Submitted: 22 December, 2023 Accepted: 28 February, 2024 Online Published: 30 August, 2024 DOI:10.22514/jomh.2024.134

ORIGINAL RESEARCH

JOMH Journal of Men's Health

Clinical characteristics, alcohol intake and risk factors of male type 2 diabetes with coronary heart disease

Fang Liang[1,*], Qingyue Liang[2], Hongtao Li[1], Yulian Chen[1], Qian Wang[1]

[1]Department of General Medicine, Chengdu Seventh People's Hospital (Affiliated Cancer Hospital of Chengdu Medical College), 610000 Chengdu, Sichuan, China
[2]Department of Nutrition, Chengdu Seventh People's Hospital (Affiliated Cancer Hospital of Chengdu Medical College), 610000 Chengdu, Sichuan, China

***Correspondence**
LF_dr56@163.com
(Fang Liang)

Abstract

To investigate the clinical characteristics, alcohol intake and risk factors of male patients with type 2 diabetes and coronary heart disease. 198 male patients with type 2 diabetes (T2DM) admitted to our hospital between October 2018 and January 2019 were selected as the T2DM group. 118 male patients with T2DM and coronary heart disease (CAD) admitted during the same period were selected as T2DM and CAD group. Collect the relevant clinical data of patients. The clinical characteristics of male patients with T2DM and CAD were analyzed using single factor analysis. An analysis of male patients' risk factors for T2DM and CAD was conducted using binary logistic regression analysis. The risk probability model was constructed. Hosmer and Lemeshow were used to test the Goodness of fit of the probability model. ROC (receiver operating characteristic curve) curves were drawn with SPSS (Statistical Package For The Social Sciences) to evaluate the prediction model's predictive value. T2DM with CAD patients were older, had longer diabetes duration, higher BMI (Body Mass Index), higher excess drinking proportion, higher hypertension proportion, higher LDL-C (Low-Density Lipoprotein Cholesterol) level, and higher FIB (Fibrinogen) than T2DM without CAD patients. Statistically significant differences were observed ($p < 0.05$). Age, BMI, diabetes duration, excessive drinking and hypertension are risk factors for coronary heart disease in male patients with T2DM. Compared with male patients with T2DM, male patients with T2DM and CAD are older, have longer durations of diabetes, have higher BMIs, excessive drinking and hypertension, and have higher levels of LDL-C and FIB. Age, BMI, diabetes duration, excessive drinking and hypertension are risk factors for male patients with T2DM and CAD. A clinical prognosis can be improved by giving early active intervention based on the risk situation of patients.

Keywords

Male; Type 2 diabetes; Concomitant coronary heart disease; Clinical characteristics; Alcohol intake; Risk factors

1. Introduction

Diabetes contributes to many diseases [1–3]. Diabetic patients are at high risk and proportion of coronary heart disease. Patients with diabetes and coronary heart disease can have detrimental effects on their organs and systems, increasing their fatality rate significantly. Therefore, research and measures aimed at preventing and controlling diabetes and coronary heart disease have huge clinical and social relevance. There is a gender difference in clinical characteristics of type 2 diabetes patients [4–6]. As compared to female patients with T2DM, male patients tend to have more unhealthy habits, such as smoking, drinking and overeating. It has been discovered that these factors can contribute to the development of complicated coronary heart disease. The majority of clinical research on male patients with type 2 diabetes and coronary heart disease focuses on analyzing clinical characteristics [7]. Research on risks for T2DM patients developing coronary heart disease is limited. Excessive drinking is associated with the incidence of coronary heart disease in patients with T2DM [8]. With this background, this study examines the clinical characteristics, alcohol consumption and risks of patients with T2DM and coronary heart disease. This study included male patients with T2DM admitted in our hospital between October 2018 and January 2019.

2. Material and methods

2.1 Clinical materials

198 male patients with T2DM admitted to Chengdu Seventh People's Hospital (Affiliated Cancer Hospital of Chengdu Medical College) between October 2018 and January 2019, were selected as T2DM group. A total of 118 male patients with type 2 diabetes and coronary heart disease were classified as T2DM and CAD during the same period.

2.1.1 Inclusion criteria

(1) patients who met the clinical diagnostic criteria for T2DM, and patients with T2DM and CAD who met the diagnostic criteria for coronary heart disease; (2) over 18 years old; (3) male.

