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Research Article

Prevalence and Risk of Type 2 Diabetes Mellitus and Dyslipidaemia in Urban-Rural Younger, Middle-Aged, and Elderly Indians

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A B S T R A C T

Introduction: Due to rapid urbanisation, Indians are more likely to develop age-specific type 2 diabetes mellitus (T2DM) and dyslipidaemia. This study intended to investigate the prevalence of T2DM and dyslipidaemia in younger (< 30 years), middle (31–40,41–50, and 51–60 years), and older (61–70 and > 70 years) age groups in urban-rural Indians.

Methods: A cross-sectional study was conducted at Metro Heart Hospital, Faridabad, Haryana. The patient's demographic information (urban-rural), gender, fasting blood glucose levels, dyslipidaemia profile (triglycerides (TG), total cholesterol (TC), high-density lipoprotein (HDL-C), and low-density lipoprotein cholesterol (LDL-C) were collected based on age groups.

Results: Urban middle-aged (41–50 years: 56.3%; 51–60 years: 76.9%) and elderly (61–70 years: 83.3%) experienced markedly higher prevalence of T2DM than rural (41–50 years: 20.8%; 51–60 years: 20.7%; 61–70 years: 38.3%) participants of similar age groups. The prevalence of dyslipidaemia measured through hypercholesterolaemia and hypertriglyceridaemia was higher in females over 45 years, and in males, it was higher in those under 45 years. The study revealed that individuals with T2DM show a higher prevalence of dyslipidaemia in middle age as compared to the elderly, with a higher prevalence of HDL-C and LDL-C in males under 45 years.

Conclusion: The prevalence of T2DM and dyslipidaemia was lower in rural India than in urban, particularly in middle age groups but their levels were still greater.

Keywords: Diabetes Mellitus, Type 2, Hypertriglyceridaemia, Hypercholesterolaemia, High-Density Lipoprotein, Low-Density Lipoprotein, Dyslipidaemia

Introduction

Diabetes mellitus is a chronic metabolic disease characterised by defects in insulin secretion, action, or resistance.[1] Globally, the prevalence of type 2 diabetes mellitus (T2DM) is increasing and it becoming an epidemic with a social and economic burden for a country like India. T2DM is affected by the patient's age, genetics, progression of the disease environment, and risks like dyslipidaemia, obesity, and cardiovascular diseases.[2–4] T2DM which is major among all cases of diabetes was earlier considered a disease in developed countries but now the disease has spread globally even to developing countries and become one of the major causes of death in younger and middle-aged populations.[3,4]

Several studies have examined the association between the severity of T2DM and the age of the subjects.[5–7] Few studies have associated younger age with the risk of complications while others have related it to older age.[8] T2DM once considered a middle and old-age disease, is now majorly diagnosed at younger ages, contributing to a significant number of global deaths.[5–8] Various studies have suggested longer the duration of T2DM higher the chances of dyslipidaemia at a younger age. In elderly T2DM is caused by genetic background, long life expectancy, decreased insulin secretion, and environmental factors.[9] Older individuals often lack typical symptoms of T2DM leading to complications like high blood pressure and dyslipidaemia often coexist with T2DM in the elderly.[2] T2DM is becoming more prevalent in young adults and adolescents due to rising obesity rates in high-income countries, resulting in worse risk factors and clinical outcomes over time compared to older individuals.[5–7,10]

With growing urbanisation risk of over-nutrition, and a sedentary lifestyle increasing in India leading to enhanced chances of T2DM.[2] T2DM is expected to become a significant burden worldwide in the coming years.[11] Studies revealed that demography, community-specific, and risk are associated with T2DM, and these risks are independent of risk developed at an independent level.[2,3] Factors like ageing, living environment, physical inactivity, hypertension, and socioeconomic status increase diabetes risk. However, research on rural-urban differences is limited. Rapid socioeconomic change, urbanisation, and industrialisation are major contributors to the global increase in the diabetes epidemic, alongside population growth and unhealthy eating habits.[2,3]

The concept of the elderly is debatable, with some claiming that a person is old if they are 60–65 years old, while others believe it is more necessary to examine their physiological age, which changes depending on genetics and environmental circumstances.[12] Understanding the age and course of T2DM in India would aid in identifying disease complications and the severity of the health problem. This study aimed to understand the effect of age on T2DM and dyslipidaemia in participants from Faridabad, Haryana, India. This study examined the association between T2DM and dyslipidaemia in all age groups including young (< 30 years), middle-aged (31–40,41–50,51–60 years), and elderly (61–70, > 70 years) rural-urban Indians. Furthermore, the study aimed to investigate the impact of T2DM on dyslipidaemia among participants aged under 45 years and above 45 years.

