RISK FACTORS ASSOCIATED WITH POOR GLYCEMIC CONTROL IN PATIENTS WITH TYPE2 DIABETES MELLITUS

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Abstract

Background: The increasing prevalence of type2 diabetes mellitus is a major global healthcare concern, where the disease is spreading at an alarming rates, leading to life threatening disabilities, increasing comorbidities and mortality rates. The causes of poor glycemic control in people with type 2 diabetes are complicated and multifaceted. **Objectives:** The goal of this study is to find the factors associated with poor glycemic control in type 2 diabetes patients. **Method:** A case control study was conducted from 1st January 2023 till the end of July 2023 at Diabetic and Endocrine center in Sulaimani city. A convenient sample of 300 participants diagnosed with type2 diabetes mellitus, 150 participants were having uncontrolled disease and 150 were having controlled disease based on their HbA1c. An interviewing questionnaire prepared including sociodemographic status of the participants and risk factors. Data was collected and analyzed by statistical package for social sciences (SPSS, version 26). Chi square test was used for getting the associated, P value ≤ 0.05 statistically regarded significant. Odd ratio for cases and controls have been done. **Results:** The mean age ± SD of cases (58.1±10.4), controls (58.6±9.7) and totally (58.3±10.0). The significant risk factors which associated with uncontrolled type2 diabetes were primary school level of education (P value <0.001), exercise (P value <0.001), family history of diabetes in 1st degree relatives (P value 0.007), healthy and fatty diet (P value <0.001), duration of diabetes (P value <0.001), cardiovascular disease (P value 0.002), other drugs used (P value <0.001), oral anti-diabetic drugs and adherence to the treatment (P value 0.02). **Conclusion:** There are many factors associated with uncontrolled hyperglycemia in type2 diabetic patients. Some of them are modifiable and will lead to good glycemic control like exercise, healthy diet, avoidance of fatty meals, and medication adherence. The other factors are non-modifiable like disease duration, associated cardiovascular complications, family history of type2 diabetes mellitus in 1st degree relatives and 2 or more other drugs used. Identifying these factors had a great impact on good glycemic control in type2 diabetes mellitus patients with decreasing complications and raising their life quality.

INTRODUCTION

Diabetes mellitus is considered a pandemic disease, and it is named as disease with complications because of increasing rates of morbidity and mortality. The worldwide health agenda put type2 diabetes in high place because of its dangerous effect on both human health and the world's economies. Over the past 20 years, the number of people with T2DM has more than doubled globally.[1] Diabetes is a chronic disease manifested by hyperglycemia, which is occure as a result of decreased insulin productions by pancreas or the peripheral tissues cannot use that insulin properly.[2]

The target for glycated hemoglobin level to be less than 7.0%, to decrease morbidity and ensure better quality of life. Glycated hemoglobin test is important in assessing the disease progression and predicting the future complications.[3] The diabetes is supposed to increase from 463 million to 700 million around the world till 2045, particularly in low economic regions.[4]

Many factors affecting the onset and the severity of this disease. Environmental, genetic, insulin resistance, sedentary life, decreased exercise, smoking, and high BMI with obesity are the most elements increasing hyperglycemia in type2DM patients.[5-8]

Usually, genetic factors appear after exposure to the environmental factors. Relatively, ethnicity also may increase certain causes leading to type2DM and its major complications.[9] Another problem that may affect the glycemic control is the fact that there are many groups of drugs help in increasing blood sugar levels like glucocorticoids, progestin injections, antipsychotic, antidepressants, anticholinergic, and antihistamines.[10] The quality and duration of sleep is also a relative factor indirectly with type2DM by its strong association with obesity. [11]

DM can be in remission nowadays with good outcomes opposite to what was thought before.[12] Detection of the diabetes as soon as possible with lifestyle modifications such as exercise, healthy diet and reducing weight, in association with establishing treatment can decrease complications and disease worsening.[13] Uncontrolled hyperglycemia in type2DM patients will lead to many vascular complications either by inflammation of small vessels which will end by retinopathy, nephropathy and neuropathy, or by atheroma formation and atherosclerosis ending by macro vascular complications and increasing cardiovascular events.[14]

PATIENTS AND METHODS

Study design:

Case control study

Study setting:

This study was conducted in Diabetic and Endocrine center in Sulaimani city. The center is located in kaniba street, near shorsh hospital. It is established in year 2007. It consist of seven departments. The number of registered patients in this center is 38 thousand patient. The center receives about 150-200 patients daily for investigations, follow up and medications.

