Original Research

Prevalence, circumstances, and consequences of falls in older adults with type 2 diabetes mellitus – A descriptive cross-sectional study in selected urban hospitals in Sri Lanka

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Abstract

Background & Aim: Falls are a major health concern for older adults with type 2 diabetes mellitus (T2DM), necessitating a better understanding of risk factors and prevention strategies. This study aimed to investigate the prevalence, circumstances, and consequences of falls among older adults with T2DM.

Methods: In this descriptive cross-sectional study, a purposive sample of 180 older adults with T2DM individuals attending outpatient diabetes clinics of the National Hospital of Sri Lanka and Colombo East Base Hospital were recruited. Socio-demographics, T2DM-specific data, and history of falls were assessed using an interviewer-administered questionnaire. Number of falls, circumstances, and consequences of the falls of the last three falls were recorded retrospectively during the past 12 months. Statistical analysis was done using SPSS version 20.0.

Results: Among 180 T2DM participants (mean age=66.61; SD=5.35 years), 38.3% (n=69) were males and 61.7% (n=111) were females. Approximately 22% (n=49) of adults with T2DM experienced falls during the previous 12 months. Fallers were reported with a significantly higher median age (median=68; IQR-65-71 years) compared to non-fallers (median=65; IQR-62-69; $p<0.05$). The majority of the falls occurred in the morning (n=25, 51.0%), in the forward direction (n=25; 51.0%), and inside the home (n=23, 46.9%) while walking (n=29, 59.2%) due to slips (n=23, 46.9%). The prevalence of fractures among fallers was 13.8%, and most of the falls resulted in bruises (n=31.0%).

Conclusions & Recommendations: The findings highlight a high prevalence of falls and associated injuries in older adults with T2DM. Although the majority of falls resulted in minor injuries like bruises, a notable percentage led to fractures. Targeted fall prevention programs focusing on home safety, balance training, and slip prevention are essential to reduce fall-related complications in this population.

Keywords: *falls, type 2 diabetes mellitus, older adults*

Introduction

Diabetes has become an important health concern that increases morbidity, mortality, and risk of developing other non-communicable diseases (1). According to the International Diabetic Federation (IDF), the estimated prevalence of diabetes in adults is projected to increase from 10.5% in 2021 to 11.3% in 2030 (2). Sri Lanka has no expectations as Type 2 diabetes mellitus (T2DM) has reached epidemic levels in the country (3). Recent estimates suggest that the prevalence of diabetes in Sri Lankan adults has reached up to 23% (4).

Falls are identified as a major health issue among older adults with T2DM that can cause unintentional injuries that require long hospitalization and increase mortality (5,6). A fall is defined as an unexpected event in which an individual comes to rest on the ground, floor, or lower level (7). An estimated number of 648,000 annual fatal falls occur globally (8). Most of the fatal falls are reported among adults aged over 60 years (9). Approximately 23.3% of elderly people with diabetes fall at least once a year (10).

Falls among older adults with T2DM can be multifactorial. Risk factors can be classified into intrinsic and extrinsic. Advanced age, female gender, gait and balance impairments, muscle weakness, polypharmacy, chronic diseases, and diabetes-related complications, including poor vision and neuropathy, are the intrinsic factors associated with falls (6,8,11-14). Main extrinsic risk factors are the environmental risk factors such as inadequate lighting, slippery surfaces, obstacles like cords, unsecured rugs, staircases, changes in floor levels and uneven walkways (15,16).

Falls result in injuries ranging from minor to severe, including grazes, bruises, sprains, lacerations, dislocations, fractures, spinal cord injuries, and head injuries (13,17). Falls and fall-related injuries often require medical attention. T2DM delays recovery from an injury due to poor circulation, risk of infection, and impaired wound healing, ultimately requiring long-term hospitalisation (18). Even though falls are non-injurious, they can result in negative consequences such as fear of falling, loss of confidence, and limitation of daily activities (19).

Enhancing knowledge of the circumstances and consequences of falls in T2DM is essential to identify aetiologies of falls and to plan preventive strategies. A recent study done in Sri Lanka found that 35.9% of falls in individuals with T2DM had one or more falls during the follow-up period (13). However, the circumstances and consequences of falls in individuals with T2DM have not been studied previously in Sri Lanka, while only modest evidence is available worldwide. Hence, the main objective of this study was to assess the circumstances and consequences of falls in a selected category of Sri Lankan adults with T2DM.

