ORIGINAL RESEARCH article

Prevalence of cardiovascular risk factors in Libyan patients with type 2 diabetes mellitus, 2013-2022

Samia A. Elmiladi [1, 2] and **Elham O. Elgdhafi** [2, 3 *]

[1] National Diabetes Hospital, [2] Faculty of Medicine, University of Tripoli, [3] Department of Cardiology, Tripoli University Hospital, Tripoli, Libya
*Author to whom correspondence should be addressed

HOW TO CITE THIS
Elmiladi SA, Elgdhafi EO (2023) Prevalence of cardiovascular risk factors in Libyan patients with type 2 diabetes mellitus. Mediterr J Pharm Pharm Sci. 3 (2): 27-33. [Article number: 112]. https://doi.org/10.5281/zenodo.7877416

Abstract: Cardiovascular disease (CVD) remains the leading reason of death among patients with diabetes mellitus (DM). Individuals with DM have a two to five times greater risk of developing CVD than non-DM. Unfortunately, little data exists on Libya's prevalence and characteristics of cardiovascular risk factors. This study aimed to evaluate the cardiovascular risk factors and assess their control among patients with type 2 DM (T2DM). All the patients with T2DM who attended the outpatient clinic at the National Diabetes Hospital from September 2013 to April 2022 were interviewed and examined and included in this study. Demographical data age, smoking habit, body mass index measure, drug intake, history of previous cardiovascular events, blood pressure and fasting lipid profile were all recorded. 1049 patients have completed the study with a mean age of 54.06±14.5 years old (females represented 68.0% of the studied sample size), there were different durations of diabetes between the studied sample, varying from newly diagnosed patients (n=265, 25.2%) and above ten years of diabetes duration patients (n=488, 46.5%). Active smoking in 129 patients (12.3%), the bodyweight of studied patients ranged from 44.0 Kg to 186 Kg (85.65±1.73), 820 of the patients had uncontrolled body weight (78.85%). Uncontrolled blood pressure, even with treatment, was found in 304 patients (29.0%), uncontrolled dyslipidaemia in 45 patients (04.3%), and uncontrolled hyperglycaemia in 816 patients (77.9%). Established CVD was positive in 295 patients (28.2%), maximum age group was 54-74 years (n=516, 49.3%). The most typical age group with multiple (more than three) CVD risk factors was 54-74 years of age, were female patients with more than ten years of history of diabetes, uncontrolled hyperglycemia (HBA1c >10%), uncontrolled body weight, uncontrolled blood pressure and dyslipidemia. Thus, the present data indicated that Libyan patients with diabetes mellitus have high CVD risk factors. Even in patients with previous events, these uncontrolled risk factors elevate the likelihood of repeated cardiovascular events. Patients with diabetes mellitus necessitate a more aggressive approach to control the modified risk factors such as hypertension, dyslipidemia, obesity and smoking.

Introduction

Cardiovascular diseases (CVD) are ischemic heart disease, cerebrovascular disease, peripheral arterial disease, heart failure, cardiac arrhythmia and hypertensive heart disease. CVD remains the most important reason for death amongst patients with type 2 diabetes (T2DM), where they have 2 - 4 folds augmented risk for CVD [1, 2]. Also, it is responsible for 80.0% of the mortality in DM [3]. DM as coronary artery disease (CAD) risk equivalent, showed that the risk of coronary artery disease CAD death for patients with DM without prior myocardial infarction (MI) was comparable with that of their non-diabetic counterparts who had a history of MI [4]. A recent meta-analysis article with 13 cohort studies established that patients with DM have a 43.0% lower risk for potential hard CAD events compared to those with previous MI suggesting that at least some subgroups in patients with Dm have much less risk than they believed before [5]. Patients with DM have a reduction in life expectancy of about 4-8 years compared with an individual without diabetes [6], and cardiovascular risk factors are considered a clinical marker of macro- and micro-vascular DM complications [7]. Although straightforward advances in cardiovascular therapy and prevention significantly reduce diabetes-related coronary mortality in developed countries [8], cardiovascular morbidity remains high in most patients with DM. Considering the increasing number of cardiovascular event survivors and the global epidemic of T2DM, the number of patients with T2DM at a higher cardiovascular risk is expected to rise, posing a tremendous challenge for healthcare systems worldwide. Therefore, cost-effective urgent policies for reducing cardiovascular risk in this population are required [9]. Due to all those mentioned above and the increased incidence of DM among Libyan citizens and to the best of our knowledge, no previous studies have been reported with ten years of duration data, therefore, we conducted this study to assess the cardiovascular risk factors in patients with type 2 diabetic mellitus in Libya.