Duration:

1st January 2023 to 1st July 2023.

Study subject

The inclusion criteria:

- All type2 diabetic patients aged 18 years old and above.
- Both genders.

The exclusion criteria:

- Tired type2 diabetic patients.
- Patients refused to participate in the study.
- Patients below age 18.
- Type1 diabetic patients.
- Type2 diabetic pregnant women.

Sampling:

A convenient type of sampling was used to identify the study participants, who were attended the sulaimani diabetic and endocrine center.

Sample size:

An estimated 300 patients diagnosed with T2DM, 150 with controlled T2DM and 150 with uncontrolled T2DM were participated in this study whom attending the diabetic and endocrine center for follow up investigations and to receive their treatments.

Data collection tools

Questionnaire:

The data was collected by direct interview using a structured questionnaire in which prepared by the researcher after reviewing similar studies and articles to collect information, then revised by the supervisor, with her advices regarding the proposed questionnaire were taken into consideration. The questionnaire contain close ended questions and it was divided into three parts:

- sociodemographic characteristic of the participants including age, gender, residency (inside city, outside city), level of education (illiterate, read and write, primary school, secondary school, high education), occupation (employee, free work, housewife, student, retired, not working), marital status, and socioeconomic status according to Dr.Nameer score.

- The associated risk factors with controlled and uncontrolled type2DM including: exercise, family history of type2DM, healthy diet, smoking, hypertension, cardiovascular diseases

- Management aspects: including type of hypoglycemic agent used, taking these drugs regularly, number of other drugs used, sleeping hours and pattern.

HbA1c test:

Obtained for all participants to assess the controlled and uncontrolled diabetic patients which was done in Sulaimani Diabetic and Endocrine center laboratory.

Fasting blood glucose test:

Obtained to all participants in the center laboratory.

Body mass index:

Obtained inside the center by measuring the weight and height of every participant.

Statistical analysis:

Data were analyzed using the statistical package for social sciences (SPSS, 26 version) and Chi square test for getting frequencies, mean standard deviation and the associated P value equal or less than 0.05 statistically regarded significant. Odd's ratio for cases and controls have been done.

Ethical consideration:

The research proposal was discussed and approved by the research ethics committee of the executive office in the Arab board of medical specialization. All the participants informed about the study aims and objectives. Confidentiality was ensured as the collected data will be used for scientific purposes only. Verbal consent was obtained from the Diabetic and Endocrine center manager in Sulaimani city before starting the research

RESULTS

The mean age and standard deviation was 58.3% (±10.0) totally with 63.3% aged 45-64 years in total. More than half (59.7%) were male, majority of cases and controls were married (82.0%), living inside city (74.7%) with moderate socioeconomic status (72.0%). Table 4-1

Table 4.1: Distribution of cases and controls in association with sociodemographic characteristics

Socio Demographic	Cases		Control		Total		P value
Age							
Mean ± SD	58.1 ± 10.4		58.6 ± 9.7		58.3 ± 10.0		0.70
22 - 44 Years	14	9.3%	12	8.0%	26	8.7%	0.87
45 - 64 Years	93	62.0%	97	64.7%	190	63.3%	
65 and more	43	28.7%	41	27.3%	84	28.0%	
Sex							
Male	88	58.7%	91	60.7%	179	59.7%	0.72
Female	62	41.3%	59	39.3%	121	40.3%	
Residency							
Inside city	110	73.3%	114	76.0%	224	74.7%	0.60
Outside city	40	26.7%	36	24.0%	76	25.3%	
Marital status							
Single	2	1.3%	0	0.0%	2	0.7%	0.37
Married	147	98.0%	149	99.3%	246	82.0%	
Widow or Divorced	1	0.7%	1	0.7%	2	0.7%	
Occupation							
Employee	21	14.0%	13	8.7%	34	11.3%	0.20
Free work	20	13.3%	27	18.0%	47	15.7%	
Housewife	77	51.3%	84	56.0%	161	53.7%	
Student	2	1.3%	0	0.0%	2	0.7%	
Retired	27	18.0%	20	13.3%	47	15.7%	
Not working	3	2.0%	6	4.0%	9	3.0%	
Socio-economic status							
Low	36	24.0%	48	32.0%	84	28.0%	0.12
Moderate	114	76.0%	102	68.0%	216	72.0%	
Total	150	100.0%	150	100.0%	300	100.0%	