2.1.2 Exclusion criteria

Patients with the following conditions were excluded: (1) with other organic diseases; (2) with cognitive disorders; (3) without complete clinical records.

2.2 Methods

The following clinical materials and information was collected and recorded, including age, BMI, diabetes duration, education background, history of smoking and excessive drinking, complicated hypertension, complicated hyperlipidemia, HbA1c (hemoglobin A1C), TC (total cholesterol), CRP (C-reactive protein), FPG (fasting plasma glucose), TG (Triglyceride), LDL-C, HDL-C (High density lipoprotein cholesterol), UA (urine acid), FIB and others.

According to the Guideline for the Prevention and Treatment of Type 2 Diabetes in China published in 2020, male alcohol consumption should be less than 25 g per day and no more than 2 times per week. Alcohol consumption of more than 25 g/d is considered excessive.

2.3 Measurement of sample size

The sample size for this study was estimated using logistic regression analysis. In total, there were 5 meaningful independent variables requiring 10 patients each estimated. T2DM with coronary heart disease was 30% in men, and the sample loss was approximately 10%. Considering that, the sample size required for this study was: $5 \times 10 \times (1 + 10\%) \div 30\% \approx 183$ cases. The sample size for this study was 198, which met the research requirements.

2.4 Statistics

SPSS27.0 (IBM (International Business Machine), USA) was used to analyze the data. *t*-test was used to analyze the measurement data. Count data were tested by χ^2. The multiple factors regression analysis was tested by Binary Logistic regression model. The Goodness of fit of the probability model was tested by Hosmer and Lemeshow, and SPSS was used to draw the ROC curve to evaluate the predictive value of the prediction model. $p < 0.05$ indicated that differences were considered as statistically significant.

3. Results

3.1 Single factor analysis of T2DM and CAD male patients

The analysis of single factor showed that patients in T2DM and CAD group were older than that of T2DM group; diabetes duration in T2DM with CAD group was longer; the BMI of T2DM with CAD group was higher; the proportion of excessive drinking in T2DM with CAD group was higher; the proportion of hypertension in T2DM with CAD group was higher; the level of LDL-C in T2DM with CAD group was higher, and the FIB in T2DM with CAD group was higher. The differences were statistically significant ($p < 0.05$). More details can be found in Table 1.

3.2 Binary logistic regression analysis of male patients with T2DM and CAD

Male patients with T2DM with or without CAD were considered the dependent variable. Age, BMI, diabetes duration, excessive drinking, hypertension, LDL-C and FIB were considered independent variables (values can be found in Table 2). Binary Logistic regression analysis was performed in SPSS on these variables. The results showed that differences between age, diabetes duration, BMI, excessive drinking and complicated hypertension were statistically significant ($p < 0.05$), and the OR (odds ratio) values were all more than 1. Thus, age, BMI, diabetes duration, excessive drinking and hypertension were risk factors for male patients with T2DM to have CAD. Table 3 contains more details.

3.3 The prediction model for male patients with T2DM and CAD

Binary Logistic regression analysis model was constructed according to Table 3.

$$\begin{aligned} Logit\ (P) &= ln\,[P/(1-P)] \\ &= -48.386 + 0.166\ X_1 + 1.012\ X_2 \\ &\quad + 0.919\ X_3 + 1.330\ X_4 + 1.218\ X_5 \end{aligned}$$

The probability model for male patients with T2DM and CAD was:

$$\begin{aligned} P = 1/[1 + exp(&48.386 - 0.166\ X_1 - 1.012\ X_2 \\ &- 0.919\ X_3 - 1.330\ X_4 - 1.218\ X_5)] \end{aligned}$$

3.4 Goodness of fit test of the probability model

Hosmer and Lemeshow were used to test the probability model's goodness of fit. As a result, $\chi^2 = 2.061$, $p = 0.979$, which indicates that the probability model fits well. Table 4 contains more details.

3.5 Predictive value of the probability model

The ROC curve indicated that the probability model had significant predictive value ($p < 0.05$). AUC (Area under curve) was 0.974. 95% CI (Confidence intervals) was between 0.960 and 0.989. Fig. 1 shows more details.