Methods

Study design and participants

Participants for this descriptive cross-sectional study were recruited from the Endocrinology Clinic of the National Hospital of Sri Lanka (NHSL) and the outpatient medical clinic of Colombo East Base Hospital from the 1st of November to the 23rd of November 2022. One hundred and eighty (180) participants were recruited using the non-probability convenient sampling method. The data were collected using face-to-face interviews by the principal investigator. Community-dwelling older adults aged 60 years or above, diagnosed with T2DM for more than five years, being able to understand instructions given for the assessment, and being able to ambulate within household distance without an assistive device were included. Those with physical disabilities, acute illness, cognitive impairments, severe neurological and musculoskeletal conditions, and who had undergone lower limb amputations and major surgeries were

excluded from the study. Fallers were defined as participants who had at least one fall during the past 12 months to analyse the association of falls with socio-demographic and disease characteristics.

Data collection and analysis

Socio-demographic data, disease-related data, duration of diabetes, family history of diabetes, fasting blood sugar level, current treatment modalities for diabetes, presence of diabetic neuropathy, number of medications, and comorbidities and falls-related data were recorded using an interviewer-administered questionnaire.

History of falls was the primary outcome and was assessed retrospectively for 12 months. In part 1 of the questionnaire, participants were asked about the mechanism of falls. The number of falls was recorded in the past 12 months up to the data collection date. Circumstances and consequences of falls were collected up to a maximum of three recent falls from those who have fallen in the past 12 months in part 2. This part consisted of questions on characteristics of the fall.

The questionnaire used in the current study was developed based on questionnaires that had been used in previous studies. Simple language was used to design the questionnaire. The translation-back-translation method was applied to confirm the comprehensiveness of the questionnaire in Sinhala and Tamil languages. The translated questionnaires were pre-tested with five undergraduates and pilot-tested with five older adults with T2DM, and those participants were excluded from the analysis. Necessary modifications to each question were made based on pre-test and pilot-test results.

Data were analysed using Statistical Package for Social Science (SPSS) version 20. Continuous data were presented as means and standard deviations, and categorical variables were presented as frequencies and percentages. Chi-Squared or Fisher's Exact and Mann-Whitney U tests were used to find associations at a significant level of $p<0.05$.

Ethics approval was obtained from the Ethics Review Committee, Faculty of Medicine, University of Colombo, Sri Lanka (UCP/AL/18/444) and the National Hospital of Sri Lanka and Colombo East Base Hospital, Sri Lanka. Informed written and verbal consent were obtained from all the participants prior to data collection.

Results

Demographic and disease characteristics

The study sample consisted of 180 participants, with a mean age (SD) of 66.61 years (5.35) ranging from 60-84 years. The majority (n=130, 72.2%) were aged 60-69 years, females (n=111, 61.7%), Sinhalese (n=149, 82.8%), married (n=168, 93.3%), had their education level up to G.C.E A/L (n= 78, 43.3%) and unemployed (n=140, 77.8%).

Most of the participants (56.1%) had a family history of diabetes and were using only oral hypoglycaemic medications (n=139, 77.2%) and had been diagnosed with diabetic peripheral neuropathy (n=68, 37.8%). Demographic and disease characteristics of the participants are shown in Table 1.

Falls in the past 12 months

Prevalence of falls was reported as 21.7% during the previous 12 months. Out of all the participants, 78.3% (n=141) had no falls, 17.2% (n=31) had a single episode of fall, and 4.4% (n=8) had two or more falls (4.4%) (Figure 1).

The demographic and disease characteristics of fallers and non-fallers are presented in Table 2. Age was significantly associated with falls ($p<0.05$). Fallers (median age=68, IQR 65-71 years) were significantly older than non-fallers (median age=65, IQR 62-69 years). Approximately 59% (59.2%) fallers (n=23) were aged 60-69 years. The prevalence of falls in females (n=27, 24.3%) was higher than in males (n=17.4%, $p>0.05$).