According to the risk factors, their mean BMI were 31.2% (±5.9) with highest percentage in 30-39.99 were (46.0%). No fatty diet consumption was (74.7%), never smoking (72.7%), no HT (52.0%), no CVD association (83.3%), 4-6hrs sleep (57.0%). Table 4-2

Table 4.2: Distribution of cases and controls in association with risk factors

Risk factors	Cases		Control		Total		P value
BMI							
Mean ± SD	31.1± 5.8		31.4 ± 6.0		31.2 ± 5.9		0.68
< 25	14	9.3%	16	10.7%	30	10.0%	0.79
25 - 29.99	54	36.0%	54	36.0%	108	36.0%	
30 - 39.99	72	48.0%	66	44.0%	138	46.0%	
40 and more	10	6.7%	14	9.3%	24	8.0%	
Fatty diet	25	16.7%	51	34.0%	76	25.3%	< 0.001
Yes	125	83.3%	99	66.0%	224	74.7%	
No							
Smoking							
Never	118	78.7%	100	66.7%	218	72.7%	0.052
Ex- smoker	18	12.0%	32	21.3%	50	16.7%	
Current	14	9.3%	18	12.0%	32	10.7%	
Hypertension							

No	84	56.0%	72	48.0%	156	52.0%	0.360
Controlled	50	33.3%	57	38.0%	107	35.7%	
Uncontrolled	16	10.7%	21	14.0%	37	12.3%	
Cardiovascular disease							
Yes	15	10.0%	35	23.3%	50	16.7%	0.002
No	135	90.0%	115	76.7%	250	83.3%	
Sleep hours							
< 4 hours	13	8.7%	29	19.3%	42	14.0%	0.02
4 - 6 Hours	94	62.7%	77	51.3%	171	57.0%	
7 - 9 Hours	43	28.7%	44	29.3%	87	29.0%	
Sleeping style							
Continuous	98	65.3%	88	58.7%	186	62.0%	0.23
Interrupted	52	34.7%	62	41.3%	114	38.0%	
Total	150	100.0%	150	100.0%	300	100.0%	

According to the management, duration of DM< 5 years was (43.7%), two and more drugs used was (41.3%), oral anti DM medication was (79.3%) with regular medication intake (58.3%).

Table 4.3: Distribution of cases and controls in association with management

DM management	Cases		Control		Total		P value
Duration of DM							
< 5 years	93	62.0%	38	25.3%	131	43.7%	< 0.001
5 - 10 Years	35	23.3%	44	29.3%	79	26.3%	
> 10 Years	22	14.7%	68	45.3%	90	30.0%	
Other drugs							
None	69	46.0%	33	22.0%	102	34.0%	< 0.001
One medication	39	26.0%	35	23.3%	74	24.7%	
Two or more medications	42	28.0%	82	54.7%	124	41.3%	
Type of anti- DM drug							
Oral	133	88.7%	105	70.0%	238	79.3%	< 0.001
Injection	2	1.3%	2	1.3%	4	1.3%	
Both	15	10.0%	43	28.7%	58	19.3%	
Taking anti DM regularly							
Yes	142	94.7%	133	88.7%	175	58.3%	0.02
No	6	4.0%	17	11.3%	25	8.3%	
Total	150	100.0%	150	100.0%	300	100.0%	