Materials and methods

This is an observational study: all the patients who attended the outpatient clinic at the National Diabetes Centre, Tripoli, Libya from September 2013 to April 2022 were included in this study. All the demographic data (including age, gender and smoking habit), the duration of diabetes, and history of previous cardiovascular events such as previous coronary artery diseases, heart failure episodes and cerebrovascular accidents were taken. In addition, other parameters were: the measurement of body weight and height for calculating body mass index (BMI), blood pressure measurement and testing for fasting lipid profile with an assessment of diabetes control by HBA1c measures. Ethical approval was obtained from the Bioethics Committee at the Biotechnology Research Center (BEC-BTRC-22-2022) to carry out this research.

Statistical analysis: continuous variables are expressed in mean ± standard deviation and they are presented using descriptive statistics. A cross-tabulation and Chi-square test to calculate Pearson Chi-square. The level of p-value of 95% confidence intervals (95% CI) with a $p < 0.05$ was considered significant. All the calculations were performed with STATA version 11 (StataCorp LLC, College Station, Texas, USA).

Results

In **Table 1**, a total of 1,297 diabetic patients were enrolled in this study and 1049 patients completed the study with a response rate of 80.9%. Their mean age was 54.06±14.5 years and females represented 68.0% of the studied sample. 516 patients were in the age group between 54-74 years (49.2%). There is a wide difference in duration of diabetes among the studied sample, varying from newly discovered in 265 patients (25.2%), duration of two to five years in 142 patients (13.5%), duration of five to ten years in 154 patients (14.6%) and more than ten years

of diabetes duration found in 488 patients (46.5%). 129 male patients with active smoking (38.4% of the total males, n=336) and 12.29% of the total number of our patients were active smokers. The body weight of the studied patients ranged from 44 Kg to 186 Kg (85.65 ± 1.73). Body mass index (BMI) was calculated for each patient as follows: the underweight range was present in 1.63 % of the patients, normal BMI in 19.5%, overweight was in 24.9%, obesity was in 25.3%, and morbid obesity was found in 27.9% of the sampled patients, thus, 820 of the patients have uncontrolled body weight (78.16%). Uncontrolled blood pressure, even with treatment found in 304 patients (29.0%), uncontrolled dyslipidaemia was present in 45 patients (4.3%), and uncontrolled hyperglycaemia was present in 816 patients (77.8%). In **Table 2**, the established cardiovascular disease was positive in 295 patients (28.2%). The most typical age group with multiple CVD risk factors (more than three risk factors), i.e., female gender, more than ten years of a history of diabetes, uncontrolled hyperglycemia (HBA1c >10.0%), uncontrolled bodyweight, uncontrolled blood pressure and dyslipidemia was 54 -74 years (**Table 2**).

