

Original Research Article

Diabetes Mellitus and Cerebrovascular accident among North African population (Libya) Community based survey

LIST OF TABLES

Table 1: showing **CHADS2** score Questionnaire used in the study

Table 2: showing **CSRC** score used in the study

Table 3 : showing DM age structure and sex

Table 4: showing **CHADS2** score among DM patients

Table 5: showing **CSRC** score among DM patient

LIST OF FIGURES

Fig 1: Showing DM age/sex structure

Fig 2: Showing **CHADS2** score among DM patients

Fig 3: Showing **CSRC** score among DM patients

ABBREVIATIONS:

AF: Atrial Fibrillation

HT: Hypertension

DM : Diabetes Mellitus

CHF: Congestive Heart Failure

TIA: Transient Ischemic attack

PS: Prior Stroke

WHO: World Health Organization

CDC: Centers of Disease Control

CSRC: Community Stroke Risk Classification

RF: Risk Factor

RP: Risk Points

ABSTRACT

Diabetes mellitus (DM) is a very common medical disorder and a major health problem in North Africa including Libya. DM is associated with an increase in the risk of stroke and hospitalization.

Objectives:

To estimate the importance of DM as a stroke risk factor among people living in Libyan community.

Methodology:

The study was community based descriptive cross-sectional study used **CHADS2** Questionnaire, as well a local Libyan classification of stroke risk factors called **Community Stroke Risk Classification (CSRC)**.

Area; North Africa (North of Libya, the capital Tripoli).

Time; For five years from 2010-2014

Population: Sampling was done from a large cohort of individuals living in the community. **7497** individuals were screened looking for risk factors of stroke. DM was one of the factors which was studied in details among those population and was diagnosed by detailed histories (including taking treatment or on diet for DM), medical examinations and previous hospital confirmation.

Results:

The prevalence of DM among our participants (**7497** individuals) was **39% (2908 patients)**, among males and females was 54.1% and 45.9% respectively ($P = 0.0001$). Among different age groups, males have higher rates compared to females except in very young (10-19) and very old (>80) where females dominated. The male to female ratio among total population screened was 21% : 17.8% (1573:1335 respectively).

DM prevalence increased with the increase of age, with higher rates among age groups over 40 ($P < 0.0001$).

53% of DM patients had hypertension (1538 patients), 21.3% had Congestive Heart Failure (CHF) (618 patients), 13% had Atrial Fibrillation (AF) (382 patients), 22% had Transient Ischemic Attack (TIA) (643 patients), 12.3% had Prior stroke (PS) (359 patients), All those risk factors accompanying DM increased with age increase ($P < 0.0001$).

99.93% of DM patients had risk points of stroke on **CHADS2** score (**0.07%** had no risk points), from that **60%** had intermediate score (1-2 Risk Points) and **40%** had high score (≥ 3 risk points).

Results of **CSRC** score showed that **99.93%** had risk factors of stroke (**0.07%** had no risk factors), from that **62.7%** had intermediate score (1-2 Risk Factors) and **37.3%** had high score (≥ 3 risk factors).

Conclusion:

DM is a major risk factor of stroke among Libyan population in North Africa and had very high risk score in **CHADS2** which mainly concentrated in **1-6** risk points ($P < 0.0001$). Almost all DM patients had risk factors of stroke on **CSRC** score which concentrated in intermediate and high scores. **CHADS2 & CSRC**

classification scores are very useful and simple tools to be used to Classify and describe the risk factors of stroke in community population having DM or not.

Key words: *DM, Stroke, Prevalence, Risk factors, Risk points, classification, community, CHADS2, CSRC, Africa, Libya.*

1. INTRODUCTION:

Diabetes mellitus (DM) is characterized by chronic hyperglycemia with disturbances in carbohydrate, lipid and protein metabolism [1]. The worldwide prevalence of DM for all age groups is set to increase from 2.8% in 2000 to 4.4% in 2030 [2].