Table 1. Distribution of demographic and disease characteristics of the participants (N=180)

Characteristic		Mean (SD)
Age		66.61 (5.35)
Duration of diabetes (years)		12.86 (7.88)
FBS level (mg/dL)		131.88 (42.70)
		No. (%)
Age categories	60-69	130 (72.2%)
	≥70	50 (27.8%)
Gender	Male	69 (38.3%)
	Female	111 (61.7%)
Ethnicity	Sinhalese	149 (82.8%)
	Tamil	20 (11.1%)
	Muslim	9 (5.0%)
	Other	2 (1.1%)
Level of education	Up to Grade 5	62 (34.4%)
	Up to General Certificate of Education (GCE) Ordinary Level	78 (43.3%)
	Up to GCE Advanced Level	37 (20.6%)
	Higher studies	3 (1.7%)
Marital status	Married	168 (93.3%)
	Unmarried	9 (5.0%)
	Divorced/Widow	3 (1.7%)
Employment status	Employed	40 (22.2%)
	Unemployed	140 (77.8%)
Family history of diabetes	With a family history	101 (56.1%)
	Without a family history	79 (43.9%)
Treatment modality	Oral hypoglycaemic drugs	139 (77.2%)
	Insulin	7 (3.9%)
	Both	34 (18.9%)
Diabetic neuropathy (DPN)	With DPN	68 (37.2%)
	Without DPN	112 (62.2%)
Comorbidities	None	43 (23.9%)
	1 - 3	135 (75.0%)
	More than 3	2 (1.1%)