Methodology

Research Design The Department of Laboratory Services at Metro Heart Institute with multispecialty Faridabad (Haryana) was the site of this descriptive study. Data from participants visiting the diabetes clinic were collected over two months, from August to September 2023. The study employed a stratified random sampling method to ensure representation across different age groups and genders. Sample size calculation was based on the prevalence of T2DM in the region, using a confidence level of 95% and a margin of error of 5%. Prevalence was calculated using the formula: Number of cases/Total populations.[13] The formula used for calculating sample size for prevalence was: $n = Z^2.P.(1-P)/d^2$ where n is the required sample size, Z is Z-value (1.96 for 95% confidence level), P is the expected prevalence (proportion) of the condition, and d is margin of error (precision).[14] Ethical approval was obtained from the local Institutional Ethical Committee of Metro Heart Institute with multispecialty Faridabad, Haryana, India (under ethical approval number 2022-672-1).

Data Collection

Participants were included in the study after obtaining their consent. The content form included questionnaires in Hindi and English. The study incorporated participant socio-demographic information such as name, gender, height, Body Mass Index (BMI), and demographic data (urban-rural).

A total of 1087 urban-rural participants of Faridabad in Haryana were included in the investigation to determine the prevalence of T2DM and dyslipidaemia in participants. Out of 1087 participants, 670 were from urban and 417 from rural. The study comprised both males and females as per their age group including younger (> 30 years), middle (31–40, 41–50, 51–60 years), and elderly (61–70, > 70 years). Furthermore, data from age groups under 45 years and above 45 years was also analysed for baseline parameters of dyslipidaemia in T2DM participants.

Inclusion criteria for the study were (i) participants diagnosed with T2DM for more than 3 months; (ii) on regular follow-up at Metro Heart Institute with multispecialty; (iii) participants residing in urban or rural areas, more than 5 years of age and willing to participate in the study.

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Exclusion criteria were (i) Type 1 DM, gestational diabetes, or secondary causes of diabetes, (ii) hypertension, (iii) on lipid-lowering drugs, (iv) hypothyroidism, renal disease, or hepatic disorders, and (v) participants records with incomplete information.

Procedure

The following measurements were included: fasting blood sugar (mg/dL), total cholesterol (mg/dL), triglycerides (mg/dL), high-density lipoprotein (mg/dL), and low-density lipoprotein (mg/dL). All the measurements were taken using standardised equipment and procedures described in the World Health Organization (WHO) manual and dyslipidaemia using the National Cholesterol Education Programme-Adult Treatment Panel III guidelines.[15,16]

All individuals were instructed to fast for at least 12 hours overnight, and 5ml of venous blood was drawn before breakfast to assess fasting blood glucose and serum lipid profile.[15,16] Screening was done as per the criteria recommended by WHO.[16] If the fasting blood sugar was > 126 mg/dL, they were diagnosed with type 2 diabetes mellitus (T2DM); if it was < 100 mg/dL, they were classified as non-diabetic. If the value were between 100–125 mg/dL condition is pre-diabetic for T2DM.

Dyslipidaemia

Dyslipidaemia was defined as the existence of one or more of the following lipid abnormalities: total cholesterol level > 200 mg/dL, triglyceride level > 150 mg/dL, low-density lipoprotein > 100 mg/dL, or high-density lipoprotein < 40 mg/dL in males or < 50 mg/dL in and females.[15–17] Individuals whose HDL was > 60 mg/dL were considered as normal. Total cholesterol < 200 mg/dL was regarded as normal, 200–239 mg/dL as borderline, and > 240 mg/dL as high. Similarly, triglycerides < 150 mg/dL were regarded as normal, those between 150 and 199 mg/dL as borderline, and those > 200 mg/dL as high. Low-density lipoprotein > 160–190 mg/dL was considered extremely high.[15–17]

Statistical Analysis

Data was entered in Microsoft Excel 2016 and analysed in the Statistical Package for Social Sciences (SPSS version 14; IBM SPSS, Inc., Chicago, IL, USA). Descriptive analysis such as mean and standard deviations were used for continuous variables and percentages were used for categorical variables on participant's data. The prevalence of variables was reported as a proportion (N, %) with a 95% confidence interval.[13,14] A p value of < 0.05 was considered statistically significant.