According to sociodemographic factors, the primary level of education was the highest percentage in both cases and controls (40.3%). Fig 4-1
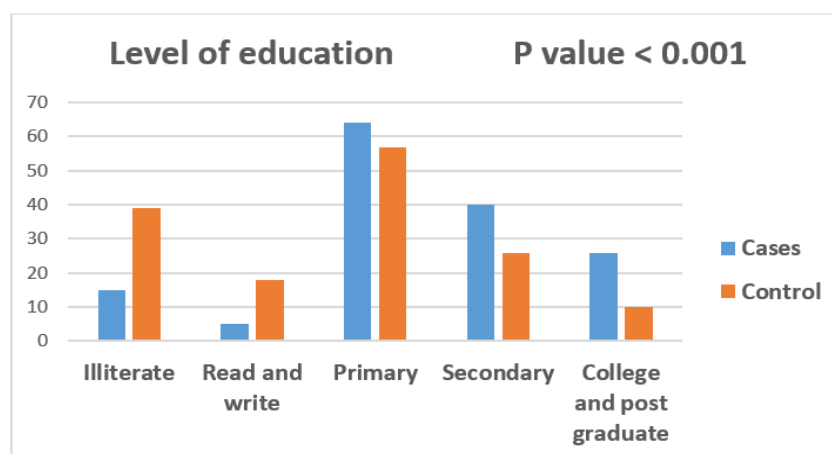

Fig 4.1: Sample distribution according to education level

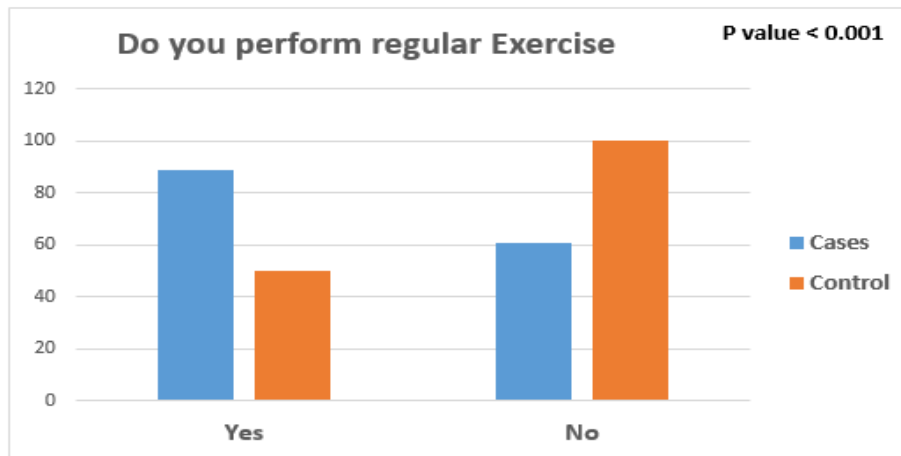According to risk factors, the highest percentage in exercise was no regular exercise in total (53.7%). Fig 4-2

Fig 4.2: Sample distribution according to exercise

Regarding to family history, the highest percentage with +ve family history in 1st degree relative in both cases and controls was (67.3). Fig 4-3
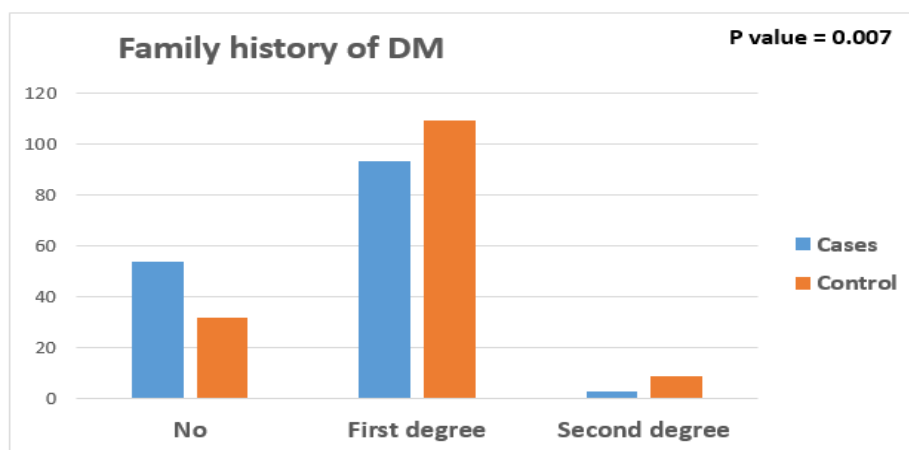

