Role of Tobacco Use in the Etiology of Diabetes Mellitus among Sudanese Patients

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Abstract: Background: *Diabetes mellitus is one of the most important chronic diseases that is associated with different risk factors, tobacco use being one of them.* *Aim:* *The main objective was to identify the role of tobacco use in the etiology of diabetes mellitus among Sudanese diabetic patients.* *Patients and methods:* *It was conducted in Khartoum State targeting all the localities of the state (North Khartoum, South Khartoum, Khartoum Bahri and Omdurman). The sample included two hundred (200) participants, divided equally among control and test group. The control group consisted of hundred (100) healthy Sudanese males and females with no signs and symptoms of diabetes mellitus, while the test group consisted of hundred (100) Sudanese patients diagnosed with diabetes mellitus. The primary data from questionnaires were analyzed using Statistical Packages for Social Sciences (SPSS). Risk factors data were compared between test and control groups using chi square test. Frequency distributions were used to present the data of the two groups.* *Results and discussion:* *It revealed that Age, and educational level, past use of tobacco, presence of someone in the family or surrounding use tobacco, family history with diabetes mellitus, atherosclerosis, hypertension, knowledge about the risk of physical activity, showed significant statistical association with diabetes mellitus (P value < 0.05), while gender, peptic ulcer and asthma showed no significant association with diabetes mellitus.* *Conclusion:* *Based on the findings of this study it can be concluded that tobacco use has a role in the etiology of diabetes mellitus. The study highly recommend the importance of education programs to educate population about the possible procedures and practices that help them to stop use of tobacco.*

Keywords: Tobacco use, diabetes, Sudanese patients.

Introduction

Diabetes is a syndrome of disordered metabolism, usually due to a combination of hereditary and environmental causes, resulting in abnormally high blood sugar levels (hyperglycemia). Blood glucose levels are controlled by a complex interaction of multiple chemicals and hormones in the body, including the hormone insulin made in the beta cells of the pancreas. Diabetes mellitus refers to the group of diseases that lead to high blood glucose levels due to defects in either insulin secretion or insulin action. [1]

Diabetes mellitus is a global health problem throughout the world in both developed and developing countries. It affects more than 120 million people worldwide and it is estimated that it will affect 220 million by the year 2020. [2]

Type II diabetes mellitus usually occurs in persons older than 30 years of age; previously was known as non-insulin dependent diabetes mellitus (NIDDM) or maturity onset diabetes. Insulin resistance is a major component of type II diabetes. In the past decade, the increase in the incidence of type II diabetes mellitus has emerged as one of the most challenging health problems in western countries. No overall strategy has been defined to reduce the epidemic. However, it is recommended that all factors associated with insulin resistance should be identified and treated.

Smoking may contribute to the development of diabetes through alterations in fat distribution, which is associated with insulin resistance, and through a direct toxic effect on pancreatic tissue. It has been shown that smoking cessation increases insulin sensitivity and improves the lipoprotein profile, despite a modest increase in weight. This suggests that the smoking-related risk of diabetes is reversible in individuals who quit smoking. In the long run, based on this study, the beneficial effects of smoking cessation outweigh the effects of weight gain; ex. smokers of 20 years' duration are no longer at increased risk of diabetes. [3]

In Sudan diabetes mellitus represents the ninth leading cause of hospital admission (1.9%), where medical problems are admission to hospital. The prevalence was 6.9% (men 3.5% and women 3.4%). It was estimated that diabetic patients are around 2 million; type I represents 25% of them and type II constitutes the remaining 75 %. [4]

People start smoking cigarette younger the more likely are to become addict to nicotine. The earlier people start smoking the more they are susceptible to health problems. These health problems are closely associated with increased risk of becoming diabetic, as there is some evidence of some risk factors and leading causes of diabetes mellitus. Thus such a study cover some parts and details required to provide needed information and knowledge about the possible association between the use of tobacco and diabetes mellitus so to set some measures of management and control of the phenomenon.

This study aimed to identify the role of tobacco use in the etiology of diabetes mellitus among Sudanese diabetic patients.