Results

Table 1 shows the number of investigated rural and urban participants (n = 1087) grouped by age. There were more urban (n = 670) participants than rural (n = 417). In the rural areas, 151 participants were female, 266 were male, and in several urban areas, 271 were female and 399 were male. The majority of urban and rural participants belonged to age groups between 41 and 70 years of age. Socio-economically, the majority of the participants belonged to the middle and upper classes. Height and BMI (Body mass index) differences were negligible for urban and rural participants (Table 1).

Table 1.Socio-Demographic Characteristics of Studied Participants According to Demography, Gender and Age Groups (Years)

	Rural		Urban	
Age (Years)	**Females n (%)**	**Males n (%)**	**Females n (%)**	**Males n (%)**
< 30	7 (4.6)	25 (9.4)	13 (4.8)	30 (7.5)
31–40	22 (14.6)	50 (18.8)	36 (13.3)	56 (14.1)
41–50	30 (19.9)	59 (22.2)	57 (21.0)	99 (24.8)
51–60	36 (23.8)	60 (22.6)	67 (24.7)	102 (25.6)
61–70	42 (27.8)	45 (16.9)	72 (26.6)	80 (20.1)
> 70	14 (9.3)	27 (10.2)	26 (9.6)	31 (7.8)
Total	151	266	271	399
Socio-economic status n (%)				
Lower	11 (7.3)	21 (7.9)	12 (4.4)	17 (4.3)
Middle	87 (57.6)	158 (59.4)	157 (57.9)	242 (60.7)
Upper	53 (35.1)	87 (32.7)	102 (37.6)	140 (35.1)
Smokers	5 (3.3)	43 (16.2)	15 (5.5)	65 (18.1)
Non-smokers	146 (96.6)	222 (83.5)	256 (94.5)	294 (81.9)
Height (cm; mean ± SD)	152.8 ± 6.5	171.1 ± 6.5	153.1 ± 6.5	169.1 ± 6.6
BMI (kg/m^2; mean ± SD)	21.8 ± 3.2	22.1 ± 3.1	24.9 ± 3.3	24.7 ± 3.4

n: Number of participants; BMI: Body Mass Index

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In both urban-rural participants, T2DM prevalence enhanced with age (Figure 1). The younger age group (31–40 years) from urban and rural participants had an almost equal prevalence of T2DM. There was a significantly higher prevalence of T2DM in age groups more than 40 in urban (age group: 41–50 years: 56.3%; 51–60 years: 76.9%; 61–70 years: 83.3%) than in rural (age group: 41–50 years: 20.8%; 51–60 years: 20.7%; 61–70 years: 38.3%) participants. T2DM prevalence was slightly higher in males than females. However, amongst all urban-rural participants in the older age group (> 70 years), females (rural: females: 63.5%, males: 33.0%; urban: females: 86.4%, males: 74.1%) had a higher prevalence of T2DM than males.

Table 2 illustrates the age-specific prevalence of dyslipidaemia by demographics in all participants. In females, hypercholesterolaemia prevalence was higher in age groups between 40 and 70 years with its peak in participants from the age group of 41–50 years (rural: 33.3%, 95% CI:29.3–37.3; urban: 46.9%, 95% CI: 42.9–50.9). In males, hypercholesterolaemia was higher in younger age group < 30 years (Rural: 18.2%, 95% CI:16.2–20.2; Urban: 40.7%, 95% CI: 37.3–43.3), 31–40 (Rural: 34.1%, 95% CI: 31.1–37.1; Urban: 59.2%, 95% CI: 54.2–64.2) specifically in urban participants and decreased after the age 70 years (Rural: 8%, 95% CI: 6–10; Urban:14.8%, 95% CI: 12.8–16.8). Like hypercholesterolaemia, the prevalence of hypertriglyceridaemia in females was higher in age groups between 31–70 years. Prevalence of hypertriglyceridaemia was much higher in younger age < 30 in males (Rural: 40.9%, 95% CI: 37.9–43.9; Urban: 51.9%, 95% CI: 47.9–55.9) than in females (Rural: 20%, 95% CI: 17–23; Urban: 9.1%, 95% CI:8.1–10.1) of same age group. It decreased in age group more than 70 in both males (Rural: 20%, 95% CI: 18–22; Urban: 29.6%, 95% CI:26.6–32.6) and females (Rural: 0%, Urban: 27.3%, 95% CI: 25.3–29.3). Hypertriglyceridaemia was higher in urban participants. A large number of participants from both rural and urban had high LDL-C and low HDL-C levels. HDL-C and LDL-C were not affected by demography and age.