Fig 4.3: Sample distribution according to family history of DM

Regarding to healthy diet, the highest percentage of both cases and controls were having healthy regular diet (73.0%). Fig 4-4
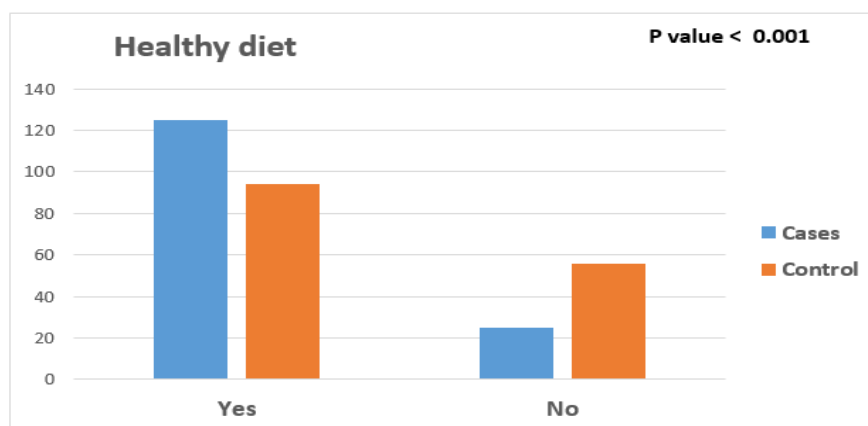

Fig 4.4: Sample distribution according to healthy diet

Regarding to Odd's ratio, level of education, 1st degree family history Of DM, fatty diet, CVD, and 2 0r more medication used had significant risk on uncontrolled T2DM, while exercise, healthy diet and oral anti-DM medications had protective effect on uncontrolled T2DM. Table 4.4

Table 4.4: Odd's ratio of the cases and controls regarding risk factors

Socio demographic	Odds ratio	95 % Confidence interval		P value
Level of education				
Illiterate	6.76	2.64	17.33	< 0.001
Read and write	9.36	2.74	32.03	< 0.001
Primary	2.32	1.03	5.22	0.043
Secondary	1.69	0.7	4.08	0.24
College and post graduate	1 *			
Exercise				
Yes	0.34	0.21	0.55	< 0.001
No				
Family History of DM				
No	1 *			
First degree	1.98	1.18	3.32	0.01
Second degree	5.1	1.28	20.1	0.02
Healthy diet				
Yes	0.34	0.2	0.58	< 0.001
No	1 *			
Fatty diet				
Yes	2.58	1.49	4.49	< 0.001
No	1 *			
Duration of DM				
< 5 years	0.13	0.07	0.24	< 0.001
5 - 10 Years	0.41	0.21	0.78	0.007
> 10 Years	1*			
Cardiovascular disease				
Yes	2.74	1.42	5.27	0.003
No	1*			
Other drugs				
None	1*			
One medication	1.88	1.01	3.48	0.045
Two or more medications	4.1	2.34	7.13	< 0.001
Type of anti- DM drug				
Oral	0.28	0.15	0.52	< 0.001
Injection	0.35	0.05	2.7	0.13
Both	1 *			
Taking anti DM regularly				
Yes	0.33	0.13	0.86	0.02
No	1*			
Sleep hours				
< 4 hours	2.18	1.002	4.74	0.049
4 - 6 Hours	0.8	0.48	1.34	0.40
7 - 9 Hours	1 *			

* Reference group

DISCUSSION

Diabetes is a serious chronic disorder that has a significant negative impact on people's lives, families, and society across the globe. According to previously estimated statistics, it was one of the 1st 10 causes of mortalities for adults and resulted in four million fatalities worldwide in 2017. This rising trend in type2 diabetes, which makes up about 90% of the total types of this disease, can be linked to aging, a

quickening urbanization rate, and obesogenic settings.[15] Aging-related changes to the body's composition and structure, such as muscle loss and a rise in visceral fat, have a major impact on inflammation and the emergence of insulin resistance, both of which raise the risk of metabolic and vascular problems.[16]

In this current study, a total number of 300 participants diagnosed with type2 diabetes were included, with 150 participants were the cases, and 150 participants were controls according to their HbA1c.

