International Journal of Public Health Asia Pacific
Open Access: e-Journal
ISSN: 2822-0587(Online)

Sociodemographic and health related factors associated with type 2 diabetes mellitus among middle-aged adult and elderly in Yangon, Myanmar

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ABSTRACT

Background: Type 2 Diabetes Mellitus (T2DM) is increasingly prevalent globally especially in low- and middle-income countries. In Myanmar, the rise of T2DM particularly among the elderly highlights the need for early detection and intervention.

Objectives: This study aimed to identify the sociodemographic and health-related factors contributing to T2DM in middle-aged and elderly populations in Yangon to inform targeted prevention strategies.

Methods: This cross-sectional study conducted in Yangon, 2024 included 512 participants aged 40 years and older selected via multistage random sampling. Data were collected using the Kobo Collect app and analysed using Stata 18.0. Descriptive statistics were used to summarize the participants' characteristics including frequencies, percentages and means. Simple logistic regression was applied to identify factors associated with T2DM followed by multiple logistic regression to assess adjusted odds ratios (AOR) for significant predictors. The significance level was set at 0.05 for all statistical tests.

Results: Of the total 512 participants, 55.66% (95% CI: 51.32-59.92) had normal fasting blood sugar (FBS), 30.08% (95% CI: 26.25-34.20) had prediabetes and 14.26% (95% CI: 11.48-17.57) had T2DM. Our multivariable analysis by multiple logistic regression analysis observed that respondents age over 60 years (AOR = 3.47, 95% CI: 1.64–7.32), being of Kayin ethnicity (AOR = 2.87, 95% CI: 1.47–5.61), larger waist measurements (AOR = 3.57, 95% CI: 1.68–7.60), had chronic illnesses (AOR = 7.97, 95% CI: 4.17–15.23) and had family history of diabetes mellitus (AOR = 4.10, 95% CI: 2.09–8.04) were associated with type 2 diabetes among the middle aged and elderly population of Yangon, Myanmar.

Conclusion: Type 2 DM is common among middle-aged and elderly individuals in Yangon. Key risk factors included age, obesity, chronic illness and family history were major predictors of it. Targeted interventions addressing these factors are essential for diabetes prevention in this population.

Keywords: Health related factors, Type 2 diabetes mellitus, Myanmar

1. Introduction

Type 2 Diabetes Mellitus (T2DM) is a global health concern with its prevalence steadily rising especially in low- and middle-income countries [1]. The World Health Organization (WHO) reported that the global incidence of diabetes reached 22.9 million in 2017 and is projected to increase to 26.6 million by 2025 [2]. In Southeast Asia, the number of adults with diabetes was estimated at 90 million in 2021 and expected to rise to 113.3 million by 2030 [3]. This sharp increase in prevalence presents a significant economic burden with diabetes-related healthcare expenditures in the region projected to reach billions annually [4].

T2DM contributes to severe complications such as cardiovascular diseases, kidney failure and nerve damage [5]. The risk of blindness, amputations and high healthcare costs also increases particularly when the condition is untreated [6]. Early detection and management of diabetes, especially among middle-aged and elderly individuals are essential to prevent these devastating consequences [7].

In Myanmar, the prevalence of diabetes is rising especially among the elderly. Between 2004 and 2014, the prevalence of diabetes among older adults increased from 14.6% to 31.9% [8]. A nationwide survey found that 10.8% of the population had diabetes with a significant proportion also at risk due to prediabetes [9]. These statistics underscored the urgent need to explore the sociodemographic and health-related factors contributing to T2DM particularly in urban areas like Yangon. Sociodemographic factors such as age, gender, education and lifestyle behaviours along with health-related factors like obesity, hypertension and family history play a critical role in the development of T2DM [9-11]. This study aimed to examine these factors among middle-aged and elderly populations in Yangon to understand the risks better and design targeted interventions. Given the increasing burden of diabetes in Myanmar, identifying these factors are vital for improving early detection and prevention strategies.

2. Methods

2.1 Study Area

This study was conducted in Yangon, Myanmar from May to November 2024. Yangon, the largest city in Myanmar, has a diverse population and represents a significant urban area where the prevalence of Type 2 Diabetes Mellitus (T2DM) is increasing particularly among middle-aged and elderly populations.

2.2 Study Design

A cross-sectional analytical study was conducted to assess sociodemographic and health-related factors associated with Type 2 Diabetes Mellitus among middle-aged adults and the elderly in Yangon.

2.3 Sample size and sampling

A sample size of 512 was estimated for this study with multiple logistic regression used for data analysis. The sample size calculation followed the logistic regression formula proposed by Hsieh, Bloch, & Larsen (1998) [12] with reference to a previous study on Myanmar migrant workers in Chiang Rai Province, Thailand [11]. A multistage random sampling procedure was employed to select individuals aged 40 years and older residing in Yangon. The sampling process involved selecting one township from each of Yangon's four districts using simple random sampling followed by systematic sampling within each township to ensure a representative sample. Data collection was conducted with the support of community leaders from the selected townships. The inclusion criteria required participants to be willing to take part in the study and provide informed consent, be at least 40 years old, of either gender or have lived in the study area for a minimum of one year. Additionally, participants needed to provide consent form for a fasting period of 6 to 8 hours prior to blood sample collection. Exclusion criteria included individuals who had been taking anti-diabetes medications for more than six months at the time of data collection, those with severe life-threatening diseases or severe mental illnesses that would hinder their ability to answer study questions and pregnant individuals during the data collection period.