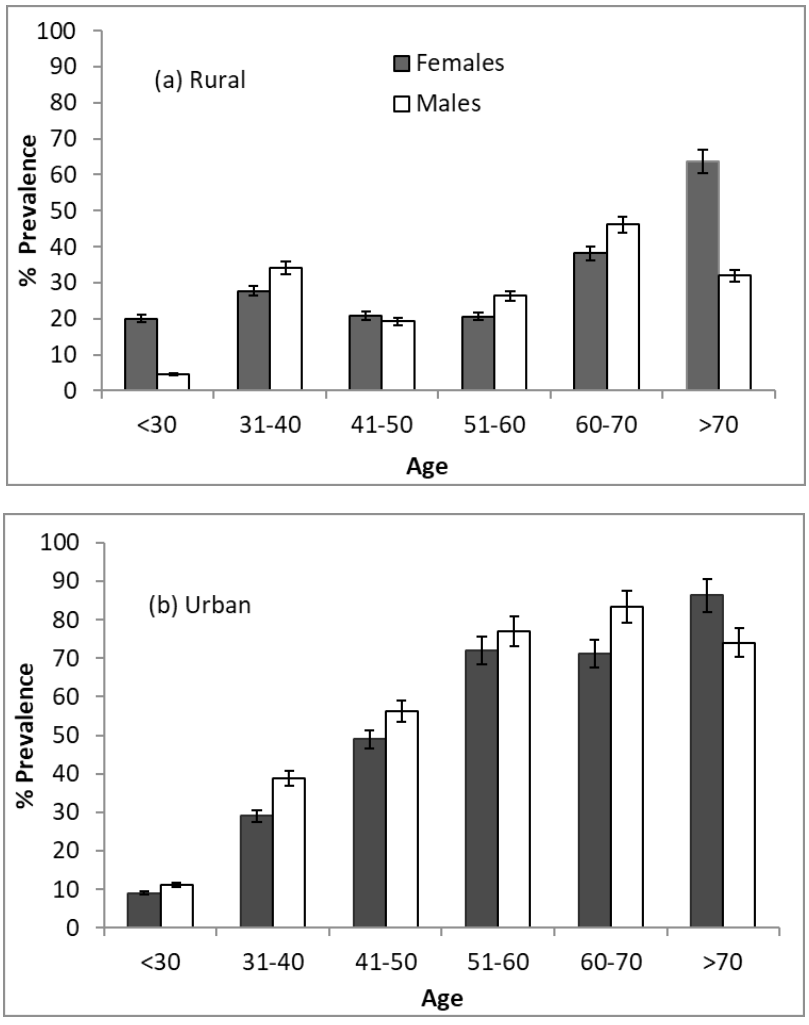

Figure 1.Age-Specific Prevalence of Type 2 Diabetic Mellitus in Patients from (a) Rural and (b) Urban Participants

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Table 2.Prevalence of Dyslipidaemia by Their Age (Years) in Participants