Diabetes mellitus occurs throughout the world, but is more common (especially type 2) in more developed countries. The greatest increase in rates was expected to occur in Asia and Africa, where most people with diabetes will probably live in 2030 [2]. The increase in rates in developing countries follows the trend of urbanization and lifestyle changes, including a "Western-style" diet. This has suggested an environmental (i.e., dietary) effect, but there is little understanding of the mechanisms at present [2].

As at 2013, 382 million people have diabetes worldwide [3]. Type 2 makes up about 90% of the cases [3,4]. This is equal to 8.3% of the adult population [3] with equal rates in both women and men [4].

In 2014, the International Diabetes Federation (IDF) estimated that diabetes resulted in 4.9 million deaths [5]. The World Health Organization (WHO) estimated that diabetes resulted in 1.5 million deaths in 2012, making it the 8th leading cause of death [6]. The discrepancy between the two estimates is due to the fact that cardiovascular diseases are often the cause of death for individuals with diabetes; the IDF uses modeling to estimate the amount of deaths that could be attributed to diabetes [7]. More than 80% of diabetic deaths occur in low and middle-income countries [8].

Uncontrolled DM may result in several dangerous complications involving most body organs including retinopathy, nephropathy, neuropathy and cardiovascular diseases [9]. Diabetes is now among the leading causes of death due to diseases in most countries of the world [10]. Therefore DM is a growing public health problem all over the world. Epidemiological studies about DM have encouraged governments to initiate or improve local diabetes monitoring and prevention strategies

Diabetes is a major risk factor for stroke [11]. Patient with diabetes are at 2 to 3 times the risk of stroke compared with the general population [11]. In Libya DM is common among the population, according to the Libyan research institute report 2001, Diabetes affects 7.9% of the Libyan people [12]. The number of diabetic patient increases over the time, which reaches 23.7% in report by CDC-WHO- 2009 [13].

This study was done in Libya to find the roll of DM as one of the most important risk factors associated with cerebrovascular accidents among population living in a community.

2. OBJECTIVES

To estimate the roll of DM as a major risk factor of stroke among people living in a community using both CHADS2 Score and the Community Stroke Risk Classification (CSRC) score.

3. METHODOLOGY

Study was a community based descriptive, cross-sectional study.

3.1 Populations: Individuals who are 16 years old or above.

3.2 Population sample: Sampling was done from a large cohort of individuals living in a community. 7497 individuals were screened by Shambesh et al, 2015 [14]. looking for risk factors of stroke.

3.3 Area: North Africa, Mediterranean area of Libya (Tripoli the capital).

3.4 Time: Five years from 2010-2015

3.5 Method of survey:

3.5.1 Using CHADS2 Questionnaire

Individuals were interviewed using CHADS2 Score questionnaire which is usually used to assess stroke risk in patients with atrial fibrillation [15], and was also adapted in this study to be used among a population without AF as it had been used in other studies elsewhere [16]. As well a local Libyan classification of stroke risk factors was used (called Community Stroke Risk Classification-CSRC which was created to be used for the first time in Libya by Shambesh et al, 2015. [14]. CHADS2 score is derived from the sum of point values of individual stroke risk factors {congestive heart failure (CHF), hypertension (HT), age ≥ 70 , diabetes (DM) (1 point each), and prior stroke or transient ischemic attack (2 points) (Table.1). The CHADS2 scoring table which, shown below, adds together the points that correspond to the condition, representing the result in a CHADS2 score which is used to estimate stroke risk as follows:

121

Score Zero points = No risk = Low Risk Score

Score 1 & 2 points = Intermediate Risk Score

Score ≥ 3 points = High Risk Score

- **Table 1:** showing CHADS2 score Questionnaire used in the study

Condition	points
C: Congestive heart failure	1
H: Hypertension	1
A: Age ≥ 70	1

D: DM	1
S: Prior Stroke or TIA	2

3.5.2 Community Stroke Risk Classification-CSRC

This classification depends on a calculation on a number of risk factors (RF), each risk factor used in the study (age ≥ 70 , DM, Hypertension, CHF, TIA and prior stroke) was given a value (number) for each condition among each individual who participated. The score is a result of summation of those risk factors as shown in Table.2