Table 1: Distribution of cardiovascular risk factors in Libyan patients with diabetes mellitus

Variables	Age ≤ 32	33 - 53	54 - 74	≥ 75	Total	P value
Gender						
Female	29	244	337	73	713	
Male	15	132	182	37	336	**0.188**
Total	**44**	**376**	**519**	**110**	**1049**	
Duration of DM						
Newly diagnosed	17	140	98	10	265	
2 - 5 years	13	60	57	12	142	
5 - 10 years	08	66	67	13	154	**0.001**
> 10 years	06	110	297	75	488	
Total	**44**	**376**	**519**	**110**	**1049**	
HBA1c						
< 6%	02	40	35	07	84	
6.5 - 7%	06	56	76	11	149	**0.07**
8 - 9%	15	159	217	60	451	
> 10%	22	121	190	32	365	
Total	**45**	**376**	**518**	**110**	**1049**	
Smoking						
No	27	267	384	71	749	
Ex-smoker	01	08	67	21	97	**0.01**
Passive	02	26	36	10	74	
Active	17	75	30	07	129	
Total	**47**	**376**	**517**	**109**	**1049**	
Body mass index						
Underweight	15	05	04	02	26	
Normal	10	80	93	20	203	
Overweight	10	84	132	36	262	**0.01**
Obese	08	96	135	26	265	
Morbid obese	09	110	151	23	293	
Total	**52**	**375**	**515**	**107**	**1049**	
Blood pressure						
Normal	35	156	108	23	322	
Controlled with treatment	11	116	240	56	423	**0.01**
Uncontrolled	4	100	170	30	304	
Total	**50**	**372**	**518**	**109**	**1049**	
Fasting lipid						
Normal	36	77	24	02	139	**0.001**
Controlled with treatment	10	285	467	103	865	
Uncontrolled	0	14	27	04	45	
Total	**46**	**376**	**518**	**109**	**1049**	

Table 2: Risk factors in patients with diabetes according to the presence of cardiovascular disease

Variables	Established CVD	Frequency	Total	P- value Chi-Square test
Age				
≤ 32	01	47	48	
33 - 53	53	323	376	
54 - 74	184	332	516	**0.001**
≥ 75	56	53	109	
Total	**294**	**755**	**1049**	
Smoking				
No	214	529	743	
Ex-smoker	40	63	103	
passive	20	54	74	**0.104**
active	25	104	129	
Total	**299**	**750**	**1049**	
Gender				
Female	189	496	685	
Male	109	255	364	**0.36**
Total	**298**	**751**	**1049**	
Duration of DM				
Newly	44	220	264	
2-5 years	28	115	143	
5-10 years	37	117	154	**0.001**
>10years	190	298	488	
Total	**299**	**750**	**1049**	
HBA1c				
< 6	17	69	86	
6.5 - 7	35	113	148	**0.002**
8 - 9	120	330	450	
≥ 10	127	238	465	
Total	**295**	**750**	**1049**	
Blood pressure				
Normal	32	290	322	
Controlled	166	257	423	**0.001**
Uncontrolled even with drugs	98	206	304	
Total	**296**	**753**	**1049**	
Dyslipidemia				
Normal	07	136	143	
Controlled	275	586	861	**0.001**
Uncontrolled even with drugs	17	28	45	
Total	**299**	**750**	**1049**	
Body mass index				
Underweight	14	12	26	
Normal	48	155	203	
Overweight	71	190	261	**0.293**
Obese	86	179	265	
Morbid obesity	83	211	294	
Total	**302**	**747**	**1049**	

Discussion

The principle that prevention is better than cure, it was necessary to conduct this study on Libyan patients with DM to reduce the complications. So, we evaluated the prevalence of CVS risk factors among T2DM in Tripoli between 2013 and 2022. The CVD risk factors can be modified or changed such as stress, systemic arterial hypertension, obesity, smoking, dyslipidemia and DM, or non-modified factors such as age, gender and genetics.