4. Discussions

The risk of clinical mortality for diabetic patients with complicated coronary heart disease is higher [9] and it is a risk factor for their mortality [10]. The clinical characteristics of patients with T2DM and CAD differ by gender. Risk

TABLE 1. Results of single factor analysis of male patients with T2DM and CAD.

Indicators	T2DM group (n = 198)	T2DM and CAD group (n = 118)	Statistics	*p* value
Age	58.36 ± 5.64	63.25 ± 6.25	7.151	<0.001
BMI (kg/m^2)	25.35 ± 2.06	28.95 ± 2.41	14.106	<0.001
Diabetes duration (yr)	8.34 ± 1.65	11.35 ± 1.98	14.534	<0.001
Smoking (n, %)				
Yes	88, 44.44	56, 47.46	0.271	0.603
No	110, 55.56	62, 52.54		
Excessive drinking (n, %)				
Yes	55, 27.78	66, 55.93	24.803	<0.001
No	143, 72.22	52, 44.07		
Hypertension (n, %)				
Yes	55, 27.78	58, 49.15	14.705	<0.001
No	143, 72.22	60, 50.85		
Hyperlipidemia (n, %)				
Yes	32, 16.16	19, 16.10	0.000	0.989
No	166, 83.84	99, 83.90		
HbA1c (%)	8.52 ± 0.46	8.54 ± 0.51	0.357	0.722
FPG (mmol/L)	7.91 ± 0.65	7.93 ± 0.64	0.370	0.712
TC (mmol/L)	4.31 ± 0.35	4.33 ± 0.36	0.479	0.632
TG (mmol/L)	1.91 ± 0.15	1.93 ± 0.16	1.029	0.304
HDL-C (mmol/L)	1.16 ± 0.11	1.14 ± 0.10	1.617	0.107
LDL-C (mmol/L)	2.81 ± 0.24	2.88 ± 0.32	2.064	0.040
UA (μmol/L)	368.15 ± 33.51	371.35 ± 35.21	0.806	0.421
FIB (g/L)	3.31 ± 0.32	3.57 ± 0.34	7.040	<0.001
CRP (mg/L)	1.61 ± 0.14	1.64 ± 0.15	1.183	0.238
Education background (n, %)				
Not more than secondary school	66, 33.33	39, 33.05		
High school and above	100, 50.51	60, 50.85	0.004	0.998
College Graduate or above	32, 16.16	19, 16.10		

Note: BMI: Body Mass Index; HbA1c: Glycated Haemoglobin; FPG: Fasting Plasma Glucose; TC: Total Cholesterol; TG: Triglycerides; HDL-C: High-Density Lipoprotein Cholesterol; LDL-C: Low-Density Lipoprotein Cholesterol; UA: Uric Acid; FIB: Fibrinogen; T2DM: diabetes mellitus type 2; CAD: coronary heart disease; CRP: C-reactive protein.

TABLE 2. Values of the Binary Logistic multi-factor regression analysis.

Factors	B	Values
T2DM and CAD group	Y	Binary variable: Yes: value 1; No: value 0
Age	X_1	Continuous variable
Diabetes duration (yr)	X_2	Continuous variable
BMI	X_3	Continuous variable
Excessive drinking	X_4	Binary variable: Yes: value 1; No: value 0
Hypertension	X_5	Binary variable: Yes: value 1; No: value 0
LDL-C	X_6	Continuous variable
FPG	X_7	Continuous variable

Note: CAD: Coronary Artery Disease; BMI: Body Mass Index; LDL-C: Low-Density Lipoprotein Cholesterol; FPG: Fasting Plasma Glucose; T2DM: diabetes mellitus type 2.

TABLE 3. Results of the Binary Logistic multi-factor regression analysis.

Factors	β	Standard error	Wald	p value	OR value	95% confidence interval of OR value	
						Lower limit	Upper limit
Age	0.166	0.044	14.489	<0.001	1.181	1.084	1.287
Diabetes duration (yr)	1.012	0.162	39.134	<0.001	2.750	2.003	3.776
BMI	0.919	0.143	41.065	<0.001	2.507	1.893	3.321
Excessive drinking	1.330	0.470	8.013	0.005	3.780	1.505	9.493
Hypertension	1.218	0.482	6.393	0.011	3.380	1.315	8.689
LDL-C	1.127	0.859	1.722	0.189	3.085	0.573	16.600
FPG	−0.172	0.383	0.202	0.653	0.842	0.398	1.783
Constant	−48.386	7.733	39.151	<0.001	0.000		

Note: BMI: Body Mass Index; LDL-C: Low-Density Lipoprotein Cholesterol; FPG: Fasting Plasma Glucose; OR: odds ratio.