Patients and methods
Study area

The study was conducted in Khartoum State targeting all the localities of the state (North, South Khartoum, Bahri and Omdurman).

Study design

This was descriptive cross-sectional study, based on study of the effects of different variables associated with tobacco use on increased risk of diabetes mellitus among diabetic patients (cases) and non-diabetic individuals (control).

Ethical consideration

The aims of this study were fully explained to the respondents and their consent to participate in this study was obtained verbally and written. An official letter was taken from Ahfad University to approach the director of Diabetic and Health Centers for permission to conduct this study.

Study populations

The study population consisted of the test group (diabetic) and control group (non-diabetic) Sudanese males and females.

Sample size

Questionnaires were filled with two hundred (200) participants, divided equally among the control and test group. The control group consisted of hundred (100) healthy Sudanese males and females with no signs and symptoms of diabetes mellitus, while the test group consisted of hundred (100) Sudanese patients with diabetes mellitus.

Data collection methods

Primary data were collected using questionnaires. Secondary data were obtained from relevant topics in both published and unpublished works including books, reports, previous studies, periodicals and Internet.

Questionnaire

A structured questionnaire was designed to obtain personal information, usage of tobacco by respondents, and information about diabetes mellitus, distributed to all the respondents.

Data Management and Analysis

The primary data from questionnaires were analyzed using Statistical Packages for Social Sciences (SPSS). Risk factors data were compared between test and control groups using chi square test. Frequency distributions were used to present the data of the two groups. Data were presented in tables and figures.

Results

Table (1) Distribution of the respondents by age

		Description				Total	
		Case		Control			
		Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Age P value = 0.000 *	**< 15 years**	0	0.0%	1	1.0%	1	.5%
	15 - 24 years	28	28.0%	58	58.0%	86	43.0%
	25 - 34 years	34	34.0%	28	28.0%	62	31.0%
	35 - 44 years	21	21.0%	7	7.0%	28	14.0%
	45 - 54 years	12	12.0%	3	3.0%	15	7.5%
	55 - 65 years	3	3.0%	2	2.0%	5	2.5%
	Above 65 years	2	2.0%	1	1.0%	3	1.5%
P Total		100	100.0%	100	100.0%	200	100.0%

* P value < 0.05 (significant)

As shown in **Table (1)** the most common age among the case group was 25 – 34 years (34%), compared to age group (15 – 24) years which reported among (58%) of the control group. Chi squire test showed significant statistical association between age and diabetes mellitus (P value < 0.05).