Many studies demonstrated that the relative risk of incident coronary artery disease is more remarkable in diabetic females than in diabetic males [10, 11] and that was found in a current study where female patients had more CV risk factors than male patients (uncontrolled hypertension, uncontrolled BMI, uncontrolled HbA1c and more than 10 years of duration of DM). However, it was the opposite of what was observed by Hussein and his colleagues [12], where 75.0% of the patients who had more CV risk factors were male. Cigarette smoking is strongly associated with an increased risk of CAD among patients with T2DM [13], thus, it is found in our study that 12.3% of the patients are active smokers and this is because the majority of the patients are females and active smoking is socially unacceptable among the females in Libyan community. This is much lower than what was observed previously that 42.5% of their patients are smokers [12]. Blood pressure is well-known to be a strong CVD risk factor, as mentioned in several studies like the UKPDS trial, which showed that tight blood pressure control decreases 44.0% stroke risk, 37.0% in microvascular endpoints and 34.0% reduction in risk in the proportion of patients with deterioration of retinopathy [14]. Systolic and diastolic blood pressure were significantly associated with myocardial infarction, stroke, coronary artery bypass, angioplasty and cardiovascular death [15]. 29.0% of our patients had uncontrolled hypertension even with treatment and this ratio is lower than that observed previously [16] where 53.0% did not meet the target values for systolic blood pressure, however, another study reported that 88.0% of the patients have uncontrolled blood pressure measurements [17].

Dyslipidemia is well known to increase CV morbidity and mortality and it is a more frequent finding with DM [18]. The risk of developing CVD increases two-fold when dyslipidemia [19], unexpectedly, it is found in our study that dyslipidemia occurs in 4.3% of the patients with an unknown explanation which could be of the Mediterranean diet or to the regular strictness of the patients to lipid-lowering drugs. Indeed, more studies to explain these observational findings are needed. Our findings were much less compared with other studies where 60.8% of their patients had dyslipidemia [12], others found 28.0% of the patients [16], 55.0% of the patients [20], 44.5% of the patients [21] and 40.0% of the patients had dyslipidemia [22]. However, some of our patients were on lipid-lowering drugs and others were on anti-hypertensive drugs. For every one percent increase in HbA1c concentration, there was 38.0% higher risk of the macrovascular event, 40.0% higher risk of microvascular event and 38.0% higher risk of death [23]. In the current study, 87.5% of the patients had HbA1c more than seven, which was higher than that of Afandi and others [16] where 59.0% of the patients, 77.0% of their patients [12] and 81.0% of another study [17] had HbA1c more than 7. Although excessive body weight is linked with morbidity and mortality in patients with T2DM, the control of this variable in diabetic populations has rarely been emphasized in most studies [24]. Currently, 78.2% of the patients were uncontrolled body weight and 24.9% of the patients were overweight, 25.3% were obese and 27.9% were morbidly obese. This result is lower than that observed by Hussein et al. [12] where 33.3% were obese and 31.8% of the patients were overweight. Bawadya et al. [25] found that 55.0% of the patients were obese and Alhazmi et al. [26] reported that 85.7% of the patients were obese. As a well-known fact, the previous history of CVD carries a much higher risk of recurrent CVD events or death [27]. Nearly, a third of our patients had an established CVS (28.2%). Our finding was lower than the finding by Hussein and others [12] where 55.8% of the patients had an established CVD.

Conclusion: A significant percentage of Libyan patients with type 2 diabetes mellitus have profound CVD risk factors. Even in patients with previous events, uncontrolled risk factors elevate the likelihood of repeated cardiovascular events. Patients with diabetes mellitus necessitate a more aggressive approach to control modified risk factors such as hypertension, dyslipidemias, obesity and smoking.