- **Table 2:** showing CSRC score used in the study

<u>Level</u>	<u>Score</u>	<u>NO. of Risks</u>
Low risk score	score of zero	No risk factors
Intermediate risk score-1	score of one	One risk factor
Intermediate risk score-2	score of two	Two risk factors
High risk with a score 3. <u>Subdivided to:</u>		
High risk score-3	score three	Three risk factors
High risk score-4	score four	Four risk factors
High risk score-5	score five	Five risk factors
High risk score-6	score six	Six risk factors

3.6 Field survey

Doctors working in the community and family medicine department were trained by professionals to collect data using CHADS2 questionnaires and CSRC scores by interviewing individuals, by taking a detailed history (present, past, medical, hospital admission), checking of any available investigations, discharge letters and medical reports and doing medical examinations. Known cases of DM, hypertension, CHF, AF, TIA and prior strokes had been established by previous medical diagnoses by hospital specialists. DM was diagnosed by histories (taking treatment or on diet for DM), medical examinations and previous hospital confirmation.

3.7 Statistical analysis

This step was done by statisticians who scored the CHADS2 and CSRC grades by statistical package of social sciences (SPSS) version 19- USA. Data was calculated and described by using mean, mode, standard

deviation, cross tabulations and graphical presentations. T student tests for independent samples of numerical data were used with Chi-square analysis for categorized data.

4. RESULTS

4.1 Diabetes Mellitus (DM) prevalence:

The prevalence of DM among our participants (7497 individuals) in study done by Shambesh et al, 2015 [14], 39% (2908 patients), among males and females was 54.1% and 45.9% respectively ($P = 0.0001$). Among different age groups, males have higher rates compared to females except in very young (10-19) and very old (>80). as shown in Table 3 & Fig. 1.

Males were higher than females among total population screened (21%:17.8%, 1573:1335 respectively).

DM prevalence increased with the increase of age, with higher rates among age groups over 40 ($P < 0.0001$). Fig. 1.

Table 3: showing DM age/sex structure

Sex	10-19	20-29	30-39	40-49	50-59	60-69	70-79	>80	Total
male	10	77	102	219	332	368	334	131	1573
Female	10	62	67	186	325	297	253	135	1335

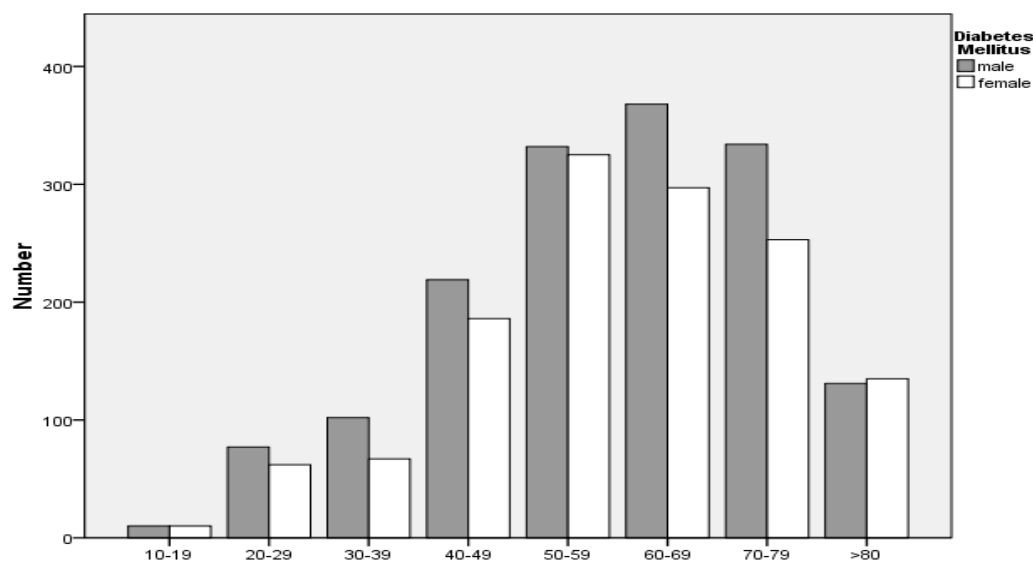


Fig. 1: showing DM age/sex structure

4.2 DM and Hypertension

53% of DM patients had hypertension (1538 patients), with 51% males and 49% females and DM increased among them by age increase ($P<0.0001$).