Age (Years)	Rural Prevalence % (95% CI)		Urban Prevalence % (95% CI)	
	Females	Males	Females	Males
Hypercholesterolaemia > 200 mg/dL				
< 30	0.0	18.2 (16.2–20.2)	9.1 (7.1–11.1)	40.7 (37.3–43.3)
31–40	11.1 (8.1–14.1)	34.1 (31.1–37.1)	19.4 (17.4–21.4)	59.2 (54.2–64.2)
41–50	33.3 (29.3–37.3)	21.2 (19.2–23.2)	46.9 (42.9–50.9)	39.1 (36.1–42.1)
51–60	27.6 (23.6–31.6)	24.5 (21.5–27.5)	38.6 (35.6–41.6)	35.2 (32.2–38.2)
61–70	29.4 (25.4–33.4)	33.3 (30.3–36.3)	23.3 (21.3–25.3)	16.6 (14.6–18.6)
> 70	27.3 (24.3–30.3)	8.0 (6.0–10.0)	27.3 (24.3–30.3)	14.8(12.8–16.8)
Hypertriglyceridaemia > 150 mg/dL				
< 30	20.0 (17.0–23.0)	40.9 (37.9–43.9)	9.1 (8.1–10.1)	51.9 (47.9–55.9)
31–40	27.8 (24.8–30.8)	54.5 (50.5–58.5)	32.2 (30.2–34.2)	63.3 (58.3–68.3)
41–50	29.2 (27.2–31.2)	36.5 (34.5–38.5)	40.8 (37.8–43.8)	66.7 (62.7–70.7)
51–60	31.1 (28.1–34.1)	39.6 (36.6–42.6)	56.2 (52.2–60.2)	56.1 (53.1–59.1)
61–70	26.5 (24.5–27.5)	38.5 (36.5–40.5)	41.6 (39.6–43.6)	41.7 (38.7–44.7)
> 70	0.0	20.0 (18.0–22.0)	27.3 (25.3–29.3)	29.6 (26.6–32.6)
HDL-C M < 40; F < 50 mg/dL				
< 30	60.0 (57.0–63.0)	40.9 (38.9–42.9)	54.5 (51.5–57.5)	51.9 (50.0–53.8)
31–40	77.8 (72.8–82.8)	52.3 (49.3–55.3)	45.2 (42.2–48.2)	40.8 (39.0–42.6)
41–50	79.2 (75.2–84.2)	55.8 (51.8–59.8)	44.9 (42.0–47.8)	49.4 (47.3–51.5)
51–60	79.3 (76.3–82.3)	41.5 (39.5–43.5)	63.2 (60.1–66.3)	46.2 (43.1–49.3)
61–70	67.6 (64.6–70.6)	30.8 (28.8–32.8)	55.0 (62.0–58.0)	50.0 (47.5–52.5)
> 70	63.6 (61.6–65.6)	32.0 (29.0–35.0)	45.5 (42.6–48.4)	44.5 (42.0–47.0)
LDL-C > 100 mg/dL				
< 30	60.0 (56.0–64.0)	63.6 (60.0–67.2)	36.4 (34.3–38.5)	59.2 (56.2–62.2)
31–40	55.6 (52.6–58.6)	65.9 (63.4–68.4)	38.7 (36.2–41.2)	73.5 (70.0–77.0)
41–50	54.2 (51.2–57.2)	40.4 (38.3–42.5)	61.2 (58.0–64.4)	63.2 (60.2–66.2)
51–60	55.2 (53.2–57.2)	66.1 (63.8–68.4)	54.4 (52.4–56.6)	51.6 (48.4–54.8)
61–70	50.0 (47.0–53.0)	43.6 (41.6–45.6)	40.0 (37.8–42.2)	36.1 (34.1–38.1)
> 70	27.8 (25.8–29.8)	32.0 (30.2–33.8)	54.5 (52.0–57.0)	37.1 (34.1–40.1)

Table 3 demonstrates the prevalence of dyslipidaemia among T2DM participants under and above the age of 45 years. In female rural participants, the prevalence of hypercholesterolaemia (age < 45 years, 0%, age > 45 years, 20%, 95% CI: 18–22) and hypertriglyceridaemia (age < 45 years, 0%, age > 45 years, 13.3%, 95% CI: 12.5–14.1) was higher above the age of 45 years. While in rural males, the prevalence of hypercholesterolaemia (age < 45 years, 29.4%, 95% CI: 25–27.6; age > 45 years, 26.3%, 95% CI: 25–27.6) and hypertriglyceridaemia (age < 45 years, rural: 58.5%, age > 45 years, 33.3%, 95% CI: 31–35.6) was less beyond the age of 45 years. In rural males and females, the prevalence of low-HDL-C (females: age < 45 years, 95%, 95% CI: 91.5–98.5; age > 45 years, 76.7%, 95% CI: 74–79.4) and LDL-C (females: age < 45 years, 83.3%, 95% CI: 81–85.6; age > 45 years, 30%, 95% CI: 28–32) was higher in younger age group (age < 45 years). In urban males and females, age-specific differences (age < 45 years versus age > 45 years) were inconsistent or negligible for low-HDL-C participants with T2DM. In urban males and females, the prevalence of LDL-C (females: age < 45 years, 50.1%, 95% CI: 48.1–52.1; age > 45 years, 43.2%, 95% CI: 41–45.4) was higher in younger age group (age < 45 years).