Figure (1) Distribution of the respondents by gender
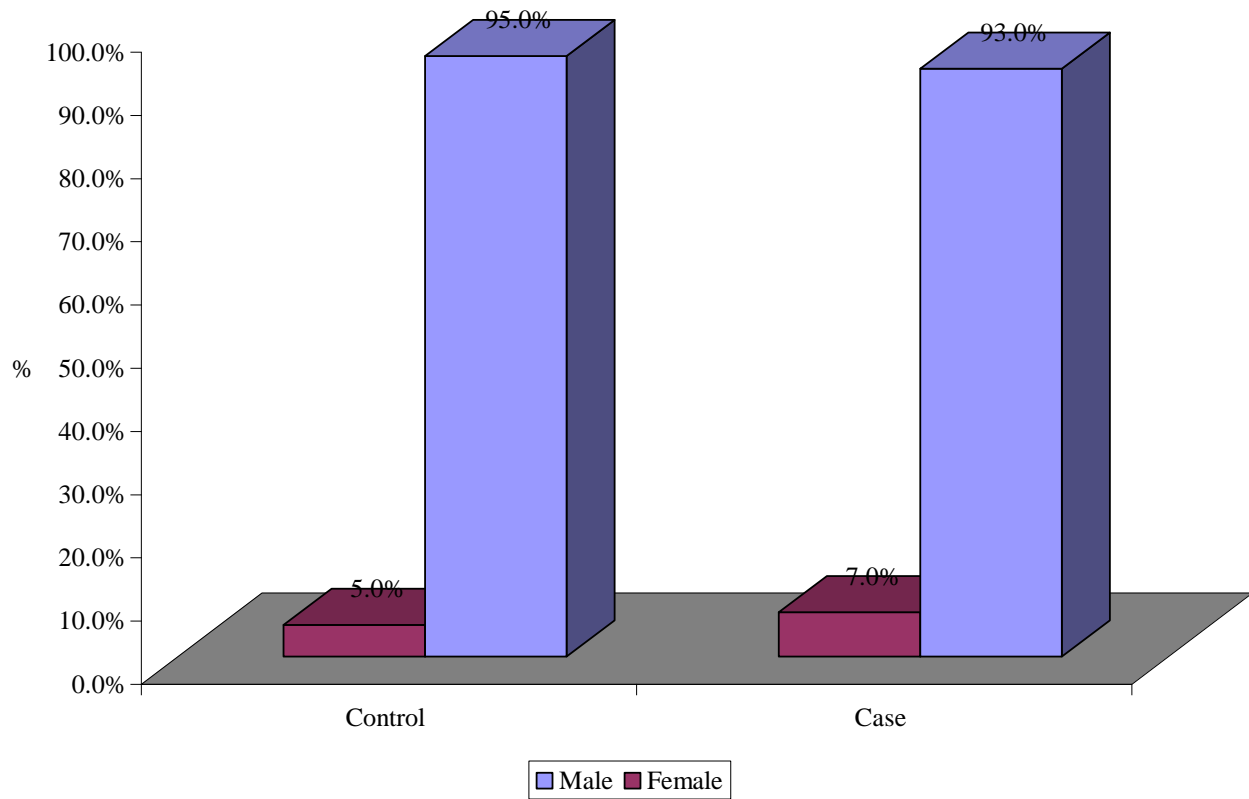
P value= 0.4 (not significant > 0.05)

The above figure shows that the majority of both case group (93%) and control group (95%) were males compared to only 3 % of case group and 5 % of control who were females. Chi squire test showed no significant association between gender and diabetes mellitus (P value > 0.05).

Table (2) Educational level of the respondents

		Description				Group Total	
		Case		Control			
		Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Educational level P value = 0.00*	**Illiterate**	5	5.0%	2	2.0%	7	3.5%
	Primary	19	19.0%	9	9.0%	28	14.0%
	Secondary	44	44.0%	18	18.0%	62	31.0%
	University	32	32.0%	70	70.0%	102	51.0%
	Postgraduate	0	0.0%	1	1.0%	1	0.5%
Group Total		100	100.0%	100	100.0%	200	100.0%

Table (2) shows that most of participants in the case group (44%) have secondary level of education, while the majority of control group (70%) has university level. Chi squire test showed significant statistical association between educational level and diabetes mellitus (P value < 0.05).
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Table (3) Current use of tobacco

	Description	Total

		Case ***		Control ****		Frequency	%
		Frequency	%	Frequency	%	Frequency	%
Use tobacco now P = 0.02*	Yes	84	84.0%	97	97.0%	181	92.5%
	No	16	16.0%	3	3.0%	19	7.5%
Group Total		100	100.0%	100	100.0%	200	100.0%
Frequency of tobacco use per day P = 0.001*	< 3 times	10	11.9%	9	9.3%	19	10.5%
	3 - 6 times	35	41.7%	21	21.6%	56	30.9%
	> 6 times	39	46.4%	67	69.1%	106	58.6%
Total		84	100.0%	97	100.0%	181	100.0%
Shisha P = 0.3 **	Yes	14	16.7%	17	17.5%	31	17.1%
	No	70	83.3%	80	82.5%	150	82.9%
Total		84	100.0%	97	100.0%	181	100.0%
Snuff P = 0.5 **	Yes	37	44.0%	45	46.4%	82	45.3%
	No	47	56.0%	52	53.6%	99	54.7%
Total		84	100.0%	97	100.0%	181	100.0%
Cigarette P = 0.002*	Yes	56	66.7%	74	76.3%	130	71.8%
	No	28	33.3%	23	23.7%	51	28.2%
Total (n=84)		84	100.0%	97	100.0%	181	100.0%
Date of starting use of tobacco P value = 0.04*	< 1 year	15	17.9%	17	17.5%	32	17.7%
	1 - 5 years	18	21.4%	30	30.9%	48	26.5%
	> 5 years	51	60.7%	50	51.5%	101	55.8%
Total		84	100.0%	97	100.0%	181	100.0%