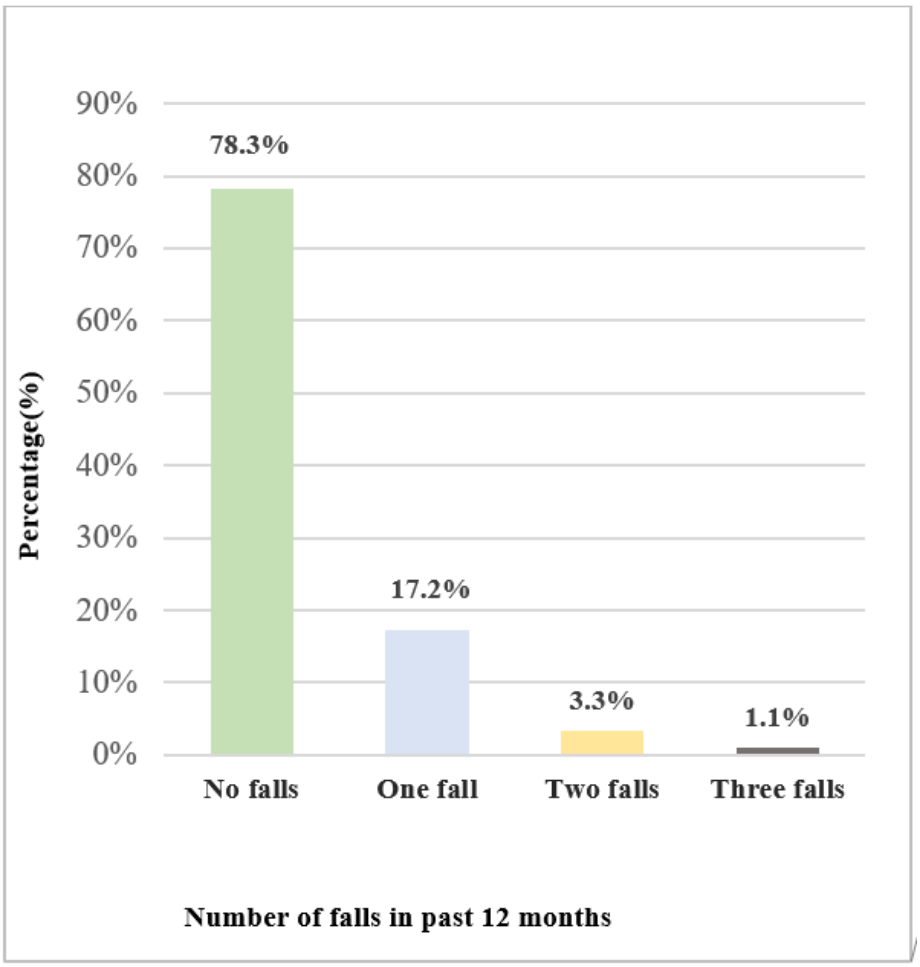

Figure 1. Prevalence of falls among older adults with T2DM

Circumstances and consequences of falls in participants with T2DM

The frequency distribution of the circumstances and consequences of falls of the last 3 falls in the previous 12 months (n=49) are presented in Table 3. Most of the falls (51.0 %, n=25) occurred in the morning, followed by evening, afternoon, and night, respectively (20.4%, 18.4%, 10.2%), and in the home (73.4%, n=36) than away from the home (26.5%, n=13). Among the falls that occurred at home, the majority were inside the home (n=23, 46.9%). Forward direction falls were the most common (51%, n=25). Slips on slippery floors were the most common cause of falls, 46.9 % (n=23) followed by trips (20.4%, n=10). Twenty-nine falls (59.2%) occurred while the participant was walking, followed by ascending and descending stairs (n=7, 14.3%).

Overall, 59.2 % (n=29) of falls resulted in injuries, which ranged from minor complaints such as feeling pain to severe injuries such as fractures. Bruises were the most common injury due to falls (n=9, 31%), followed by sprain/strain (n=7, 24.1%). Four participants (13.8%) reported fractures due to falls. The majority of falls did not require access to any health care service (71.4%, n= 35), while 71.4% (n= 10) of those who sought medical attention needed a doctor visit or emergency care visit.

Gender and age did not have any significant association with circumstances of falls of the last falls in the previous 12 months ($p>0.05$) between males and females. Adults aged 60-69 years were more likely to fall in the forward direction compared to people aged ≥ 70 years ($p=0.009$) (Table 4).

Table 2. Comparison of demographic and disease characteristics between fallers and non-fallers of T2DM

Characteristic		Fallers (n=39)	Non-fallers (n=141)	*p* value
Median (IQR)				
Age (years)		68 (65-71)	65 (62-69)	0.007[a*]
Duration of diabetes (years)		10 (7-20)	15 (10-20)	0.118[a]
Fasting blood sugar level (mg/dL)		110 (98-135)	125 (11-153)	0.061[a]
No. (%)				
Age groups	60-69	23 (59.0)	107 (75.9)	**0.037[b*]**
	≥70	16 (41.0)	34 (24.1)	
Gender	Male	12 (30.8)	57 (40.4)	0.272[b]
	Female	27 (69.2)	84 (59.6)	
Ethnicity	Sinhalese	34 (87.2)	115 (81.6)	0.330[c]
	Tamil	2 (5.1)	7 (5.0)	
	Muslim	2 (5.1)	18 (12.8)	
	Other	1 (2.6)	1 (0.7)	
Level of education	Up to Grade 5	2 (5.1)	52 (36.9)	0.115[c]
	Up to G.C.E O/L	21 (53.8.)	57 (40.4)	
	Up to G.C.E A/L	6 (15.4)	31 (22.0)	
	Higher studies	2 (5.1)	1 (0.7)	
Marital status	Married	38 (97.4)	130 (92.2)	0.225[c]
	Unmarried	0 (0)	9 (6.4)	
	Divorced/Widow	1 (2.6)	2 (1.4)	
Current employment status	Employed	5 (12.8)	35 (24.8)	0.111[b]
	Unemployed	34 (87.2)	106 (56.0)	
Family history of T2DM	With family history	22 (56.4)	79 (56.0)	0.966[b]
	Without family history	17 (43.6)	62 (44.0)	
Treatment modality	Oral hypoglycaemic drugs	31 (79.5)	108 (76.6)	0.869[c]
	Insulin	1 (2.6)	6 (4.3)	
	Both	7 (17.9)	27 (19.1)	
Diabetic neuropathy (DPN)	With DPN	17 (43.6)	51 (36.2)	0.389[b]
	Without DPN	22 (56.4)	90 (63.8)	

Data are shown as median (IQR) or N (%) and corresponding p-values

a: Based on Mann-Whitney U test result,

b: Based on Chi-Square test results

c: Based on Fishers Exact test results

**<0.05, statistically significant*

Abbreviations: N- Total number of cases, FBS- Fasting Blood Sugar level, T2DM- Type 2 Diabetes Mellitus, DPN- Diabetic Peripheral Neuropathy