2.4 Data Collection

Data were collected using the Kobo Collect mobile app (v2021.2.4). The questionnaire used in this study included sociodemographic characteristics, physical health status, depression index and fasting blood glucose levels. Content validity was ensured by consulting three experts and the questionnaire was revised based on their feedback. It was then translated into Myanmar and English using both forward and backward translation methods to ensure accuracy. A pre-test was conducted with 30 participants who were not part of the target population for the study. To assess the reliability of the questionnaire, Cronbach's alpha was calculated yielding a value of 0.82 for the PHQ-9 (Personal Health

Questionnaire 9) indicating strong internal consistency across the standardized items.

2.5 Data Analysis

Data were analysed using STATA version 18.0 (College Station, Texas 77845 USA). Descriptive statistics including frequency and percentage for categorical data and mean, standard deviation (S.D.), median, minimum and maximum for continuous data were used. Multiple logistic regression was used to analyse the association between each factor and T2DM. After bivariate analysis, factors with a P-value of less than 0.25 were checked for multicollinearity, with a Variance Inflation Factor (VIF) value of 1.21 and then entered into multivariable analysis. The association was described by Adjusted Odds Ratio (AOR), 95% Confidence Interval (95% CI) and P-value < 0.05.

2.6 Ethical Clearance

This study was approved by "the Centre for Ethics in Human Research, Khon Kaen University" with the reference number HE672184 on 18th October 2024.

3. Results

3.1 Basic Characteristics of the participants

The study included 512 participants aged 40 years and older with a mean age of 53.90 years (SD ±10.79). The largest age group was 40-49 years accounting for 41.21% followed by 50-59 years (28.12%), 60-69 years (21.88%) and those aged 70 years and above (8.79%). Most participants were female (66.99%) and the majority were married (68.36%) with smaller proportions being single (14.84%), widowed (15.43%), divorced (0.98%) or separated (0.39%). In terms of educational attainment, 32.23% of participants had completed high school, 31.25% had a bachelor's degree or higher while 17.38% had primary school education and 14.65% completed middle school. Only 4.49% had no formal education whether literate or illiterate.

Most participants lived in urban areas (81.05%) with 17.39% residing in semi-urban areas and a small proportion (1.56%) in rural areas. Ethnically, the majority were Burma (70.51%) followed by Kayin (22.85%), Shan (1.76%), Rakhine (0.58%) and other ethnicities (4.30%). Regarding occupation, 37.11% were dependents, 30.08% were private employees and 10.16% were manual labourers while 8.79% ran their own businesses, 5.47% worked as government staff, and 1.95% engaged in agriculture or livestock. The average household size was 4.38 members (SD ±1.73)

with 41.21% of families having five or more members. Financially, 41.02% of households reported a monthly income between 120-285 USD while 31.05% earned 285-480 USD and 15.23% earned over 480 USD. Monthly household expenditures followed a similar distribution with 48.44% spending 120-285 USD and 33.98% spending 285-480 USD. Financially, 53.32% reported having "enough" resources while 30.27% managed savings, 8.60% had debts and 7.81% found their finances insufficient.

The mean Body Mass Index (BMI) of participants was 23.81 kg/m² (SD ±3.64) with a majority being either overweight (24.03%) or classified as Obese Class I (30.66%). Normal BMI was recorded in 33.40% while 6.05% were underweight and 5.86% fell into the Obese Class II category. Waist circumference indicated that 60.16% of participants had values above the interim cutoff (≥90 cm for men and ≥80 cm for women). Most participants reported being in good health with 95.90% considering themselves healthy. However, 10.94% reported acute illnesses in the past including coughing (21.36%), headaches (20.40%), sneezing (15.53%) and fever (14.56%). Chronic illnesses were present in 34.77% with hypertension (33.73%) and diabetes mellitus (25.70%) being the most prevalent. Of those with chronic illnesses, 78.53% were receiving regular treatment. Family history revealed that 31.64% had a history of hypertension primarily from their mothers (48.96%) or siblings (21.88%). Diabetes mellitus was reported in 17.77% of families predominantly through maternal history (54.37%). Other non-communicable diseases (10.94%) were noted most frequently from siblings (36.67%) or mothers (35.00%).

Depression was evaluated using the PHQ-9 scale. The majority (83.01%) showed no symptoms of depression while 14.84% experienced mild symptoms and 1.37% and 0.78% had moderate and moderately severe depression, respectively. The mean depression score was 2.06 (SD ±3.01), with a median score of 1 (range: 0-18) (Table 1).