4.3 DM and Congestive heart failure (CHF)

21.3% of DM patients had CHF (618 patients), males showed slight raise (50.6%) compared to females (49.4%), and CHF increased among them by age increase ($P<0.0001$).

4.4 DM and Atrial Fibrillation (AF)

13% of DM patients had AF (382 patients), males showed significant raise (54.7%) compared to females (45.3%) in all age groups and AF increased among them by age increase ($P<0.0001$).

4.5 DM and Transient ischemic attack (TIA)

22% of DM patients had TIA (643 patients), males showed significant raise (59.3%) compared to females (40.7%) ($P<0.0001$), and TIA increase among them by age increase ($P<0.0001$).

4.6 DM and Prior stroke (PS) (embolic or hemorrhagic):

12.3% of DM patients had PS (359 patients), males showed significant raise (53.8%) compared to females (46.2%) ($P<0.0001$), and PS increased among them by age increase ($P<0.0001$).

4.7 DM and CHADS2 score

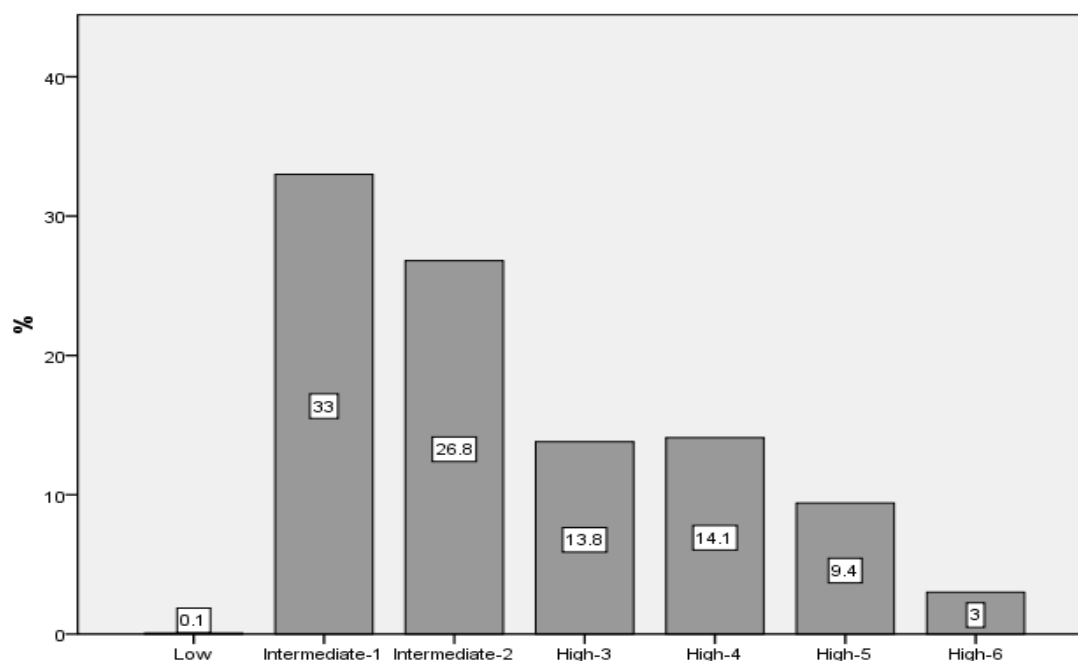
CHADS2 score works with points, higher the points (P) higher the risk (R) score for stroke. DM patients showed that **99.93%** had risk points of stroke (**0.07%** had no risk points), from that **60%** had intermediate score (1-2 Risk Points) and **40%** had high score (≥ 3 Risk Points). (**Table 4 & Fig. 2**).