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Table 3.Prevalence Rates (%) of Dyslipidaemia in Participants Diagnosed with T2DM from Faridabad, Haryana

Rural	Females			Males		
Age (Years)	< 45 % (95% CI)	> 45 % (95% CI)	Overall % (95% CI)	< 45 % (95% CI)	> 45 % (95% CI)	Overall % (95% CI)
Hypercholesterolaemia (mg/dL)	0.0	20.0 (18.0–22.0)	16.7 (15.0–18.4)	29.4 (26.8–32.0)	26.3 (25.0–27.6)	27.1 (25.1–29.1)
Hypertriglyceridaemia (mg/dL)	0.0	13.3 (12.5–14.1)	11.1 (10.1–12.1)	58.5 (55.0–62.0)	33.3 (31.0–35.6)	39.2 (36.2–42.2)
HDL-C (mg/dL)	95.0 (91.5–98.5)	76.7 (74.0–79.4)	80.6 (77.0–84.2)	70.6 (68.0–73.2)	38.6 (37.0–40.2)	45.9 (44.0–47.8)
LDL-C (mg/dL)	83.3 (81.0–85.6)	30.0 (28.0–32.0)	38.9 (37.0–40.8)	70.6 (68.6–72.6)	52.6 (50.0–55.2)	56.8 (54.0–59.6)
Urban	**Females**			**Males**		
Age (Years)	< 45 % (95% CI)	> 45 % (95% CI)	Overall % (95% CI)	< 45 % (95% CI)	> 45 % (95% CI)	Overall % (95% CI)
Hypercholesterolaemia (mg/dL)	38.9 (37.0–40.8)	32.2 (31.0–33.4)	33.1 (32.0–34.2)	47.7 (45.0–50.4)	27.5 (26.0–29.0)	31.5 (30.0–33.0)
Hypertriglyceridaemia (mg/dL)	44.4 (42.0–46.8)	44.9 (42.0–47.8)	44.9 (42.4–47.4)	65.9 (62.9–68.9)	38.8 (36.8–40.8)	44.1 (42.1–46.2)
HDL-C (mg/dL)	55.6 (53–57.9)	61.9 (60.0–63.8)	61.1 (59.1–63.1)	50.0 (47.5–52.5)	50.6 (49.0–52.2)	50.5 (49.0–52.0)
LDL-C (mg/dL)	50.1 (48.1–52.1)	43.2 (41.0–45.4)	44.1 (42.1–46.1)	65.9 (63.9–67.9)	44.9 (42.9–46.9)	49.1 (47.1–51.1)

Data was presented as (95% CI).

Discussion

Risks of T2DM are associated with a person's socioeconomic status, demographics, age, gender, and lifestyle. Diabetes is a global health problem, especially in low- and middle-income nations like India.[4,18,19] This study investigated age-specific differences in T2DM amongst urban-rural participants from Faridabad, India. Urban middle-aged (41–50 and 51–60 years) and elderly (> 70 years) experienced a markedly higher prevalence of T2DM than rural or similar age groups (Figure 1). In urban-rural participant's prevalence of T2DM amongst younger subjects (age group < 30 and 30–40 years) was significantly lesser. However, after the age of 40 years, urban participants experienced a much higher prevalence of T2DM than rural (Figure 1). In rural-urban participants, T2DM prevalence (urban: females: 86.4% males: 74.1%; rural: females: 63.6% males: 32%) enhanced significantly in elderly (age > 70 years) than middle age groups. This difference in prevalence of T2DM may resulted from a sedentary lifestyle, nutrition habits, and living environments in middle-aged and elderly urban participants. Henceforth, sugar-sweetened beverages should be avoided by elderly participants to decrease the chance of developing T2DM. Furthermore, as per the ICMR-INDIAB study based on 28 states, the prevalence of diabetes in urban (16.4%) was higher than in rural (8.9%) areas.[17] Some studies have also predicted that diabetes might affect a significant number of the Indian population aged 18–69 years.[17,20] In the current study too, a significant percentage of rural-urban participants diagnosed with T2DM were from middle and older age groups (Figure 1).