Table 1: Basic characteristics of the participants among middle-aged adult and elderly in Yangon, Myanmar (n=512)

Characteristics	Number (n)	Percentage (%)
1. Sociodemographic factors		
Age (Years)		
40-49	211	41.21
50-59	144	28.12
60-69	112	21.88
≥70	45	8.79
Mean (±SD)	53.90(±10.79)	

Characteristics	Number (n)	Percentage (%)
Median (Min: Max)	53 (40:91)	
Sex		
Male	169	33.01
Female	343	66.99
Marital status		
Single	76	14.84
Married	350	68.36
Divorced	5	0.98
Widowed	79	15.43
Separated	2	0.39
Education		
No formal education and illiterate	4	0.78
No formal education and literate	19	3.71
Primary school	89	17.38
Middle school	75	14.65
High school	165	32.23
Bachelor's degree and above	160	31.25
Living area		
Urban	415	81.05
Semiurban	89	17.39
Rural	8	1.56
Ethnicity		
Burmese	361	70.51
Kayin	117	22.85
Shan	9	1.76
Rakhine	3	0.58
Other	22	4.30
Occupation		
Agriculture and livestock	10	1.95
Government staff	28	5.47
Own business	45	8.79
Private employee	154	30.08
Manual labour	52	10.16
Dependent	190	37.11
Other	33	6.45
Number of family member		
≤4	301	58.79
>4	211	41.21
Mean (±SD)	4.38 (±1.73)	
Median (Min: Max)	4 (1:12)	
Monthly household income (USD)		
<120 USD	65	12.70
120-285 USD	210	41.02
285-480 USD	159	31.05
>480 USD	78	15.23
Mean (±SD)	346.3 (±244.4)	
Median (Min: Max)	288.1 (24:1,680.4)	
Monthly household expenditure (USD)		
<120 USD	55	10.74
120-285 USD	248	48.44
285-480 USD	174	33.98
>480 USD	35	6.84
Mean (±SD)	303 (±178.2)	
Median (Min: Max)	240 (24:1,200.2)	

Characteristics	Number (n)	Percentage (%)
Financial status		
Not enough	40	7.81
Enough with debt	44	8.60
Enough	273	53.32
Enough with savings	155	30.27
2. Physical health status		
Body Mass Index (BMI) (kg/m^2)		
Underweight (<18.5)	31	6.05
Normal (18.5-22.9)	171	33.40
Overweight (23-24.9)	123	24.03
Obese I (25-29.9)	157	30.66
Obese II (≥30)	30	5.86
Mean BMI score (±SD)	23.81 (±3.64)	
Median (Min: Max)	23.62 (14.50:36.29)	
Waist circumference (cm)		
Below interim cut off point (<90 in men & <80 in women)	204	39.84
Interim cut off point and above (≥90 in men & ≥80 in women)	308	60.16
Mean waist circumference (±SD)	85.77 (±12.33)	
Median (Min: Max)	85 (50:125)	
Current health status (Self-reported)		
Healthy	491	95.90
Unhealthy	21	4.10
Mean score (±SD)	7.97 (±1.21)	
Median (Min: Max)	8 (4:10)	
Having acute illness		
No	456	89.06
Yes	56	10.94
Type of acute illness (n=56)		
Fever	15	14.56
Headache	21	20.40
Sneezing	16	15.53
Coughing	22	21.36
Diarrhoea	4	3.88
Other	25	24.27
Having chronic illness		
No	334	65.23
Yes	178	34.77
Types of chronic illness (n=178)		
Hypertension	84	33.73
Diabetes mellitus	64	25.70
Stroke	2	0.80
Heart disease	20	8.03
Arthritis	25	10.04
Cancer	2	0.80
Chronic obstructive pulmonary disease	9	3.61
Other	43	17.27
Taking regular treatment for chronic diseases (n=177)		
No	24	13.56
Yes	139	78.53
Other	14	7.91
Family history of hypertension		
No	350	68.36

Characteristics	Number (n)	Percentage (%)
Yes	162	31.64
Family history of hypertension (n=162)		
Mother	94	48.96
Father	55	28.64
Grandparents	1	0.52
Sibling	42	21.88
Family history of diabetes mellitus		
No	421	82.23
Yes	91	17.77
Family history of diabetes mellitus (n=91)		
Mother	56	54.37
Father	20	19.42
Grandparents	1	0.97
Sibling	26	25.24
Family history of other non-communicable diseases		
No	456	89.06
Yes	56	10.94
Family history of other non-communicable diseases (n=56)		
Mother	21	35.00
Father	17	28.33
Sibling	22	36.67
3. Depression disorder (PHQ9)		
None (0-4)	425	83.01
Mild (5-9)	76	14.84
Moderate (10-14)	7	1.37
Moderately severe (15-19)	4	0.78
Mean depression score (±SD)	2.06 (±3.01)	
Median (Min: Max)	1 (0:18)	

3.2 Prevalence of hyperglycaemia among middle-aged adult and elderly in Yangon, Myanmar

The study categorized fasting blood sugar (FBS) levels into three groups: normal, prediabetes and diabetes. Among the participants, 55.66% (95% CI: 51.32-59.92) had normal FBS levels (<100 mg/dl). A significant proportion 30.08% (95% CI: 26.25-34.20) exhibited prediabetes with FBS levels ranging between 100-125 mg/dl indicating a high risk for developing diabetes. Additionally, 14.26% (95% CI: 11.48-17.57) were classified as diabetic with FBS levels ≥126 mg/dl (Table 2).