These results found that DM group had very high risk scores in **CHADS2** which concentrated in intermediate and high scores (1-6 risk points) ($P<0.0001$).

Table 4: showing CNADS2 score among DM patients

Score	No.	%
Low	2	0.07
Intermediate-1	595	33

Intermediate-2	779	26.8
High-3	401	13.8
High-4	409	14
High-5	272	9.4
High-6	86	3



184

185 **Fig. 2: Showing CHADS2 score among DM patients**

186

187 **4.8 DM and Community Stroke Risk Classification score (CSRC)**

188 CSRC works with number of **risk factors (RF)**, higher the number of risk factors higher the stroke risk.
 189 DM patients showed that **99.9%** had risk factors of stroke (**0.07%** had no risk factors), from that **62.7%**
 190 had intermediate score (1-2 Risk Factor) and **37.3%** had high scores (≥ 3 Risk Factors). (**Table 5 & Fig. 3**).

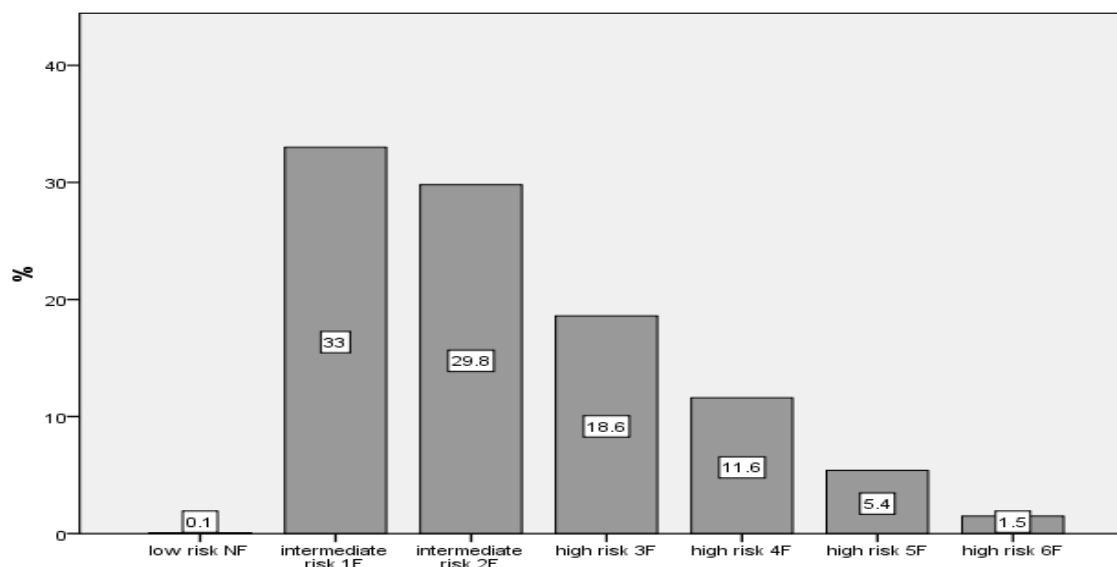
191 This result founds almost of all DM patients had risk factors of stroke and concentrated in intermediate and
 192 high scores (1-6 risk points, ($P < 0.0001$)).

193 **Table 5: showing CSRC score among DM patients**

Score	No.	%
low risk NF	2	0
intermediate risk 1F	958	33

intermediate risk 2F	866	30
high risk 3F	541	19
high risk 4F	338	12
high risk 5F	158	5
high risk 6F	45	2

194



195

196

197 **Fig. 3: showing CSRC score among DM patients**

198

199

200

201

202

203 **5. Discussion**

204 Hypertension, ischemic heart disease, diabetes mellitus, smoking and hypercholesterolemia are well-known risk factors for stroke. Oxfordshire community stroke project study in United Kingdom showed that risk factors for cerebral infarction were present in 80% of cases, hypertension in 52%, ischemic heart disease in 38%, peripheral vascular disease in 25%; cardiac lesions were a major potential source of emboli to the brain in 20% and diabetes mellitus in 10% [17]. Our study results also confirmed such reports that DM is a major risk factor for stroke but the stroke prevalence in Libya among Diabetic patients (12.3%) was more than in United Kingdom, and this may be explained that the increase in rates of DM in the developing countries in Africa like Libya follows the trend of urbanization and lifestyle changes, including a "Western-style" diet [2].

