumference, associated disease), we could detect the relationship (OR=3.404, 95% C.I: 2.514-4.610) with Pre-DM and (OR: 2.308, 95% C.I: 1.697-3.139) with DM (Table 2).

Table 1: Baseline characteristics of participants and by diabetic status.

Characteristics	NG(n=1453)	pre_DM (.n=1203)	DM (n=536)	p-value
	n(%) or M(SD)	n(%) or M(SD)	n(%) or M(SD)	
Age, yr	72.85 (5.13)	72.71(4.97)	73.06(4.93)	n.s.
Gender				
Male	589(42.7)	536 (38.9)	254 (18.4)	0.402
Female	864(47.7)	667 (36.8)	283 (15.6)	
House income				
Q1	364(45.0)	295(36.5)	150(18.5)	<.001
Q2	379(46.8)	293(36.2)	138(17.0)	
Q3	356(45.2)	299(38.0)	132(16.8)	
Q4	349(45.3)	304(39.5)	117(15.2)	
SBP (mmHg)	127.95(17.76)	129.82(17.17)	128.46(16.58)	0.02
DBP(mmHg)	72.94(9.85)	69.98(9.71)	69.88(9.71)	<.001
Waist (cm)	83.31(8.68)	86.00(8.71)	89.17(9.38)	<.001
BMI	23.64(3.02)	24.50(3.07)	25.16(3.59)	<.001
Hypertension				
Normal	298(20.5)	157(13.1)	62(11.5)	<.001
Pre HBP	337(23.2)	212(17.6)	93(17.3)	
HBP	818(56.3)	833(69.3)	382(71.1)	
Hyperlipidemia (%)				
No	1142(47.8)	892(37.4)	353(14.8)	<.001
YES	147(38.7)	140(36.8)	93(24.5)	
Hypercholesterolemia				

No	990(70.2)	749(64.7)	308(62.1)	0.001
YES	421(29.8)	408(35.3)	188(37.9)	
Hypertriglyceride				
No	1142(47.8)	892(37.4)	353(14.8)	<.001
YES	147(38.7)	140(36.8)	93(24.5)	
TG/HDL-C quartile				
Q1	413(28.4)	301(25.0)	78(14.5)	<.001
Q2	392(26.9)	294(24.4)	116(21.6)	
Q3	354(24.3)	291(24.2)	153(28.4)	
Q4	294(20.2)	316(26.3)	189(35.1)	

Note: BMI: Body Mass Index (Kg/m^2)

Table 2: Relationship between TG/HDL-C and the diabetic status.

Variables	Pre-DM			DM			
	OR	95% C.I	*p*		OR	95% C.I	p
Total	3.404	(2.514-4.610)	<.001	Total	2.308	(1.697-3.139)	<.001
Men	2.795	(1.789-4.365)	<.001	Men	2.243	(1.436-3.504)	<.001
Women	2.384	(1.558-3.647)	<.001	Women	3.984	(2.628-6.040)	<.001

Discussion

Our finding indicated that, after controlling for covariates, TG/HDL-C was positively linked with the incidence of diabetes even in later life, both men and women. Previous studies reported that high TG/HDL-C has been associated with insulin resistance such as American (Vega, et al. [8]), Korean adults (Sung, et al. [10,11]), and Chinese adults (Chen, et al. [12]), but not shown any evidence in the elderly population. However, the results of this study has similar in other Asian study. TG/HDL-C was found to be positively correlated with the risk of diabetes by Chen et al. [12]. The result of this study is significant in that we has similar results with only older subjects. While in Irnanian study TG/HDL-C was not robust predictors of type II Diabetes in high risk individual (Janghorbani, et al. [13]). Additionally, our study's findings are consistent with past research showing the TG/HDL-C ratio as a surrogate metabolic indicator that can predict, in individuals with pre-hypertension or even normal blood pressure, the onset of type II diabetes (Wagner, et al. [14]). Cheng et al. [15] shown in dose-response relationships between their 4173 Chinese men and 6568 women that the Type 2 diabetes is associated with the TG/HDL-C ratio, an independent risk factor and Women in particular experienced this interaction. According to our findings, women had a greater OR of DM when compared to men's. Diabetes in older adults is linked to an increased absolute risk of cardiovascular (CV) or microvascular disease, even though young adults with early onset type 2 diabetes and hipoglycemia have a higher relative CV risk. These consequences include a higher death rate, an increase in hospital admissions and institutionalization, as well as a greater social and financial burden. It is yet unknown how precisely a high TG/HDL-C ratio contributes to the onset of type 2 diabetes. Insulin resistance and decreased insulin production are two characteristics of type II diabetes (Pantoja-Torres, et al. [16]).

Therefore, one theory for the connection between high TG/HDL-C ratio and the onset of type II diabetes and pre-DM could be malfunctioning aging pancreatic beta-cells. Reduced HDL-C subsequently results in decreased cholesterol export, which builds up cholesterol in pancreatic beta cells. This includes higher levels of nitric oxide, ceramide, and blood glucose. Elevated TG levels may also cause beta cell death (Levy, et al. [17-19]). Future research should take our study's possible shortcomings into account. First off, because this study is based on a secondary analysis of national health data, variables like interleukin-5 that were not part of the original dataset cannot be changed, even if they may have an impact on TG and HDL-C levels. Similarly, as this study's foundation is a secondary analysis of published data, characteristics like hip circumference and tumor necrosis factor that are not part of the data set cannot be changed.