* P value significant (< 0.05)
** P value not significant (> 0.05)
*** Percentage calculated for frequency, type of tobacco, and duration out of 84 (respondents who currently using tobacco)
**** Percentage calculated for frequency, type of tobacco, and duration out of 97 (respondents who currently using tobacco)

In **Table (3)** the findings show that the majority of both case group (88%) and the control (97%) currently use tobacco. Most of the case group (46.4%) used tobacco more than 6 times per day, compared to 69.1% of control group who used it in the same frequency. Shisha was used by 16.7% of the case group, and 17.5 % of the control group, snuff (tomback) was used by 44% of the case group and by 46.3% of the control group, cigarette was smoked by 66.7% of the case group and by 76.3% of the control. The majority of the case group (60.7%) used tobacco for more than 5 years, while 51.5% of the control practiced it for the same duration.

Table (4) Past Use of Tobacco

		Description				Total	
		Case ***		Control ****			
		Frequency	%	Frequency	%	Frequency	%
Past use of tobacco P = 0.05 *	Yes	16	16.0%	3	3.0%	19	7.5%
	No	84	84.0.%	97	97.0%	181	92.5
Total		100	100.0%	100	100.0%	14	100.0%
Frequency of use per day P = 0.6 **	< 3 times	2	12.5%	2	66.7%	3	21.4%
	3 - 6 times	6	37.5%	1	33.3%	5	35.7%
	> 6 times	8	50.0%	0	.0%	6	42.9%
Total		16	100.0%	3	100.0%	14	100.0%
Shisha P = 0.2 **	Yes	10	32.5%	0	.0%	5	35.7%
	No	6	67.5%	3	100.0%	9	64.3%

Total		16	100.0%	3	100.0%	14	100.0%
Snuff **P = 0.5 ****	**Yes**	12	75.0%	0	.0%	7	50.0%
	No	4	25.0%	3	100.0%	7	50.0%
Total		16	100.0%	3	100.0%	14	100.0%
Cigarette **P = 0.2 ****	**Yes**	14	87.5%	3	100.0%	12	85.7%
	No	2	12.5%	0	.0%	2	14.3%
Total		16	100.0%	3	100.0%	14	100.0%

* P value significant (< 0.05)
** P value not significant (> 0.05)
*** Percentage calculated for frequency, and type of tobacco out of 16 (respondents who used tobacco in the past)
**** Percentage calculated for frequency, type of tobacco, and duration out of 3 (respondents who used tobacco in the past)

Table (4) shows that only (16%) of case group and 3% of control used tobacco in the past. Half of the case group who used tobacco (in the past) used it for more than 6 times per day, compared to 66.7% of control group who used it for less than one year. Shisha was used by 32.5% of case group, who previously used tobacco, and by none of the control group. Snuff (tomback) was used by 75% of the case group and none of the control group. Cigarette previously smoked by 87.5% of the case group and 100% of the control group. Chi squire test showed significant statistical association between past use of tobacco and diabetes mellitus (P value < 0.05), while there is no significant association between the type and duration of use of tobacco in the past and diabetes mellitus (P value > 0.05).