212

213 Several articles reported stroke incidence in Arab and North African countries: Kuwait, Saudi Arabia, Qatar, Libya and Bahrain. The incidence varied from the lowest of 27.5 per 100,000 population per year in Kuwait to highest of 63 per 100,000 population in Libya. The most frequent stroke type is ischemic. Stroke increased with age affecting old patients, males were more affected than females. Hypertension was the

216

most frequent risk factor, followed with DM, hyperlipidemia, cardiac diseases and cigarettes smoking [18]. Our study results confirm all this stroke results reviewed in the previous Arab countries studies summary specially that DM is a leading factor. This shows that Arab countries constitute populations with a similar lifestyle and diet that may influence DM risk and stroke risk, type and survival after stroke [18,19].

This study confirmed that DM is second to hypertension as the most frequent risk factor of stroke among Libyans and this was also found in other studies in Arab countries [18].

Risk factors of stroke in Libya are multiple and complex, Libyan population surveys done in 2001, showed obesity prevalence of 32.7%, only 18% of study population were performing exercise and 45% were smokers with male of 99.3% [12]. Survey done on 2009 showed that only 12.4% of population study having daily healthy diet, only 22.6% of population having daily exercise, 63.5% were obese, 20% having high cholesterol and 25% were smokers [13]. These reports in Libya showed that such risk factors may play roll in the increase of DM prevalence and hence accelerated cerebrovascular accidents rates among Libyan population

DM prevalence in this study showed unexpected high rate of 39% among total population with male predominance, where in previous study in Tripoli in localized small area in Tagora community showed prevalence of 7.9 in 2001 [12], increased incredibly to 23.7% in 2009 in community survey in Tripoli area done by CDC-WHO [13]. It means that the prevalence is increased 15.8% in eight years from 2001 to 2009, with increase by 2% each year, and this aggress with the prevalence of 39% in this study which was detected in 2014 and goes with the expectation of high prevalence of DM among Libyan population. This expected prevalence is complicated by multiple risk factors but not accounting the severe trauma related to sever stress caused by civil war started in 2011 which may play a major risk factor of increasing DM and hence storks in Libya and if this will be accounted, the high level of DM in this study will be accepted.

Mortel et al [20]. reported that diabetes is second to hypertension as a risk factor for stroke, followed by heart disease and smoking which also showed by this study results and by Shambesh et al, 2015 [14], were DM & hypertension are heading risk factor Followed by CHF.

This study confirmed that DM is the most frequent risk factor of stroke after hypertension among Libyan populations and this was also found in other studies in Arab countries [18] and in the Middle East and North Africa [19].

This study confirmed that DM is a major risk factor associated with stroke among Libyans and its widely affecting large populations constitute very important public health problem.

6. CONCLUSION

This study concluded that stroke is a major important public health problem in Libya in North Africa. DM is a major risk factor associated with stroke. Moreover, stroke risk factors such as Hypertension, CHF and previous history of stroke or transient ischemic attack are higher among DM patients.

Additionally, both CHADS2 & CSRC classification scores are very useful, easy to use and simple tools which are used to estimate, describe and classify the risk factors of stroke in a population living in a community based on studies of having DM or not.

7. STRENGTHS & LIMITATIONS OF THE STUDY

It is the first Libyan community based study to use CHADS2 & CSRC questionnaires to assess stroke risk factors among those who have DM. Moreover, it uses a large enough sample size, thus, the results produced from this study reflects the real situation in the Libyan community. Finally, because, this study is a cross-sectional study; it therefore explores associations, not causation.