References

1. Preis SR, Hwang SJ, Coady S, Pencina MJ, D'Agostino Sr RB, Savage PJ, Levy PJ, Fox CS (2009) Trends in all-cause and cardiovascular disease mortality among women and men with and without diabetes mellitus in the Framingham Heart Study, 1950 to 2005. Circulation. 119 (13): 728-1735. doi: 10.1161/CIRCULATIONAHA. 108.829176

2. Gregg EW, Cheng YJ, Saydah S, Cowie C, Garfield S, Geiss L, Barker L (2012) Trends in death rates among US adults with and without diabetes between 1997 and 2006: findings from the National Health Interview Survey. Diabetes Care. 35 (6): 1252-1257. doi: 10.2337/dc11-1162

3. Morrish NJ, Wang SL, Stevens LK, Fuller JH, Keen H (2001) Mortality and causes of death in the WHO multinational study of vascular disease in diabetes. Diabetologia. 44 (Suppl. 2): S14-S21. doi: 10.1007/pl00002934

4. Haffner SM, Lehto S, Rönnemaa T, Pyörälä K, Laakso M (1998) Mortality from coronary heart disease in subjects with type 2 diabetes and non-diabetic subjects with and without prior myocardial infarction. The New England Journal of Medicine. 339 (4): 229-234. doi: 10.1056/NEJM199807233390404

5. Bulugahapitiya U, Siyambalapitiya S, Sithole J, Idris I (2009) Is diabetes a coronary risk equivalent? Systematic review and meta-analysis. Diabetic Medicine. 26 (2): 142-148. doi: 10.1111/j.1464-5491. 2008.02640.x

6. Gu K, Cowie CC, Harris MI (1998) Mortality in adults with and without diabetes in a national cohort of the US population, 1971-1993. Diabetes Care. 21 (7): 1138-1145. doi: 10.2337/diacare.21.7.1138

7. Bonadonna RC, Cucinotta D, Fedele D, Riccardi G, Tiengo A (2006) The metabolic syndrome is a risk indicator of microvascular and macrovascular complications in diabetes: results from meta screen, a multicenter diabetes clinic-based survey. Diabetes Care. 29 (12): 2701-2707. doi: 10.2337/dc06-0942

8. NCD Management-Screening, Diagnosis and Treatment (2016) Global report on diabetes. World Health Organization. 83. ISBN: 9789241565257.

9. Gregg EW, Zhuo X, Cheng YJ, Albright AL, Narayan KM, Thompson TJ (2014) Trends in lifetime risk and years of life lost due to diabetes in the USA, 1985-2011: a modeling study. Lancet Diabetes Endocrinology. 2 (11): 867-874. doi: 10.1016/S2213-8587(14)70161-5

10. Peters SAE, Huxley RR, Woodward M (2014) Diabetes as a risk factor for incident coronary heart disease in women compared with men: a systematic review and meta-analysis of 64 cohorts including 858,507 individuals and 28,203 coronary events. Diabetologia. 57 (8): 1542-1551. doi: 10.1007/s00125-014-3260-6

11. Lee WL, Cheung AM, Cape D, Zinman B (2000) Impact of diabetes on coronary artery disease in women and men: a meta-analysis of prospective studies. Diabetes Care. 23 (7): 962-968. doi: 10.2337/diacare.23.7.962

12. Hussein A, Mahmoud SED, Awad MS (2020) Assessment of cardiovascular risk factors in patients with type 2 diabetes in Upper Egypt Villages. Diabetes, Metabolic Syndrome and Obesity. 13: 4737-4746. doi: Nil.

13. Al-Delaimy WK, Manson JE, Solomon CG, Kawachi I, Stampfer MJ, Willett WC, Hu FB (2002) Smoking and risk of coronary heart disease among women with type 2 diabetes mellitus. Archives of Internal Medicine. 162 (3): 273-279. doi: 10.1001/archinte.162.3.273

14. King P, Peacock I, Donnelly R (1999) The UK Prospective Diabetes Study (UKPDS): clinical and therapeutic implications for type 2 diabetes. British Journal of Clinical Pharmacology. 48 (5): 643-648. doi: 10.1046/j.1365-2125.1999.00092.x

15. Glynn RJ, L'Italien GJ, Sesso HD, Jackson EA, Buring JE (2002) Development of predictive models for long-term cardiovascular risk associated with systolic and diastolic blood pressure. Hypertension. 39 (1): 105-110. doi: 10.1161/hy1201.097199