**Figure (2) Other people using tobacco in surrounding of the respondents**
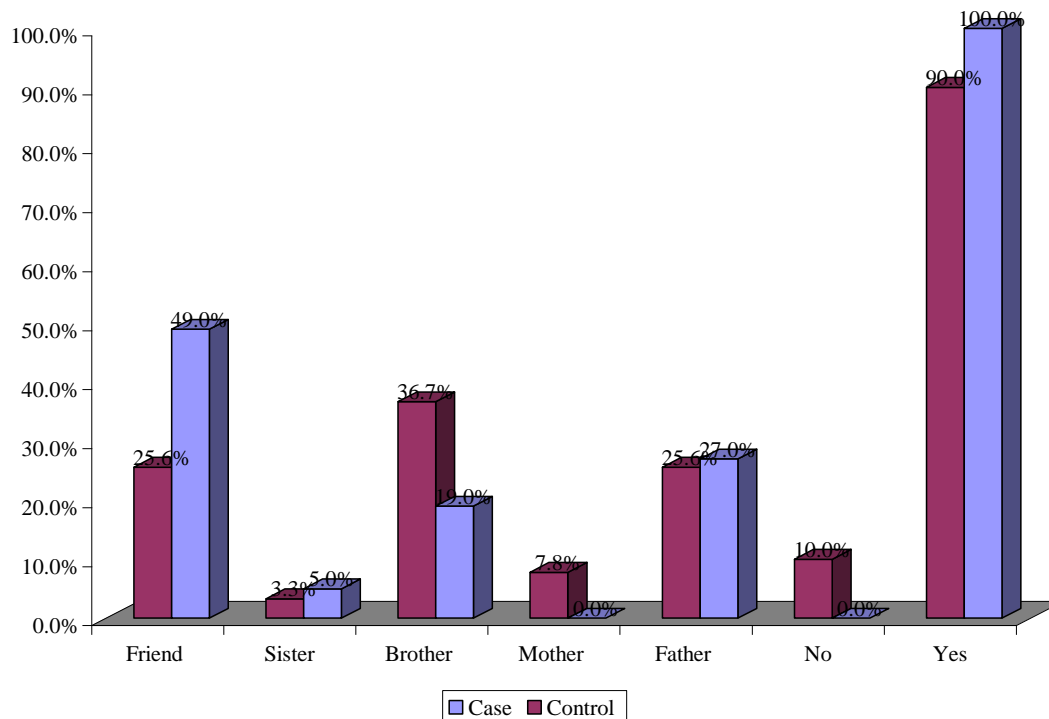
P value = 0.01 (significant < 0.05)
For case group: the percentages o persons used tobacco in surrounding (fathers,…) calculated out of 100, and for control group out of 90.
As shown in **figure (2)** all the case group reported that there is some one used tobacco in their home, neighboring or work place, 49% of them said their friends, 27% said father, 19% said brother and none of them mentioned mother or sister. On the other hand 90% of the control group said there is some one used tobacco among their relatives and friends, 36.7% of them mentioned brother, 25.6% friends and fathers, 7.8% mothers and 3.3% sisters. Chi squire test showed there is a significant statistical association between the presence of other persons among relatives or friends used tobacco and diabetes mellitus (P value < 0.05).

Figure (3) History of diabetes mellitus in the family
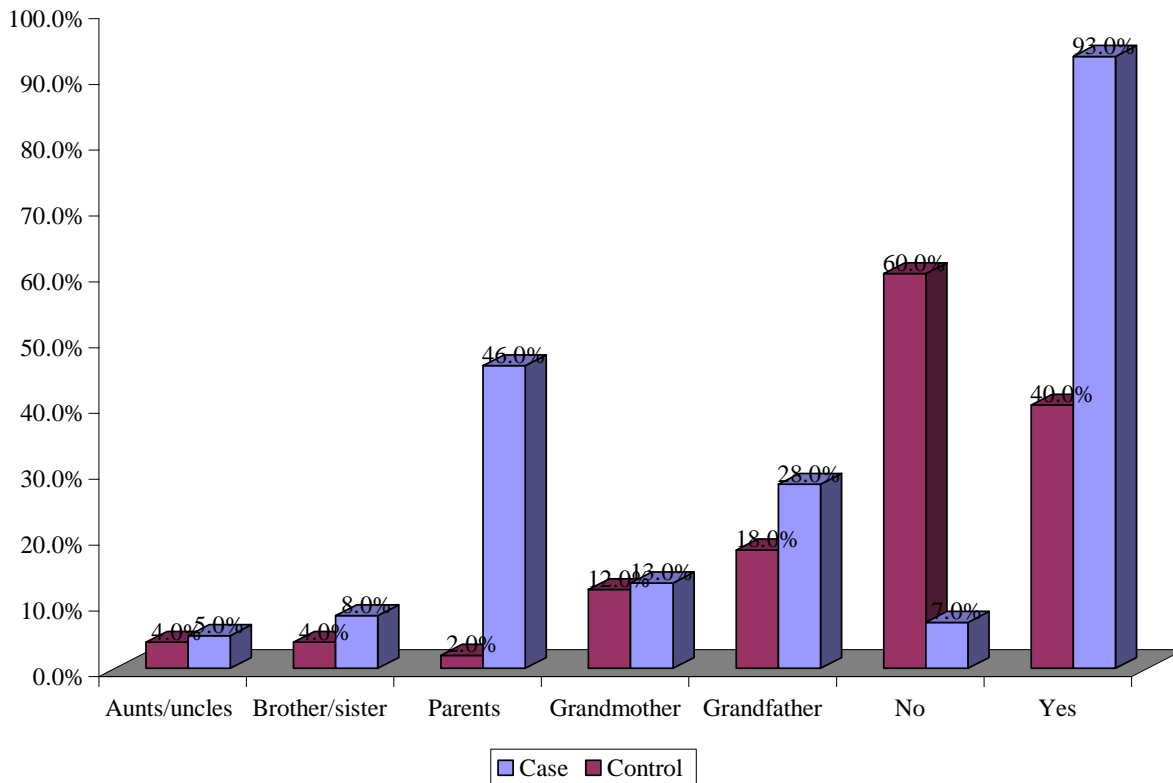
P value = 0.00 (significant < 0.05)