8. RECOMMENDATION

To do other studies in order to measure stroke risk factors by using laboratory investigations, and other medical diagnostic procedures. Consequently, to estimate the most accurate and true rates.

9. References

1. Kitabchi AE, Umpierrez GE, Miles JM, Fisher JN. "Hyperglycemic crises in adult patients with diabetes.". *Diabetes Care*. 2009;32 (7): 1335–43.
2. Wild S, Roglic G, Green A, Sicree R, King H. "Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030". *Diabetes Care*. 2004; 27 (5): 1047–53.
3. Williams textbook of endocrinology (12th ed.). Philadelphia: Elsevier/Saunders. pp. 1371–1435. ISBN 978-1-4377-0324-5.
4. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, Shibuya K, Salomon JA, Abdalla S, Aboyans V, et al. "Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010.". *Lancet*. 2012; **380** (9859): 2163–96.
5. "Update 2014". IDF. International Diabetes Federation. Retrieved 29 November 2014. <http://www.idf.org>
6. "The top 10 causes of death Fact sheet N°310". World Health Organization. Oct 2013. <http://www.who.org>
7. IDF DIABETES ATLAS (6th ed.). International Diabetes Federation. 2013. p. 7. ISBN 2930229853. http://www.idf.org/sites/default/files/EN_6E_Atlas_Full_0.pdf
8. Mathers CD, Loncar D. "Projections of global mortality and burden of disease from 2002 to 2030". *PLoS Med*. 2006; **3** (11): e442.

293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336

9. Stolar M. Glycemic control and complications in type 2 diabetes mellitus. *Am J Med.* 2010;123(3 Suppl):S3–S11.
10. Alicic RZ, Tuttle KR. Management of the Diabetic Patient with Advanced Chronic Kidney Disease. *Semin Dial.* 2010;23(2):140–147.
11. Dormandy JA, Charbonnel B, Eckland DJ, Erdmann E, Massi-Benedetti M, Moules IK, et al. Secondary prevention of macrovascular events in patients with type 2 diabetes in the proactive Study (prospective pioglit azone Clinical Trial in macro Vascular Events): a randomised controlled trial. *Lancet.* 2005; 366 (9493): 1279–89.
12. Bony AM, Sasi AA, Bacuch MM, Elmshergy A. Risk factors of hypertension in Libya. National Research Institute. July, 2001:1-32
13. Tamer HE, Al-Shref EA, Imsalem OR, et al. Survey of risk factors of non-communicable diseases in Libya. Ministry of Health Report. 2009: 1-48
14. Shambesh M, Emahbes T, Saleh Z, Franks E, Bosnena O. Community based study of cerebrovascular risk factors in Tripoli-Libya (North Africa). *Journal of Scientific Research and Reports.* 2015;6(6):451–60.
15. Skanes A, Healey J, Cairns J, Dorian P, Gillis A, McMurtry M, et al. Focused 2012 update of the Canadian Cardiovascular Society atrial fibrillation guidelines: recommendations for stroke prevention and rate/rhythm control. *Can J Cardiol.* 2012;28:125–36.
16. Morillas P , Pallarés V , Fácila L , Llisterri JL , et al. The CHADS2 Score to Predict Stroke Risk in the Absence of Atrial Fibrillation in Hypertensive Patients Aged 65 Years or Older. *Rev Esp Cardiol (Engl Ed).* 2014 Dec 2:1-7.
17. Sandercock PA, Warlow CP, Jones LN, et al. Predisposing factors for cerebral infarction: the Oxfordshire community stroke project. *BMJ* 1989;298:75-80.
18. Benamer HT, Grosset D. Stroke in Arab countries: a systematic literature review. *J Neurol Sci.* April 2009; (jns-10981):1-6.
19. Tran J, Mirzaei M, Anderson L, et al. The epidemiology of stroke in the middle east and north Africa. *J Neurol Sci.* May 2010; (jns-11401):1-3.
20. Mortel KF, Meyer JS, Sim PA, et al. Diabetes mellitus as a risk factor for stroke. *South Med J* 1990;83:904-11.