5-1 Sociodemographic factors: the highest rate of age was among 45-64 years, with 62.0% for cases and 64.7% for controls and mean standard deviation of (58.3 +- 10) in total. There was no significant P value regarding the age. This goes with a study conducted in Ramallah, Palestine in which the highest rate was among patients below 60 years with mean standard deviation of (58.1+- 9.8) totally.[17] The cause of this result is due to patients of this age group attended more often to the diabetic center at time of the study.

Regarding gender, high percentage of both cases and controls were male (58.7%) (60.7%) and total percentage was (59.7%). There was no significant P value regarding gender. In a study conducted to Ghana, the total percentage was highest in females (75.9%) and P value was not significant.[18] While in a study done in Ethiopia in which cases and control percentage in male were highest (53.7%) (57.60%) respectively.[19] These results may be due to cultural similarity in the society.

Regarding to residency, the highest percentage of both cases and controls were among patients living inside city (73.3%) (76.0%) respectively with total percentage was (74.7%). There was no significant P value in association with residency. In the study conducted in Ethiopia, the residency outside city was higher in cases (59.50%) while inside city was higher in controls (64.40%).[19]

Regarding the level of education, the highest percentage in level of education was primary school level in cases and controls (42.7%) (38.0%) respectively and total percentage was (40.3%). The P value was significant. A study conducted in Jeddah, Saudi Arabia, in which the highest percentage of cases were illiterate (34.0%) while the highest percentage of controls were bachelor degree level of education (39.4%) and P value was significant too. These diabetic patients have least knowledge about their disease, factors related to their disease and steps of caring and follow up.[20]

Regarding to marital status, the highest percentage in cases and controls were married (98.0%) (99.3%) and total percentage was (82.0%). P value was not significant. In opposite to the study of Saudi Arabia in which P value was significant in married patients.[20]

Regarding to the occupation, the highest percentage was among housewives in both cases and controls (51.3%) (56.0%) respectively and total percentage was (53.7%). P value was not significant. In opposite to a study conducted in Ghana in which the highest level of patients with uncontrolled type2 diabetes were civil servants.[18] The results of our study maybe due to less physical activity level among housewives and less care about healthy life.

Regarding to socioeconomic level, the highest percentage were moderate socioeconomic level of both cases and controls (76.0%) (68.0%) respectively and in total (72.0%). P value was not significant. In opposite to a study done in Ghana in which highest percentage of cases was among low socioeconomic level (54.2%) while

the highest percentage in controls was among high socioeconomic level (63.3%). The results in this current study could be due to the patients visiting our diabetic center at time of study.[18]

Risk factors:

The mean standard deviation of BMI in both cases and controls was 31.2 ± 5.9 in total. The highest percentage of cases and controls was at 30-39.9 level BMI (obesity class 1&2) (48.0%) (44.0%) respectively. The highest percentage in total was (46.0%) in class 1&2 obesity. P value was not significant. While in a study conducted to Calabar, Nigeria, in which the highest percentage of cases were overweight (51.5%), and highest percentage of controls were normal weight (52.7).[21]

Regarding to the exercise, the highest percentage of cases were having minimum 3days weekly exercise (59.3%), while the highest percentage of controls were not doing any exercise (66.7%), with total highest percentage was no exercise (53.7%). P value was significant regarding level of exercise. In another study done in Taif city, the highest percentage of cases was with regular exercise training, while in controls was with no exercise with no significant p value.[22]

Regarding to the family history of type2 diabetes, the highest level of cases and controls was in 1st degree relatives (62.0%) (72.7%) and total (67.3%). P value was significant. While in a study conducted to Riyadh city, total percentage (56.9%) were having +ve family history of type2 diabetes.[23] This could be due to genetic factors that goes in certain hereditary steps and activated by environmental factors.