As shown in the above figure the majority of case group (93%) have a history of diabetes mellitus in their families compared to 40% of the control group. 46 % Of the case group mentioned that their parents have diabetes mellitus, 28% have diabetic grandfathers, 13% grandmothers, 8% sister/brother and 5% have aunt/uncle. On the other hand, 18% of the control group has diabetic grandfathers, 12% grandmothers, 4% sister/brother, 4% aunt/uncle and 2% parents. Chi squire test showed significant statistical association between family history with diabetes and the current presence of diabetes mellitus (P value < 0.05).

Figure (4) Date of discovering diabetes mellitus and Starting tobacco use before or after diabetes (cases only)
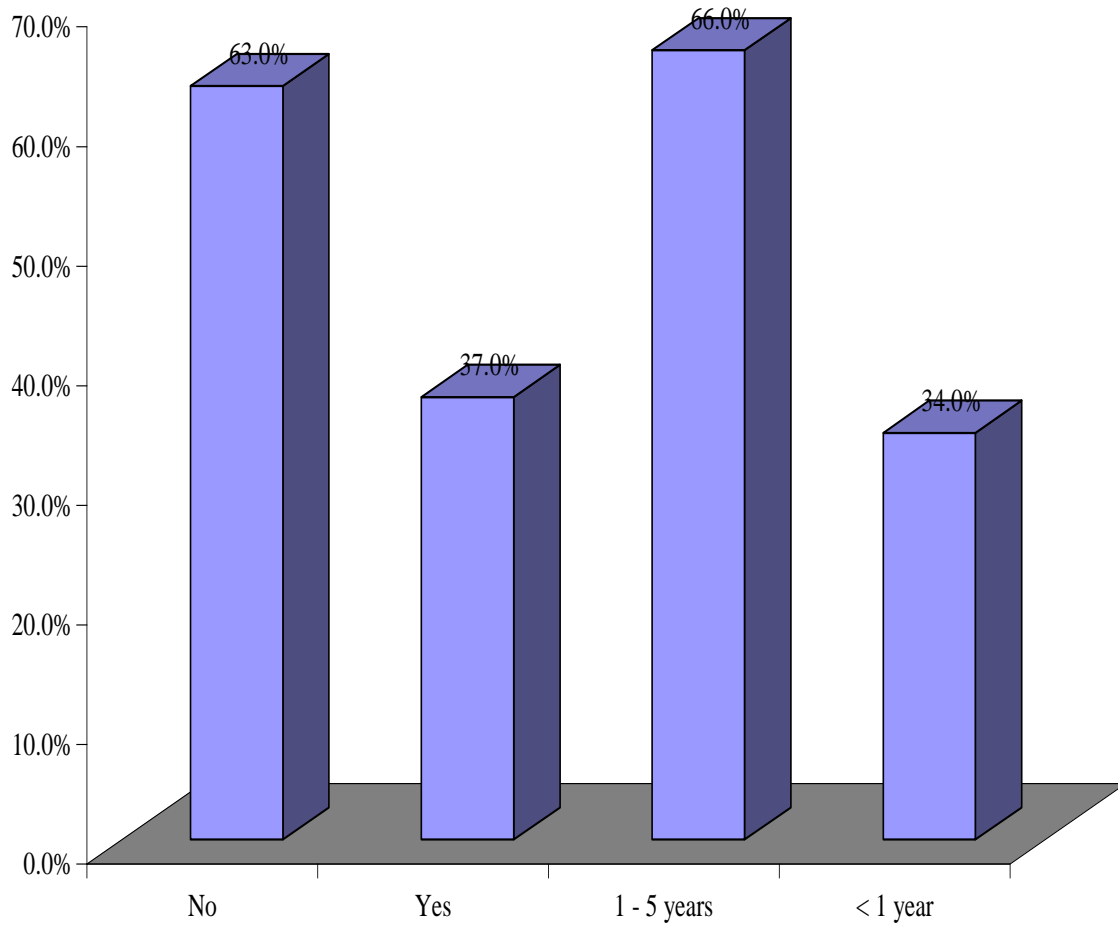
Figure (4) shows that the majority of the case group (66%) discovered diabetes mellitus before 1 – 5 years, and (67%) of them did not seize smoking after discovery of diabetes mellitus.