Table 2: Prevalence of hyperglycaemia among middle-aged adult and elderly of the participants (n=512)

High blood glucose	Number (n)	Percentage (%)	95% CI
Normal (FBS <100 mg/dl)	285	55.66	51.32-59.92
Prediabetes (FBS 100-125 mg/dl)	154	30.08	26.25-34.20
Diabetes (FBS ≥126 mg/dl)	73	14.26	11.48-17.57

3.3 Factors associated with hyperglycaemia using Multiple logistic regression

The multivariate analysis using multiple logistic regression identified several factors that were significantly associated with hyperglycaemia among middle-aged and elderly participants. Age emerged as a key determinant with the likelihood of hyperglycaemia increasing significantly in older age groups. Participants aged ≥60 years were more likely to have hyperglycaemia (AOR = 3.47, 95% CI: 1.64–7.32) compared to those aged 40–49 years highlighting the heightened vulnerability of older individuals. Ethnicity also played a significant role. Compared to the majority Burmese ethnic group, Kayin participants were nearly three times more likely to have hyperglycaemia (AOR = 2.87, 95% CI: 1.47–5.61).

Waist circumference was another strong predictor. Participants with waist measurements at or above the interim cutoff point (≥90 cm in men and ≥80 cm in women) were more than three times as likely to have hyperglycaemia (AOR = 3.57, 95% CI: 1.68–7.60) compared to those with smaller waist measurements. This underscored the critical role of central obesity in glycaemic regulation. Chronic illness was found to have a profound impact with participants who had chronic conditions being nearly eight times more likely to have hyperglycaemia (AOR = 7.97, 95% CI: 4.17–15.23) compared to those without. This result highlighted the burden of comorbidities on glycaemic control. Similarly, a family history of diabetes mellitus significantly increased the risk of hyperglycaemia with participants having a family history being over four times as likely to exhibit hyperglycaemia (AOR = 4.10, 95% CI: 2.09–8.04) (Table 3).

Table 3: Bivariate and Multivariate analysis of factors associated with hyperglycaemia using simple and multiple logistic regression among middle-aged adult and elderly of the participants (n=512)

Factors	Number of samples	% of T2DM	Crude Odd Ratio (COR)	95% CI	P-value	AOR	95% CI	P-value
Sociodemographic factors								
Age					<0.001			0.002
40-49	211	7.58	1	1		1	1	
50-59	144	14.58	2.08	1.05-4.14		1.37	0.62-3.03	
≥60	157	22.93	3.63	1.93-6.82		3.47	1.64-7.32	
Sex					0.094			
Male	169	10.65	1	1				

Factors	Number of samples	% of T2DM	Crude Odd Ratio (COR)	95% CI	P-value	AOR	95% CI	P-value
Female	343	16.03	1.60	0.91-2.83				
Marital status					0.946			
Single	76	13.16	1	1				
Married	350	14.57	1.13	0.54-2.33				
Divorced/Widowed / Separated	86	13.95	1.07	0.43-2.64				
Education					0.852			
Bachelor's degree and above	160	13.12	1	1				
High school	165	15.76	1.24	0.67-2.30				
Middle school	75	16.00	1.26	0.58-2.72				
Primary school	89	13.48	1.03	0.48-2.21				
No formal education and illiterate/ literate	23	8.70	0.63	0.14-2.89				
Living area					0.350			
Semiurban/ rural	97	11.34	1	1				
Urban	415	14.94	1.37	0.69-2.72				
Ethnicity					0.024			0.006
Burmese	361	11.63	1	1		1	1	
Kayin	117	22.22	2.17	1.26-3.73		2.87	1.47-5.61	
Shan/ Rakhine/ Other	34	14.71	1.31	0.48-3.57		2.37	0.73-7.70	
Occupation					<0.001			
Agriculture and livestock/ Manual labour	62	6.45	1	1				
Government staff/ Private employee	182	8.24	1.30	0.42-4.08				
Own business	45	13.33	2.23	0.59-8.42				
Dependent	190	21.05	3.87	1.32-11.29				
Other	33	24.24	4.64	1.28-16.83				
Number of family member					0.131			
≤4	301	12.29	1	1				
>4	211	17.06	1.47	0.89-2.41				
Monthly household income (USD)					0.673			
<120 USD	65	13.85	1	1				
120-285 USD	210	12.38	0.88	0.39-1.99				
285-480 USD	159	15.09	1.11	0.48-2.53				
>480 USD	78	17.95	1.36	0.55-3.38				
Monthly household expenditure (USD)					0.842			
<120 USD	55	14.55	1	1				
120-285 USD	248	12.90	0.87	0.38-2.01				
285-480 USD	174	15.52	1.08	0.46-2.54				
>480 USD	35	17.14	1.22	0.38-3.86				
Financial status					0.952			
Not enough/ Enough with debt	84	14.29	1	1				
Enough	273	14.65	1.03	0.51-2.07				
Enough with savings	155	13.55	0.94	0.44-2.02				