TABLE 4. Hosmer-Lemeshow test of probability model.

χ^2	Degree of freedom	p value
2.061	8	0.979

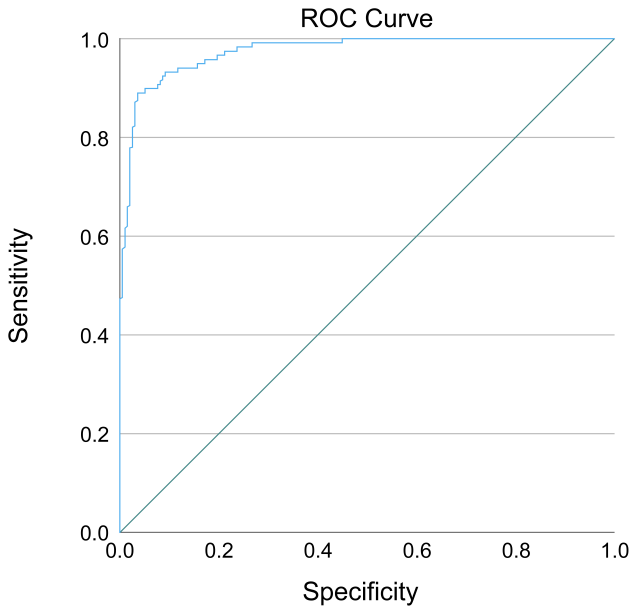

FIGURE 1. ROC curve of the probability model. ROC: receiver operating characteristic curve.

factors are more prevalent in male patients [11]. In particular, excessive drinking accelerates the development of diabetes and complicated coronary heart disease [12]. However, research in this field is limited. To provide more reference for clinical studies and practice of treatment of male patients with T2DM and CAD, this study examined their clinical characteristics, alcohol consumption and other risk factors.

The clinical characteristics of male patients with T2DM differed from those patients with T2DM and CAD based on age, disease duration, BMI, excessive drinking, hypertension, LDL-C, FIB and other factors. Specifically, those with T2DM and CAD were older, had a longer diabetes duration, higher BMI, more alcohol consumption, more serious hypertension, and had higher levels of LDL-C and FIB. Based on Binary Logistic regression analysis, age, diabetes duration, BMI, excessive drinking and hypertension were risk factors for CAD in male patients with T2DM.

Statistically [13], the elderly are a high-risk group for T2DM, and their incidence is significantly higher than that of other populations. It is mainly caused by a decline in body functions. Their immune modulating function, as well as their ability to cope with stress and inflammation, deteriorate as they age. According to clinical research, an unreasonable diet structure leads to higher rates of diabetes and cardiovascular disease in terms of BMI and LDL-C [14]. As a result of an unreasonable diet structure, patients will gain weight, become obese, and have high blood pressure which will have an adverse effect on their blood lipid metabolism. Blood viscosity will be affected when abnormalities in blood pressure and blood lipids cannot be fixed. This will damage epithelial cells in the coronary arteries, which in turn will lead to coronary heart disease [15]. When blood sugar level remains high for a long time, vascular endothelial cells are damaged by a specific protein in the blood. Consequently, capillary permeability improves, resulting in lipid accumulation and platelet aggregation, which promotes the activity of phagocytes and continuously induces atherosclerosis of coronary arteries [16]. A number of adverse conditions have been linked to excessive drinking [17]. Several diseases, including diabetes, have been proved to be worsened by it. According to the Guideline for the Prevention and Treatment of Type 2 Diabetes in China published in 2020, male alcohol consumption should be less than 25 g per day and no more than 2 times per week. Alcohol consumption of more than 25 g/d is considered excessive. Patients with T2DM who consume excessive alcohol have an increased risk of developing CAD, because alcohol causes abnormal blood pressure, abnormal blood lipid metabolism, and alcohol directly damages their cardiomyocytes [18]. Numerous clinical studies have shown that complex hypertension is associated with T2DM and CAD [19], which is primarily caused by arteriosclerosis, especially atherosclerosis of coronary arteries. FIB has been proven to be a vital factor in thrombosis. Through its effect on inflammatory reaction by influencing the vasoconstriction

function, it can induce coronary atherosclerosis to a certain extent [20].