Table (5) Complaining some health problems

		Description				Total	
		Case		Control			
		Frequency	%	Frequency	%	Frequency	%
Atherosclerosis **P = 0.00***	Yes	27	27.0%	2	2.0%	29	14.5%
	No	73	73.0%	98	98.0%	171	85.5%
Total		100	100.0%	100	100.0%	200	100.0%
Hypertension or **hypotension** **P = 0.00***	Yes	27	27.0%	4	4.0%	31	15.5%
	No	73	73.0%	96	96.0%	169	84.5%
Total		100	100.0%	100	100.0%	200	100.0%
Peptic ulcer **0.4****	Yes	35	35.0%	1	1.0%	36	18.0%
	No	65	65.0%	99	99.0%	164	82.0%
Total		100	100.0%	100	100.0%	200	100.0%
Asthma **0.6****	Yes	37	37.0%	3	3.0%	40	20.0%
	No	63	63.0%	97	97.0%	160	80.0%
Total		100	100.0%	100	100.0%	200	100.0%

* Significant (p value < 0.05)   ** not significant (p value > 0.05)

As indicated by **Table (5)** 27 % of the case group and 2 % of the control group complained from atherosclerosis, 27% of the case group and 4 % of control complained from hypertension, 35% of case group and 1% of control complained from peptic ulcer, 37% of case group and 3% of control complained from asthma. Chi squire test showed that there is a significant statistical association between atherosclerosis, hypertension and diabetes mellitus (P value < 0.05), while there is no significant association between peptic ulcer, asthma and diabetes mellitus (P value > 0.05).

Table (6) Information of respondents about the link between tobacco use and diabetes mellitus

		Description				Total	
		Case ***		Control ****			
		Frequency	%	Frequency	%	Frequency	%
Having information **P = 0.00***	Yes	67	67.0%	25	25.0%	92	46.0%
	No	33	33.0%	75	75.0%	108	54.0%
Total		100	100.0%	100	100.0%	200	100.0%
Friends **P = 0.03***	Yes	9	13.4%	10	40.0%	19	20.7%
	No	58	86.6%	15	60.0%	73	79.3%
Total		67	100.0%	25	100.0%	92	100.0%
Radio **P = 0.03***	Yes	39	58.2%	8	32.0%	47	51.1%
	No	28	41.8%	17	68.0%	45	48.9%
Total		67	100.0%	25	100.0%	92	100.0%
Television **P = 0.01***	Yes	25	37.3%	13	52.0%	38	41.3%
	No	42	62.7%	12	48.0%	54	58.7%
Total		67	100.0%	25	100.0%	92	100.0%
Study curricula **P = 0.5 ****	Yes	18	26.9%	5	20.0%	23	25.0%
	No	49	73.1%	20	80.0%	69	75.0%
Total		67	100.0%	25	100.0%	92	100.0%
Forums and **lectures P =0.02***	Yes	15	22.4%	3	12.0%	18	19.6%
	No	52	77.6%	22	88.0%	74	80.4%
Total		67	100.0%	25	100.0%	92	100.0%