Factors	Number of samples	% of T2DM	Crude Odd Ratio (COR)	95% CI	P-value	AOR	95% CI	P-value
Physical health status								
Body Mass Index (BMI) (kg/m^2)					<0.001			
Normal	202	6.93	1	1				
Overweight	123	14.63	2.30	1.10-4.82				
Obesity	187	21.93	3.77	1.98-7.18				
Waist circumference (cm)					<0.001			<0.001
Below interim cut off point (<90 in men & <80 in women)	204	4.90	1	1		1	1	
Interim cut off point and above (≥90 in men & ≥80 in women)	308	20.45	4.99	2.49-9.98		3.57	1.68-7.60	
Current health status (Self-reported)					0.234			
Healthy	491	13.85	1	1				
Unhealthy	21	23.81	1.94	0.69-5.48				
Having acute illness					0.686			
No	456	14.47	1	1				
Yes	56	12.50	0.84	0.37-1.94				
Having chronic illness					<0.001			<0.001
No	334	5.09	1	1		1	1	
Yes	178	31.46	8.56	4.79-15.31		7.97	4.17-15.23	
Family history of hypertension					0.035			
No	350	12.00	1	1				
Yes	162	19.14	1.74	1.05-2.88				
Family history of diabetes mellitus					<0.001			<0.001
No	421	10.69	1	1		1	1	
Yes	91	30.77	3.71	2.16-6.39		4.10	2.09-8.04	
Family history of non-communicable diseases					0.995			
No	456	14.25	1	1				
Yes	56	14.29	1.003	0.45-2.22				
Depression disorder (PHQ9)					0.240			
No depression	425	13.41	1	1				
Depression	87	18.39	1.45	0.79-2.68				

4. Discussion

The prevalence of T2DM among middle-aged and elderly individuals in Yangon, Myanmar was observed to be 30.08% for prediabetes (95% CI: 26.25–34.20) and 14.26% for diabetes (95% CI: 11.48–17.57). When compared to the findings of a national study conducted in 2014 which reported a diabetes prevalence of 18.2% in the Yangon region [9], the current prevalence is notably lower. However, the prevalence in our study was higher than that reported in several previous studies conducted in other settings including among Myanmar migrant workers

in Thailand [11] as well as populations in India [10, 13, 14], Indonesia [15], Albania [16], the Czech Republic [17], Venezuela [18], Ethiopia [19-21] and Kenya [22]. Conversely, studies conducted in countries such as Iran [23], China [24, 25] and Pakistan [26, 27] had reported a higher prevalence of high blood glucose compared to our findings. These variations highlighted the need for context-specific strategies to address the growing burden of hyperglycaemia.

Age emerged as a significant determinant, with older adults, particularly those aged 60 years and above, being significantly more likely to develop T2DM. Participants aged 60 years and older were found to be 3.47 times more likely to have T2DM compared to those in the 40–49 age group. This highlighted the heightened vulnerability of older populations to T2DM suggesting the need for age-specific screening and early intervention strategies to manage risk factors and prevent diabetes-related complications.

Our findings were consistent with studies from various countries that highlighted the increased risk of diabetes with age. For instance, a study in Kenya found a higher risk of diabetes in the 45-59 age group (AOR: 6.59) [22] while a study in Ethiopia reported a similar increase in the 54-60 age group (AOR: 4.0) [28]. In Pakistan, a study observed a higher likelihood of diabetes for individuals aged ≥43 years [27] and another study found that those aged ≥61 years had a 4.93-fold increased risk [26]. Conversely, studies in China [25] reported a more modest increase in risk (AOR: 1.59) while research from Venezuela found a much stronger association with older age (AOR: 20) [18]. The findings from Nepal (AOR: 4.7) [10] also aligned closely with our study. However, an Indian study observed a weaker association (AOR: 1.14) suggesting that additional factors beyond age may influence the risk of diabetes [29].

Ethnicity emerged as a significant factor in the study with participants from the Kayin ethnic group showing a notably higher likelihood of T2DM compared to the majority Burmese group. This suggested that genetic, cultural and environmental factors may play a role in the ethnic disparities observed in diabetes prevalence highlighting the need for further research on ethnic-specific risk factors and the development of targeted prevention strategies. In line with this, a study focused on Myanmar migrant workers reported that the Burmese ethnic group had a 4.76-fold increased risk of diabetes (AOR: 4.76, 95% CI: 1.25–18.14)

compared to the Ahka ethnic group [11]. Similarly, a study from the hill tribe elderly populations in northern Thailand found that the Karen ethnic group had a 5.03-fold higher risk of diabetes (AOR: 5.03, 95% CI: 2.35–10.78) compared to the Ahka ethnic group [30].