Previous cross-sectional studies indicated that dyslipidaemia affects over 80% of T2DM participants in Korea, Thailand, the USA, and India.[5,21,22] The study in Thailand employed TC, TG, HDL-C, and LDL-C levels to define dyslipidaemia, but the study in the USA only used LDL-C.[5,22] In the current study, for dyslipidaemia, all four parameters: TC, TG, HDL-C, and LDL-C were analysed in all age groups (Tables 2 and 3). In females, hypercholesterolaemia and hypercholesterolaemia-driven dyslipidaemia were higher in middle-age groups between 40 and 70 years. In

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males, hypercholesterolaemia and hypercholesterolaemia was more pronounced in middle-age groups (Table 2). However, prevalence rates of hypercholesterolaemia and hypercholesterolaemia decreased amongst the elderly > 70 years; (Figure 1 and Table 2). Furthermore, the prevalence of LDL-C, hypertriglyceridaemia, and hypercholesterolaemia peaked in the middle-aged group of 31–50 years as compared to the elderly, and then they roughly plateaued throughout the later age groups (Table 2).

Globally, various studies have investigated the prevalence of dyslipidaemia subjects as per their age group. As per the ICMR-INDIAB study, dyslipidaemia was found in 81.2% of participants.[17,20] According to Korean population research, 90% of participants under the age of 40 had dyslipidaemia, while another study found that 15–20% of participants under 40 had T2DM.[22,23] In Thailand, where participants with diabetes mellitus under 50 years of age had a greater incidence of dyslipidaemia than those over 50 years of age.[5] In the current study, the prevalence of hypercholesterolaemia and hypertriglyceridaemia, in rural females was higher above the age of 45 years while in males it was lesser above the age of 45 years (Table 3). In rural males and females, the prevalence of low HDL-C and LDL-C was higher in the younger age group (age < 45 years). Age-specific differences in urban males and females were inconsistent or negligible for low HDL-C participants with T2DM. In urban males and females, the prevalence of LDL-C was higher in the younger age group (age < 45 years). These findings imply that males and females diagnosed with T2DM experience one of the four parameters (TC, TG, HDL-C, and LDL-C) responsible for dyslipidaemia earlier in life than the elderly. Additionally, studies have described the global narrowing of the incidence of T2DM in urban-rural participants.[24–27] Similarly, in the current investigation, although the incidence of hypertriglyceridaemia, hypercholesterolaemia, low-HDL-C, and high-LDL-C were lower in rural participants than in urban areas, their levels were still greater (Table 3). Thus, it is impossible to dismiss or underestimate the notable shifts in the prevalence of T2DM in rural India.

These findings had certain strengths and limitations including the prevalence of T2DM in India from both rural and urban participants using fasting blood glucose measurements were reported. The study had several limitations, including not measuring variables like sleep period, depression, obesity, and dyslipidaemia caused due to secondary drugs. There were limited female and rural participants in the study due to a lack of awareness about disease progression. Furthermore, this study did not consider the proportion of diabetic patients as migrants, potentially causing bias in rural-urban diabetes prevalence.

Conclusions

In conclusion, the prevalence of T2DM and dyslipidaemia were more common in urban participants than in rural ones. T2DM enhanced with age in both urban-rural participants. Urban middle-aged and elderly experienced a higher prevalence of T2DM while in rural participants T2DM prevalence was higher in the elderly only. However, unlike T2DM prevalence of dyslipidaemia was higher in middle-aged rural and urban. The middle-aged group of 30–50 years old was the highest for the prevalence rates of LDL-C, hypertriglyceridaemia, and hypercholesterolaemia. Participants with T2DM who also had dyslipidaemia were more likely to be under 40. However, there was a decrease in the urban-rural prevalence gap for hypercholesterolaemia, hypertriglyceridaemia, and LDL according to their respective age groups in previous reports. Thus, in recent years, lifestyle changes, urbanisation, and migration to urban areas have led to enhanced cases of T2DM in rural India.

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