Despite its limitations, this study has certain advantages.

- This study's sample size was comparatively large when compared to earlier, comparable research;
- We managed the independent variable by secondary data analysis.

Conclusion

In conclusion, among Korean older individuals who live in communities, a high TG/HDL-C ratio independently predicts the incidence of Type II diabetes in the future. This prediction is not influenced by other related variables.

References

1. Sesti G, Incalzi RA, Bonora E, Consoli A, Giaccari A, et al. (2018) Management of diabetes in older adults. Nutrition metabolism and cardiovascular diseases 28(3): 206-218.
2. Jung C H, Son J W, Kang S, Kim W J, Kim H S, et al. (2021) Diabetes fact sheets in Korea, 2020: an appraisal of current status. Diabetes & Metabolism Journal 45(1): 1-10.
3. Bae J H, Han K D, Ko S H, Yang Y S, Choi J H, et al. (2022) Diabetes fact sheet in Korea 2021. Diabetes & Metabolism Journal 46(3): 417-426.
4. Sinclair A, Morley JE, Rodriguez-Mañas L, Paolisso G, Bayer T, et al. (2012) Diabetes mellitus in older people: position statement on behalf of the International Association of Gerontology and Geriatrics (IAGG), the European Diabetes Working Party for Older People (EDWPOP), and the International Task Force of Experts in Diabetes. Journal of the American Medical Directors Association 13(6): 497-502.
5. Yang M, Rigdon J, Tsai SA (2019) Association of triglyceride to HDL cholesterol ratio with cardiometabolic outcomes. Journal of Investigative Medicine 67(3): 663-668.
6. Ren X, Chen Z ai, Zheng S, Han T, Li Y, et al. (2016) Association between triglyceride to HDL-C ratio (TG/HDL-C) and insulin resistance in Chinese patients with newly diagnosed type 2 diabetes mellitus. PloS one 11(4): e0154345.
7. Bertsch R A, Merchant M A (2015) Study of the use of lipid panels as a marker of insulin resistance to determine cardiovascular risk. The Permanente Journal 19(4): 4-10.
8. Vega GL, Barlow CE, Grundy SM, Leonard D, DeFina LF (2014) Triglyceride–to–high-density-lipoprotein-cholesterol ratio is an index of heart disease mortality and of incidence of type 2 diabetes mellitus in men. Journal of Investigative Medicine 62(2): 345-349.
9. Pan WH, Yeh W-T (2008) How to define obesity? Evidence-based multiple action points for public awareness, screening, and treatment: an extension of Asian-Pacific recommendations. Asia Pacific journal of clinical nutrition 17(3): 370374.
10. Sung KC, Park HY, Kim MJ, Reaven G (2016) Metabolic markers associated with insulin resistance predict type 2 diabetes in Koreans with normal blood pressure or prehypertension. Cardiovascular diabetology 15: 1-8.
11. Park B, Jung DH, Lee HS, Lee YJ (2021) Triglyceride to HDL-cholesterol ratio and the incident risk of ischemic heart disease among Koreans without diabetes: a longitudinal study using national health insurance data. Frontiers in cardiovascular medicine 8: 716698.
12. Chen Z, Hu H, Chen M, Luo X, Yao W, et al. (2020) Association of Triglyceride to high-density lipoprotein cholesterol ratio and incident of diabetes mellitus: a secondary retrospective analysis based on a Chinese cohort study. Lipids in health and disease 19(1): 1-11.
13. Janghorbani M, Amini M (2016) Utility of serum lipid ratios for predicting incident type 2 diabetes: the Isfahan diabetes prevention study. Diabetes/metabolism research and reviews 32(6): 572-580.
14. Wagner AM, Perez A, Sánchez-Quesada JL, Ordóñez-Llanos J (2005) Triglyceride–to–HDL cholesterol ratio in the dyslipidemic classification of type 2 diabetes. Diabetes care 28(7): 1798-1800.
15. Cheng C, Liu Y, Sun X, Yin Z, Li H, et al. (2019) Dose–response association between the triglycerides: High-density lipoprotein cholesterol ratio and type 2 diabetes mellitus risk: The rural Chinese cohort study and meta-analysis. Journal of diabetes 11(3): 183-192.
16. Pantoja Torres B, Toro Huamanchumo C J, Urrunaga Pastor D, Guarnizo Poma M, Lazaro Alcantara H, et al. (2019) High triglycerides to HDL-cholesterol ratio is associated with insulin resistance in normal-weight healthy adults. Diabetes & Metabolic Syndrome: Clinical Research & Reviews 13(1): 382-388.
17. Levy J, Atkinson A, Bell P, McCance D, Hadden D (1998) Beta-cell deterioration determines the onset and rate of progression of secondary dietary failure in type 2 diabetes mellitus: the 10-year follow-up of the Belfast Diet Study. Diabetic medicine 15(4): 290-296.
18. Han T, Yuan T, Liang X, Chen N, Song J, et al. (2022) Sarcopenic obesity with normal body size may have higher insulin resistance in elderly patients with type 2 diabetes mellitus. Diabetes, metabolic syndrome and obesity: targets and therapy 15: 1197-1206.
19. Lim T K, Lee H S, Lee Y J (2020) Triglyceride to HDL-cholesterol ratio and the incidence risk of type 2 diabetes in community dwelling adults: A longitudinal 12-year analysis of the Korean Genome and Epidemiology Study. Diabetes research and clinical practice 163: 108150.

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