Our study identified waist circumference as a significant predictor of T2DM. Participants with measurements at or above the cutoff points (≥90 cm for men and ≥80 cm for women) were more than three times as likely to develop T2DM (AOR: 3.57, 95% CI: 1.68–7.60) compared to those with smaller waist measurements. Community-based obesity reduction programs, incorporating physical activity and dietary education are critical to reducing this risk factor. These findings aligned with previous research across diverse populations. For instance, a study in Myanmar reported that individuals with larger waist circumferences had an increased risk of prediabetes (RR: 3.1, 95% CI: 2.4–4.2) and diabetes (RR: 1.4, 95% CI: 1.1–1.8) [9]. Similarly, research in the Czech population found that high waist circumference was associated with elevated risks of prediabetes (RR: 1.81, 95% CI: 1.36–2.41) and diabetes (RR: 9.86, 95% CI: 4.82–20.20) [17]. Additional studies from Ethiopia and India demonstrated comparable trends, showing that high waist circumference significantly increased the risk of diabetes (RR: 4.1 and RR: 13.41, respectively) [29, 31].

Chronic illness was found to have a profound impact with participants who had chronic conditions being nearly eight times more likely to have T2DM compared to those without. chronic illnesses especially comorbid conditions like hypertension were found to substantially increase the likelihood of T2DM. This highlighted the importance of integrated care approaches that addressed both diabetes and its comorbidities to improve patient outcomes.

Our study found that chronic illness significantly increased the risk of T2DM with participants suffering from chronic conditions being nearly eight times more likely to develop type 2 diabetes mellitus compared to those without. In particular, comorbidities such as hypertension substantially elevated this risk highlighting the importance of integrated care approaches that address both diabetes and its associated conditions. These findings aligned with results from various international studies. For instance, a study in Kenya reported that individuals with raised blood pressure had a

2.77 times higher risk of developing diabetes (95% CI: 1.53–5.03) compared to those with normal blood pressure [22]. Similarly, research from Pakistan found a 2.2-fold increased risk (95% CI: 1.9–2.5) [27] while a study in Venezuela identified a risk ratio of 2.36 (95% CI: 1.6–3.5) for individuals with elevated blood pressure [18]. In the Czech Republic, raised blood pressure was associated with a 4.35 times higher risk of diabetes (95% CI: 2.65–7.12) [17]. Studies from Ethiopia demonstrated similar trends, with risk ratios of 4.77 (95% CI: 1.90–11.97) and 7.36 (95% CI: 3.35–16.17) [21, 31]. Additionally, research in Myanmar indicated that raised blood pressure significantly increased the risk of diabetes (RR: 3.83, 95% CI: 1.82–8.03) [11]. In Korea, a study reported a more modest association with raised blood pressure linked to an increased risk of impaired fasting glucose (RR: 1.31, 95% CI: 1.03–1.66) [32].

Our study identified a family history of diabetes mellitus as a significant risk factor, with individuals having a family history being more than four times as likely to develop T2DM. This finding underscored the hereditary component of type 2 diabetes mellitus and highlighted the importance of early screening and preventive measures for those with a familial predisposition. These results aligned with findings from studies conducted in various populations. For example, research from Pakistan indicated that individuals with a family history of diabetes had a 3.94-fold higher risk of developing diabetes [26]. Another study from Pakistan reported a 1.9-fold increased risk [27]. In Thailand, a study observed a 1.5-fold increased risk among individuals with a family history of diabetes [30]. Similarly, research focusing on Myanmar migrant workers found that individuals with a family history had a significantly elevated risk (RR: 6.86, 95% CI: 1.45–32.46) [11]. In South America, a study conducted in Venezuela reported a risk ratio of 2.01 (95% CI: 1.1–3.5) [18]. Studies from Ethiopia and India demonstrated even higher risks. In Ethiopia, having a family history increased the likelihood of developing diabetes by 20.24 times [19] while research from India found a 4.18-fold increase [29].

To address the identified risk factors and reduce the burden of T2DM in Myanmar, several recommendations are proposed. Age-based screening programs should focus on early detection in older adults particularly those aged 60 and above. Culturally sensitive education campaigns tailored to ethnic

minorities are essential to address disparities in diabetes prevalence. Community-based interventions should encourage physical activity and healthy eating to reduce obesity. Integrated care models that include management of chronic illnesses like hypertension into diabetes prevention programs are needed. Family-cantered interventions should provide targeted education and preventive measures for individuals with a family history of diabetes. By prioritizing these strategies, public health stakeholders can reduce the burden of T2DM in Yangon and contribute to improved health outcomes for vulnerable populations.