Table 3. Frequency distribution of the circumstances and consequences of falls of last three falls

Characteristic		No. (%)
Time of fall (n=49)	Morning	25 (51.0)
	Afternoon	9 (18.4)
	Evening	10 (20.4)
	Night	5 (10.2)
Location of fall (n=49)	Inside home	23 (46.9)
	Outside home	13 (26.5)
	Away from home	13 (26.5)
Direction of fall (n=49)	Forward direction	25 (51.0)
	Backward direction	13 (26.5)
	The direction is not sure	11 (22.4)
Reason for fall (n=49)	Tip over something	10 (20.4)
	Slip on slippery floor	23 (46.9)
	Felt dizzy/giddy/faint	7 (14.3)
	Loss of balance	3 (6.1)
	Legs gave away	2 (4.1)
	I was distracted	2 (4.1)
	Not exactly sure the cause	2 (4.1)
Activity during fall (n=49)	Walking	29 (59.2)
	Bending	3 (6.1)
	Reaching forward/turning	3 (6.1)
	Ascending/descending stairs	7 (14.3)
	Rushing/hurrying	3 (6.1)
	Changing the position	1 (2.0)
	Other	3 (6.1)
Type of fall injury (n=29)	Pain	6 (20.7)
	Bruises	9 (31.0)
	Cuts/grazes	3 (10.3)
	Sprains/strain	7 (24.1)
	Fractures	4 (13.8)
Type of health care service taken (n=14)	Doctor visit	10 (71.4)
	Emergency care visit	3 (21.4)
	Physiotherapy visit	1 (7.1)

Table 4. Circumstances of the last fall in males and females and between age categories

Circumstances of falls	Total No. (%)	Males (n=12) No. (%)	Females (n=27) No. (%)	*p* value	60-69 (n=23) No. (%)	≥ 70 (n=16) N0. (%)	*p* value
Time of fall							
Morning	22 (56.4)	8 (66.7)	14 (51.9)	0.756 [a]	12 (52.2)	10 (62.5)	0.109 [a]
Afternoon	6 (15.4)	1 (8.3)	5 (18.5)		6 (26.1)	0 (0)	
Evening	6 (15.4)	1 (8.3)	5 (18.5)		2 (8.7)	4 (25)	
Night	5 (12.8)	2 (16.7)	3 (11.1)		3 (13)	2 (12.5)	
Location of fall							
Inside home	18 (46.2)	4 (33.3)	14 (51.9)	0.558[a]	10 (43.5)	8 (50.0)	0.768 [a]
Outside home	11 (28.2)	4 (33.3)	7 (25.9)		6 (26.1)	5 (31.2)	
Away from home	10 (25.6)	4 (33.3)	6 (22.2)		7 (30.4)	3 (18.8)	
Direction of fall							
Forward direction	20 (51.3)	8 (66.7)	12 (44.4)	0.285[a]	9 (39.1)	11 (68.1)	**0.005[a]***
Backward direction	10 (25.6)	1 (8.3)	9 (33.3)		10 (43.5)	0 (0)	
The direction is not sure	9 (23.1)	3 (25.0)	6 (22.2)		4 (17.4)	5 (31.2)	
Reason for fall							
Tip over something	9 (23.1)	3 (25.0)	6 (22.2)	0.685[a]	5 (21.5)	4 (25.0)	0.533[a]
Slip on slippery floor	17 (46.3)	4 (33.3)	13 (48.1)		11 (47.8)	6 (37.5)	
Felt dizzy/giddy/faint	5 (12.8)	2 (16.7)	3 (11.1)		1 (4.3)	4 (25.0)	
Loss of balance	3 (7.7)	1 (8.3)	2 (7.4)		2 (8.7)	1 (6.2)	
Legs gave away	1 (2.6)	1 (8.3)	0 (0)		1 (4.3)	0 (0)	
I was distracted	2 (5.1)	0 (0)	2 (7.4)		2 (8.7)	0 (0)	
Not exactly sure the cause	2 (5.1)	1 (8.3)	1 (3.7)		1 (4.3)	1 (6.2)	
Activity during fall							
Walking	24 (61.5)	8 (66.7)	16 (59.3)	0.708[a]	1 (60.9)	10 (62.5)	0.812 [a]
Bending	3 (7.7)	0 (0)	3 (11.1)		1 (4.3)	2 (12.5)	
Reaching forward/turning	2 (5.1)	0 (0)	2 (7.4)		2 (8.7)	0 (0)	
Ascending/descending stairs	5 (12.8)	2 (16.7)	3 (11.1)		3 (13.0)	2 (12.5)	
Rushing/hurrying	3 (7.7)	1 (8.3)	2 (7.4)		2 (8.7)	1 (6.2)	
Changing the position	1 (2.6)	1 (8.3)	0 (0)		0 (0)	1 (6.2)	
Other	1 (2.6)	0 (0)	1 (3.7)		1 (4.3)	0 (0)	