Binary Logistic regression was applied to multiple factor regression analysis. Hosmer-Lemeshow was used to test the probabilistic model's goodness of fit. ROC curve was used to determine the prediction value. A significant prediction value was found and the model fit well.

In this study, originality is evident from two perspectives. On the one hand, this study focuses on male patients with T2DM and CAD. Studies on these two diseases are relatively rare. This study provides an alternative perspective. On the other hand, this study analyzes risk factors and explores various potential risk factors affecting male patients with T2DM and CAD. Personalized treatment and prevention strategies can be provided.

Since objects were all selected from our hospital and the sample size was relatively small, this study has some limitations. To provide preference for clinical prevention and control of T2DM in male patients, more objects should be included in future studies.

5. Conclusions

Based on the clinical characteristics between males with T2DM and males with T2DM and CAD, the differences were in age, diabetes duration, BMI, proportion of excessive drinking, proportion of complicated hypertension, LDL-C and FIB. Age, BMI, diabetes duration, excessive drinking and complicated hypertension are risk factors for T2DM patients having CAD. This study used a risk prediction model to assess the risk of CAD in patients with T2DM. To improve prognosis, patients should receive personalized early intervention based on their risks, such as weight control (BMI control), blood sugar control, blood pressure control, and alcohol consumption control.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

FL—designed the study and carried them out; prepared the manuscript for publication and reviewed the draft of the manuscript. FL, QYL, HTL, YLC and QW—supervised the data collection, analyzed the data, interpreted the data. All authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethics Committee of Chengdu Seventh People's Hospital (Affiliated Cancer Hospital of Chengdu Medical College) (Approval no. 2018038). Written informed consent was obtained from a legally authorized representative for anonymized patient information to be published in this article.

ACKNOWLEDGMENT

Not applicable.

FUNDING

This research received no external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Liu Y, Liu J-E, He H, Qin M, Lei H, Meng J, *et al.* Characterizing the metabolic divide: distinctive metabolites differentiating CAD-T2DM from CAD patients. Cardiovascular Diabetology. 2024; 23: 14.

[2] Zhu T, Cui J, Goodarzi MO. Polycystic ovary syndrome and risk of type 2 diabetes, coronary heart disease, and stroke. Diabetes. 2021; 70: 627–637.

[3] Hamedifard Z, Farrokhian A, Reiner Ž, Bahmani F, Asemi Z, Ghotbi M, *et al*. The effects of combined magnesium and zinc supplementation on metabolic status in patients with type 2 diabetes mellitus and coronary heart disease. Lipids in Health and Disease. 2020; 19: 112.

[4] Aune SK, Byrkjeland R, Solheim S, Arnesen H, Trøseid M, Awoyemi A, *et al*. Gut related inflammation and cardiorespiratory fitness in patients with CAD and type 2 diabetes: a sub-study of a randomized controlled trial on exercise training. Diabetology & Metabolic Syndrome. 2021; 13: 36.

[5] Yang T, Liu Y, Li L, Zheng Y, Wang Y, Su J, *et al*. Correlation between the triglyceride-to-high-density lipoprotein cholesterol ratio and other unconventional lipid parameters with the risk of prediabetes and type 2 diabetes in patients with coronary heart disease: a RCSCD-TCM study in China. Cardiovascular Diabetology. 2022; 21: 93.

[6] Goodarzi MO, Rotter JI. Genetics insights in the relationship between type 2 diabetes and coronary heart disease. Circulation Research. 2020; 126: 1526–1548.

[7] Konerding U, Redaèlli M, Ackermann K, Altin S, Appelbaum S, Biallas B, *et al*. A pragmatic randomised controlled trial referring to a Personalised Self-management SUPport Programme (P-SUP) for persons enrolled in a disease management programme for type 2 diabetes mellitus and/or for coronary heart disease. Trials. 2021; 22: 659.

[8] Xiao H, Ma Y, Zhou Z, Li X, Ding K, Wu Y, *et al.* Disease patterns of coronary heart disease and type 2 diabetes harbored distinct and shared genetic architecture. Cardiovasc Diabetol. 2022; 21: 276.