This study provided valuable insights into the sociodemographic and health-related factors associated with Type 2 Diabetes Mellitus (T2DM) among middle-aged and elderly individuals in Yangon, Myanmar. However, it is important to acknowledge several limitations. First, the cross-sectional design limits the ability to establish causality. It identified associations between variables but cannot determine cause-and-effect relationships. Second, self-reported data for certain health variables such as chronic illness status and family history of diabetes may introduce recall bias or inaccuracies potentially affecting the reliability of the findings. Third, the sample may not fully represent the entire population of middle-aged and elderly individuals in Yangon as certain subgroups particularly those in rural areas may be underrepresented. This limits the generalizability of the findings to other regions or populations within Myanmar.

Additionally, the study did not account for potential confounding factors such as dietary habits, physical activity levels or environmental influences which could also play a significant role in the development of T2DM. Lastly, the absence of certain biochemical measurements such as insulin resistance or HbA1c levels limits the study's ability to provide more precise insights into the metabolic conditions contributing to hyperglycaemia. Acknowledging these limitations emphasizes the need for future longitudinal studies with broader population coverage, improved data collection methods and comprehensive assessments to provide a more nuanced understanding of T2DM risk factors in Myanmar.

5. Conclusion

In conclusion, this study highlighted several key sociodemographic and health-related factors that are significantly associated with Type 2 Diabetes Mellitus in middle-aged and

elderly populations in Yangon, Myanmar. Age, ethnicity, waist circumference, chronic illness and family history of diabetes were identified as important predictors of hyperglycaemia. These findings suggested that targeted interventions including age-specific screenings, obesity prevention, and addressing comorbidities could help mitigate the risk of T2DM. The study emphasized the need for public health strategies that consider the complex interplay of genetic, lifestyle and health factors in the management and prevention of diabetes. However, future longitudinal studies that incorporate more detailed measures and diverse populations are needed to further clarify the causality and broader applicability of these findings.

Acknowledgement

I sincerely thank the Karen Baptist Convention Hospital team for their essential support in data collection. Their dedication and professionalism played a crucial role in the success of this study.

References

[1] Khan MAB, Hashim MJ, King JK, Govender RD, Mustafa H, Al Kaabi J. Epidemiology of Type 2 Diabetes - Global Burden of Disease and Forecasted Trends. J Epidemiol Glob Health. 2020;10(1):107-11.
[2] Lin X, Xu Y, Pan X, Xu J, Ding Y, Sun X, et al. Global, regional, and national burden and trend of diabetes in 195 countries and territories: an analysis from 1990 to 2025. Scientific Reports. 2020;10(1):14790.
[3] IDF. IDF_Atlas_10th_Edition_2021.pdf. 2021.
[4] Butt MD, Ong SC, Rafiq A, Kalam MN, Sajjad A, Abdullah M, et al. A systematic review of the economic burden of diabetes mellitus: contrasting perspectives from high and low middle-income countries. J Pharm Policy Pract. 2024;17(1):2322107.
[5] Balaji R, Duraisamy R, Kumar MP. Complications of diabetes mellitus: A review. Drug Invention Today. 2019;12(1).
[6] Amit Sapra PB. Diabetes. National Library of Medicine. 2023.
[7] WHO. Diabetes Fact sheet 2023 [Available from: https://www.who.int/news-room/fact-sheets/detail/diabetes.
[8] Aung WP, Bjertness E, Htet AS, Stigum H, Kjollesdal MKR. Trends in Diabetes Prevalence, Awareness, Treatment and Control in Yangon Region, Myanmar, Between 2004 and 2014, Two Cross-Sectional Studies. Int J Environ Res Public Health. 2019;16(18).
[9] Latt TS, Zaw KK, Ko K, Hlaing MM, Ohnmar M, Oo ES, et al. Measurement of diabetes, prediabetes and their associated risk factors in Myanmar 2014. Diabetes Metab Syndr Obes. 2019;12:291-8.
[10] Shrestha N, Karki K, Poudyal A, Aryal KK, Mahato NK, Gautam N, et al. Prevalence of diabetes mellitus and associated risk factors in Nepal: findings from a nationwide population-based survey. BMJ Open. 2022;12(2):e060750.
[11] Dah Poe NE, Srichan P, Khunthason S, Apidechkul T, Suttana W. Prevalence and Factors Associated with Hyperglycemia among Myanmar Migrant Workers in Mueang District, Chiang Rai Province, Thailand: a Cross-Sectional Study. Journal of Health Science and Medical Research. 2022.
[12] Hsieh FY, Bloch DA, Larsen MD. A simple method of sample size calculation for linear and logistic regression. Statistics in medicine. 1998;17(14):1623-34.