Data are shown as median (IQR) or N (%) and corresponding p-values

a: Based on Fishers Exact test results,

Abbreviations: N- Total number of cases

**<0.05, statistically significant difference*

Discussion

The current study assessed the prevalence, circumstances, and consequences of falls in people with T2DM treated at selected urban hospitals in the Colombo District, Sri Lanka. The prevalence of falls in our study was comparatively low to previous studies in which prevalence ranged from 31.4% to 41% (13,17,19,20). One study reported similar results where 23.3% of elderly diabetic older adults had experienced falls in the previous year (10).

The slightly lower fall prevalence in our study might be due to differences in the mean age of participants and different approaches to fall surveillance, such as retrospective vs prospective.

Current study findings confirm that older adults with T2DM have a higher tendency to experience falls, which is consistent with previous studies (6,22). Gender was not associated with falls in the study, while conclusions cannot be made as available literature findings are contradictory (8,16,22,23).

The majority of falls occurred in the morning in our study, which aligns with the findings of previous studies (24,25). Reasons can be concluded as individuals being more active in the morning, which is the time of maximum ambulatory and transferring activities. Similar to previous study findings (17,26,27), the majority of the falls occurred at home, specially inside the home. Spending most of the time at home with restricted or limited outdoor activities of elderly people might be a reason for elderly people having more falls at home. Elderly women are more likely to fall inside the home as they might have engaged in more household activities compared to males (26). However, we could not find any significant difference in the location of falls between females and males of T2DM.

Consistent with previous study findings (17,20,22,23,26,28), the majority of falls (67.3%) were caused by trips or slips. Age-related changes in gait and deterioration of muscle strength may contribute to slips and falls in the elderly (29), which could be worsened by the presence of hazards and obstacles such as carpet edges, loose rugs, and codes both inside and outside the home (16). Older adults have lower obstacle avoidance success rates, longer reaction times, larger foot clearance, and smaller toe and heel distances compared to younger individuals (30). Therefore, older adults are at a higher risk of falls due to slips and trips. Inadequate lighting, lack of awareness of hazard obstacles, and distractions can be other possible causes for falls during trips. Most of the falls in our study were recorded while walking, which is consistent with previous study findings (16,22,24).

Overall, 59.2% of falls were injurious in the current study, indicating a decline in activities of daily living due to falls. Similar to other studies (17,22,28), we also found that bruises were the most prevalent injury due to falls. A considerable percentage of fractures reported in the current study may be caused by age-related progressive loss of bone mineral density (26). More than half of the falls did not require any medical attention, which is also consistent with previous studies (17,24,28).

Despite all the measures taken to reduce potential biases, self-reported retrospective fall history assessment conducted in this study might have resulted in recall bias and underestimated the incidence of falls.

Conclusions

The findings of this study provide information on the prevalence, circumstances, and consequences of falls in older adults with T2DM in the Sri Lankan context. Falls were common among older adults with T2DM, and advancing age was significantly associated with fallers. Age-related functional limitations, impaired mobility, and balance deficit combined with environmental hazards might be contributing factors for falls and related injuries. Targeted fall prevention strategies consisting of patient education, home environmental

modifications, and evidence-based exercise programmes could reduce fall-related injuries and associated complications, particularly for older adults with T2DM.

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Author Declarations

Competing interests: The authors declare that they have no competing interests.

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