Regarding to the diet, healthy diet consumption was the highest percentage in both cases and controls (83.3%) (62.7%) with total percentage of (73.0%). P value was significant. In a study conducted in Malaysia, there was no relation between good glycemic control and healthy diet consumption.[24] Opposite to a study in south India in which 59% of patients with uncontrolled type2 diabetes did not consume healthy diet which was statistically significant.[25] Relatively, no fatty diet consumption was highest in both cases and controls (83.3%) (66.0%) with total (74.7%). P value was significant. The result of current study could be due to moderate socioeconomic status of both cases and controls in which they can afford healthy food and can follow their doctor's advice about healthy life.

Regarding to smoking, highest percentage of cases and controls were not smokers (56.0%) (66.7%) and total percentage was (72.7%). No significant P value detected. In a study conducted to South Africa, majority of the participant never smokers (77.1%).[26] In a study done in Dire-Dawa, Ethiopia, the majority of participants were nonsmokers (92.3%). No significant P value found.[27]

Regarding to hypertension, the highest percentage in cases and controls were not having the disease (56.0%) (48.0%) with total percentage (52.0%). No significant P value found. While in the study conducted to Taif city, highest percentages of cases were having hypertension (51.5%) and highest percentage of controls were not having the disease (63.7%). P value was significant in their study.[22] In another study in China, the total percentage of cases having high blood pressure was (20.8%) and total percentage of controls having the disease were (22.6%). Again, P value was not significant.[28] Regarding to cardiovascular disease association with type2 diabetes, the highest percentage of cases and controls were not having CVD (90.0%) (76.7%) respectively, with total percentage not having the disease (83.3%). P value was

significant. In a study conducted to Zagreb, Croatia, the largest percentage of associated diseases was among diabetic patients who have vascular problems (69.7%) with coronary artery diseases total percentage (17.2%), this study show obesity, dyslipidemia with cardiovascular disorders increased in uncontrolled type2 diabetic patients.[29] (58) in a study done in Spain show that cardiovascular problems has strong relation to increase BMI, dyslipidemia and hypertension and not associated to poor glycemic control only.[30]

Regarding to sleeping hours, highest percentage of cases and controls were among 4-6hrs sleep (62.7%) (51.3%) and total percentage (57.0%). P value was not significant. About sleeping pattern, the highest percent of cases and controls was continuous pattern (65.3%) (58.7%) with total percentage (62.0%). No significant P value found. In a study conducted to Richmond show that short sleep duration (4-6hrs) and interrupted pattern of sleep related strongly with hyperglycemia.[31] In a study conducted to UK, the largest proportion of diabetic patients with poor sleep were having other associated factors like obesity, low exercise and sedentary life in which all together lead to increase cardiovascular events.[32]

DM management:

Regarding to the duration of the DM, the highest percentage in cases was < 5 years of disease duration (62.0%), while in control was >10 years (45.3%), and totally (43.7%). P value was significant. In a study conducted to Bahrain, more than half of the diabetic patients had >10 years duration of the disease and there was no significant P value.[33] while in another study conducted to Tabuk city, the highest percentage of cases were having the disease more than 10 years, while controls were having less than 5 years, and there was significant association between the poor diabetes control and longer disease duration.[34]

Regarding to adherence to anti-diabetic drugs, the highest percentage of cases and controls were taking their drugs regularly (94.7%) (88.7%) with total percentage (58.3%). P value was significant. In a study conducted to Tanzania, only (17.5%) of diabetic patient were taking their medications regularly, with (38%) were having low adherence to their drugs and this was associated with poor glycemic outcome.[35] This variation of the results could be due to the high cost of these agents, unavailability of the drugs, or due to variations in level of education. Regarding to the type of anti-diabetic drugs, the highest percentage of cases and controls were taking oral anti-diabetic agents (88.7%) (70.0%) and total percentage (79.3%). P value was significant. In a study conducted to Ethiopia, the highest percentage of cases were having both oral agents and insulin, and highest percentage of controls were taking insulin only, P value not significant.[36] Regarding to other drugs taking by the diabetic patients, highest percentage of cases were not taking any other medication (46.0%), while the highest percentage in controls were taking 2 or more drugs (54.7%) with total percentage (41.3%). P value was significant. A study conducted to Libya, the highest number of cases were using > 3 agents while highest percentage of controls were using 1-2 drugs. No significant P value were found.[37]