[13] Subramani SK, Yadav D, Mishra M, Pakkirisamy U, Mathiyalagen P, Prasad G. Prevalence of Type 2 Diabetes and Prediabetes in the Gwalior-Chambal Region of Central India. Int J Environ Res Public Health. 2019;16(23).
[14] Tripathy JP, Thakur JS, Jeet G, Chawla S, Jain S, Pal A, et al. Prevalence and risk factors of diabetes in a large community-based study in North India: results from a STEPS survey in Punjab, India. Diabetol Metab Syndr. 2017;9:8.
[15] Susetyowati S, Huriyati E, Kandarina BJI, Muhammad HFL, Faza F. Prevalence and determinants of high blood glucose in urban and rural Indonesian adult population. International Journal of Diabetes in Developing Countries. 2019;39(2):346-54.
[16] Dika Q, Duli M, Burazeri G, Toci D, Brand H, Toci E. Health literacy and blood glucose level in transitional Albania. Frontiers in Public Health. 2020;8:405.
[17] Broz J, Malinovska J, Nunes MA, Kucera K, Rozekova K, Zejglicova K, et al. Prevalence of diabetes and prediabetes and its risk factors in adults aged 25-64 in the Czech Republic: A cross-sectional study. Diabetes Res Clin Pract. 2020;170:108470.
[18] Nieto-Martinez R, Mechanick JI, Brajkovich I, Ugel E, Risques A, Florez H, et al. Prevalence of diabetes in three regions of Venezuela. The VEMSOLS study results. Prim Care Diabetes. 2018;12(2):126-32.
[19] Endris T, Worede A, Asmelash D. Prevalence of Diabetes Mellitus, Prediabetes and Its Associated Factors in Dessie Town, Northeast Ethiopia: A Community-Based Study. Diabetes Metab Syndr Obes. 2019;12:2799-809.
[20] Aynalem SB, Zeleke AJ. Prevalence of Diabetes Mellitus and Its Risk Factors among Individuals Aged 15 Years and Above in Mizan-Aman Town, Southwest Ethiopia, 2016: A Cross Sectional Study. Int J Endocrinol. 2018;2018:9317987.
[21] Dereje N, Earsido A, Temam L, Abebe A. Prevalence and Associated Factors of Diabetes Mellitus in Hosanna Town, Southern Ethiopia. Ann Glob Health. 2020;86(1):18.
[22] Mohamed SF, Mwangi M, Mutua MK, Kibachio J, Hussein A, Ndegwa Z, et al. Prevalence and factors associated with pre-diabetes and diabetes mellitus in Kenya: results from a national survey. BMC Public Health. 2018;18(Suppl 3):1215.
[23] Mirzaei M, Rahmaninan M, Mirzaei M, Nadjarzadeh A, Dehghani Tafti AA. Epidemiology of diabetes mellitus, pre-diabetes, undiagnosed and uncontrolled diabetes in Central Iran: results from Yazd health study. BMC public health. 2020;20(1):166.
[24] Zhang H, Ni J, Yu C, Wu Y, Li J, Liu J. Sex-Based Differences in Diabetes Prevalence and Risk Factors: A Population-Based Cross-Sectional Study Among Low-Income Adults in China. Front Endocrinol. 2019; 10: 658. 2019.
[25] Yan Z, Cai M, Han X, Chen Q, Lu H. The interaction between age and risk factors for diabetes and prediabetes: a community-based cross-sectional study. Diabetes, Metabolic Syndrome and Obesity. 2023:85-93.
[26] Aamir AH, Ul-Haq Z, Mahar SA, Qureshi FM, Ahmad I, Jawa A, et al. Diabetes Prevalence Survey of Pakistan (DPS-PAK): prevalence of type 2 diabetes mellitus and prediabetes using HbA1c: a population-based survey from Pakistan. BMJ Open. 2019;9(2):e025300.
[27] Basit A, Fawwad A, Qureshi H, Shera AS, Members N. Prevalence of diabetes, pre-diabetes and associated risk factors: second National Diabetes Survey of Pakistan (NDSP), 2016-2017. BMJ Open. 2018;8(8):e020961.
[28] Sahile AT, Bekele GE. Prevalence of Diabetes Mellitus and Associated Factors in Addis Ababa Public Health Facilities, Addis Ababa, Ethiopia, 2016. Diabetes Metab Syndr Obes. 2020;13:501-8.
[29] Adhikary M, Chellaiyan VG, Chowdhury R, Daral S, Taneja N, Das TK. Association of risk factors of type 2 diabetes mellitus and fasting blood glucose levels among residents of rural area of Delhi: a cross sectional study. International Journal Of Community Medicine And Public Health. 2017;4(4).
[30] Apidechkul T. Prevalence and factors associated with type 2 diabetes mellitus and hypertension among the hill tribe elderly populations in northern Thailand. BMC Public Health. 2018;18(1):694.
[31] Aynalem SB, Zeleke AJ. Prevalence of diabetes mellitus and its risk factors among individuals aged 15 years and above in Mizan-Aman town, Southwest Ethiopia, 2016: a cross sectional study. International journal of endocrinology. 2018;2018(1):9317987.

[32] Byeon H. Exploring the risk factors of impaired fasting glucose in middle-aged population living in South Korean communities by using categorical boosting machine. Frontiers in Endocrinology. 2022;13:1013162.