[9] Kalashnikov VI, Michurova MS. New opportunities of antithrombotic therapy in patients with type 2 diabetes mellitus and stable coronary heart disease for reducing the cardiovascular risk and cardiovascular complications: THEMIS, THEMIS-PCI trials. Therapeutic Archive. 2022; 94: 1204–1210. (In Russian)

[10] Tamlander M, Mars N, Pirinen M, Widén E, Ripatti S. Integration of questionnaire-based risk factors improves polygenic risk scores for human coronary heart disease and type 2 diabetes. Communications Biology. 2022; 5: 158.

[11] Xie Q, Huang J, Zhu K, Chen Q. Percutaneous coronary intervention versus coronary artery bypass grafting in patients with coronary heart disease and type 2 diabetes mellitus: cumulative meta-analysis. Clinical Cardiology. 2021; 44: 899–906.

[12] Tian X, Gao Y, Zhong M, Kong M, Zhao L, Feng Z, *et al*. The association between serum Sestrin2 and the risk of coronary heart disease in patients with type 2 diabetes mellitus. BMC Cardiovascular Disorders. 2022; 22: 281.

[13] Meng XM, Kang SX, Li J, Zhang HT, Li M. Clinical significance of N-terminal natriuretic peptide combined with inflammatory factors,

oxidative stress factors and blood lipid detection in elderly patients with type-2 diabetes complicated with coronary heart disease. Pakistan Journal of Medical Sciences. 2022; 38: 1310–1315.

[14] Mayr HL, Kelly JT, Macdonald GA, Russell AW, Hickman IJ. Clinician perspectives of barriers and enablers to implementing the mediterranean dietary pattern in routine care for coronary heart disease and type 2 diabetes: a qualitative interview study. Journal of the Academy of Nutrition and Dietetics. 2022; 122: 1263–1282.

[15] Ferguson LD, Linge J, Dahlqvist Leinhard O, Woodward R, Hall Barrientos P, Roditi G, *et al*. Psoriatic arthritis is associated with adverse body composition predictive of greater coronary heart disease and type 2 diabetes propensity—a cross-sectional study. Rheumatology. 2021; 60: 1858–1862.

[16] Gao B, Gao W, Wan H, Xu F, Zhou R, Zhang X, *et al.* Efficacy and safety of alogliptin versus acarbose in Chinese type 2 diabetes patients with high cardiovascular risk or coronary heart disease treated with aspirin and inadequately controlled with metformin monotherapy or drug-naive: a multicentre, randomized, open-label, prospective study (ACADEMIC). Diabetes, Obesity and Metabolism. 2022; 24: 991–999.

[17] Afanas'ev SA, Kondrat'eva DS, Muslimova EF, Budnikova OV, Akhmedov SD, Kozlov BN. Expression of genes and proteins of the sarcoplasmic reticulum Ca^{2+}-transport systems in cardiomyocytes in concomitant coronary heart disease and type 2 diabetes mellitus. Bulletin of Experimental Biology and Medicine. 2021; 172: 117–120.

[18] Boronat M. NOS3 RS1799983 and RS2070744 Polymorphisms and their association with advanced chronic kidney disease and coronary heart disease in canarian population with type 2 diabetes. Acta Endocrinologica. 2021; 17: 440–448.

[19] Xu S, Scott CAB, Coleman RL, Tuomilehto J, Holman RR. Predicting the risk of developing type 2 diabetes in Chinese people who have coronary heart disease and impaired glucose tolerance. Journal of Diabetes. 2021; 13: 817–826.

[20] Yubero-Serrano EM, Alcalá-Diaz JF, Gutierrez-Mariscal FM, Arenas-de Larriva AP, Peña-Orihuela PJ, Blanco-Rojo R, *et al.* Association between cholesterol efflux capacity and peripheral artery disease in coronary heart disease patients with and without type 2 diabetes: from the CORDIOPREV study. Cardiovascular Diabetology. 2021; 20: 72.

How to cite this article: Fang Liang, Qingyue Liang, Hongtao Li, Yulian Chen, Qian Wang. Clinical characteristics, alcohol intake and risk factors of male type 2 diabetes with coronary heart disease. Journal of Men's Health. 2024; 20(8): 91-96. doi: 10.22514/jomh.2024.134.