Odd's ratio of cases and controls regarding risk factors:

Regarding to sociodemographic factors, low levels of education show significant effects on uncontrolled T2DM (OR=2.32, CI=1.03-5.22) while in a study conducted to Jeddah, secondary level of education was significant (OR=1.07, CI=0.23-4.84).[20]

Regarding to risk factors, exercise show significant protective effect in controlling T2DM (OR=0.34, CI=0.21-0.55). In a study conducted to Ethiopia, no exercise show significant negative effects on uncontrolled diseased.[36]

Regarding to family history of T2DM in 1st degree relative, it show a significant negative effect in controlling the disease (OR=1.98, CI= 1.18-3.32), which is similar to another study that show (OR=7.38, CI=4.09-13.31).[34]

Regarding to healthy diet, it show a protective effect on controlling the disease (OR=0.34, CI=0.2-0.58). A study conducted to Ghana show positive effect of healthy ways of eating on controlling the disease.[38]

Regarding to fatty diet, it show significant risk on uncontrolled T2DM (OR=2.58, CI=1.49-4.49). In a study conducted to India, there was a significant risk of fatty diet consumption on uncontrolled T2DM.[39]

Regarding to duration of T2DM, <5 year duration show significant protective effect on uncontrolled disease (OR=0.13, CI=0.07-0.24), 5-10 years duration also show significant protective effect (OR=0.41, CI=0.21-0.78). In a study conducted to western Ethiopia, <5 years duration if T2DM show no significance as protective or risk on controlled disease, 5-10 years duration also show no significance on controlled disease, but a duration >10 years show significant effect on uncontrolled T2DM.[40]

Regarding the associated CVD, it shows significant risk on worsening the disease progress (OR=2.74, CI=1.42-5.27). In a study done in United States also show a significant risk effect of the associated CVD on uncontrolled T2DM (OR= 1.70, CI=1.58-1.83 P=<0.01).[41] While in another study conducted to Islamabad, the associated CVD was not significant and mactrovascular complications were associated with controlled diabetic patients.[42]

Regarding other drugs used, 2 and more medication use had significant risk on uncontrolled diabetes (OR=4.1, CI=2.34-7.13, P=<0.001).

Adherence to anti- DM medications show protective effect on controlling the disease progress (OR= 0.33, CI=0.13-0.86, P=0.002). While in a study conducted to Kuala Lumpur, taking anti-DM drugs regularly show no significant effect on controlling the disease.[24]

Regarding to the types of anti-DM drugs, oral type show significant protective effect on uncontrolled T2DM (OR=0.28, CI=0.15-0.52, P=<0.001). While in a study conducted to Ethiopia, the oral anti-DM medications had no significant effect on controlling the disease.[43] Regarding the sleep hours, less than 4 hours sleep has weak risk effect on uncontrolled T2DM (OR=2.18, CI=1.002-4.74, P=0.049). While in a study conducted to berlin, there was a significant risk with worsening T2DM with chronic decrease in sleep hours.[44]

Limitations of the study:

- The time limit

- The setting of the study

CONCLUSIONS

1) There are many factors associated with uncontrolled T2DM, either as a protective or a risk factor.

2) Low levels of education has a negative impact on controlling T2DM.

3) Family history of DM in 1st degree relatives, fatty diet and the associated CVD can significantly increase the risk of uncontrolled disease.

4) Exercise, healthy diet and less than 10 years duration of DM have protective effects on the disease progress

5) In management aspects, oral anti-DM drugs and medication adherence has a protective effect on controlling T2DM, while using 2 or more drugs has a negative impact on the disease control.

6) Less than 4 hours sleep has a weak effect on controlling the disease progress.

RECOMMENDATIONS

1) Patients should understand the justifications for their own self-care practices and make the needed adjustments.

2) The health sector should continuously promote healthy behavior modification, stressing the value of promoting physical activity, healthy aspects of eating and steps in controlling the cardiovascular problems.

3) Through active screening and rigorous management of those at risk, the healthcare system should give diabetes prevention efforts top priority.

4) Future studies should examine the success of diabetes education initiatives and the challenges in maintaining lifestyle changes.

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