16. Afandi B, Ahmad S, Saadi H, Elkhumaidi S, Karkoukli MA, Kelly B, Assaf H, Matear D (2006) Audit of a diabetes clinic at Tawam Hospital, United Arab Emirates, 2004-2005. Annals of the New York Academy Sciences. 1084 (1): 319-324. doi. 10.1196/annals.1372.017

17. Al Slail FY, Abid O, Assiri AM, Memish ZA, Ali MK (2016) Cardiovascular risk profiles of adults with type-2 diabetes treated at urban hospitals in Riyadh, Saudi Arabia. Journal of Epidemiology and Global Health. 6 (1): 29-36. doi: 10.1016/j.jegh.2015.07.004

18. American Diabetes Association (2004) Standards of medical care in diabetes. Diabetes Care. 27 (Suppl 1): e15-e35. doi.org/10.2337/diacare.27.2007.S15

19. Gebreegziabiher G, Belachew T, Mehari K, Tamir D (2021) Prevalence of dyslipidemia and associated risk factors among adult residents of Mekelle City, Northern Ethiopia. PLoS One. 16 (2): e0243103. doi: 10.1371/journal.pone.0243103

20. Hirbli KI, Jambeine MA, Slim HB, Barakat WM, Habis RJ, Francis ZM (2005) Prevalence of diabetes in greater Beirut. Diabetes Care. 28 (5): 1262. doi: 10.2337/diacare.28.5.1262

21. Kharal M, Al-Hajjaj A, Al-Ammri M, Mardawi G, Tamim HM, Bin Salih S, Yousuf M (2010) Meeting the American Diabetic Association standards of diabetic care. Saudi Journal of Kidney Diseases and Transplantation. 21 (4): 678-685. doi: Nil.

22. Bryant W, Greenfield JR, Chisholm DJ, Campbell LV (2006) Diabetes guidelines: easier to preach than to practice? Medical Journal of Australia. 185 (6): 305-309. doi: 10.5694/j.1326-5377.2006.tb00583.x

23. Khaw KT, Wareham N, Bingham S, Luben R, Welch A, Day N (2004) Association of hemoglobin A1c with cardiovascular disease and mortality in adults: The European prospective investigation into cancer in Norfolk. Annals of Internal Medicine. 141 (6): 413-420. doi: 10.7326/0003-4819-141-6-200409210-00006

24. Rodriguez BL, Lau N, Burchfiel CM, Abbott RD, Sharp DS, Curb JD (1999) Glucose intolerance and 23-year risk of coronary heart disease and total mortality: The Honolulu Heart Program. Diabetes Care. 22: 1262-1265.

25. Bawady N, Aldafrawyb O, ElZobair EM, Suliman W, Alzaabi A, Ahmed SH (2022) Prevalence of overweight and obesity in type 2 diabetic patients visiting PHC in the Dubai Health Authority. Dubai Diabetes and Endocrinology Journal. 28: 20-24. doi. 10.1159/000519444

26. Alhazmi RS, Ahmed AAB, Alshalan MH, Alfuhigi ZD, Alhazmi SF, Aldughmi AN, Alshammari NN, Alruwaili AE, Alenezi GS, Alanazi TS, Shouq Amjad Almadani SA (2017) Prevalence of diabetes mellitus and its relation with obesity in Turaif (Saudi Arabia) in 2017. Electronic Physician. 9 (10): 5531-5535. doi: 10.19082/5531

27. Lin FJ, Tseng WK, Yin WH, Yeh H-I, Chen J-W, Wu C-C (2017) Residual risk factors to predict major adverse cardiovascular events in atherosclerotic cardiovascular disease patients with and without diabetes mellitus. Scientific Reports. 7 (1): 9179. doi: 10.1038/s41598-017-08741-0