Magazines and news papers P = 0.03 *	Yes	40	59.7%	5	20.0%	45	48.9%
	No	27	40.3%	20	80.0%	47	51.1%
Total		67	100.0%	25	100.0%	92	100.0%
Health settings P = 0.02*	Yes	28	41.8%	3	12.0%	31	33.7%
	No	39	58.2%	22	88.0%	61	66.3%
Total		67	100.0%	25	100.0%	92	100.0%

* P value significant (< 0.05)   ** P value not significant (> 0.05)
*** Percentage calculated sources of information out of 67 (case group)
**** Percentage calculated sources of information out of 25 (control group)

As shown in the above table (67%) of the case group has knowledge about the association between use of tobacco and diabetes mellitus, compared to (25%) of the control group who have the same knowledge. This information was gained from different sources including mass media, friends, study curriculum, forums and health settings. Chi squire test showed significant statistical association between knowledge about association between use of tobacco and diabetes mellitus (P value < 0.05).

Figure (5) Factors other than tobacco use associated with diabetes mellitus
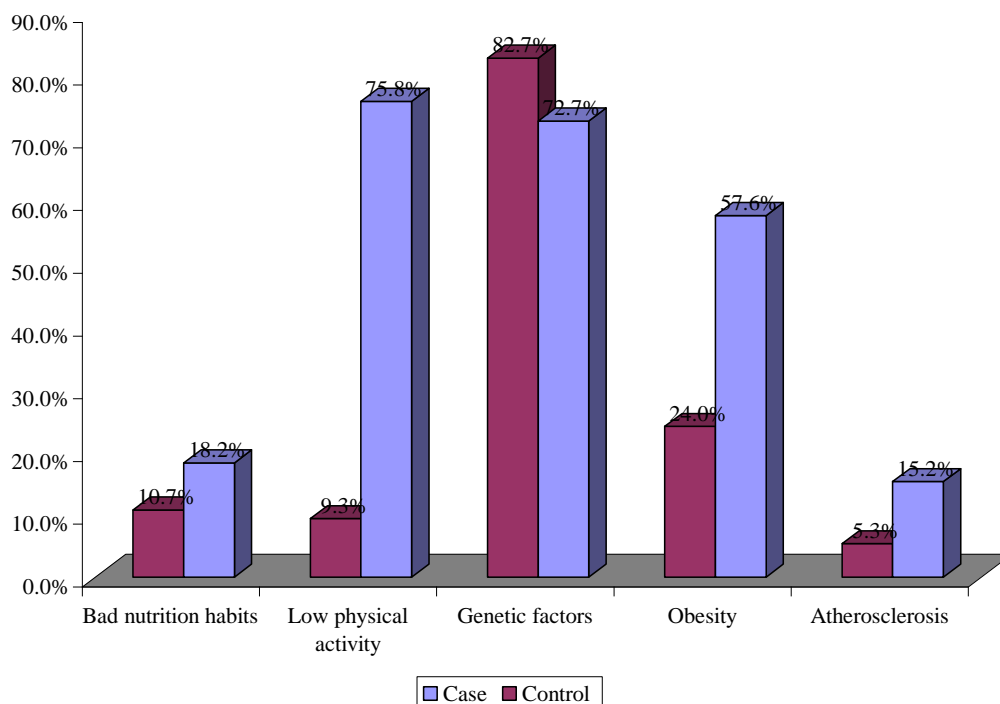
P value = 0.03 (significant < 0.5)
Case group (n=33),   control group (n=75)

As shown in **figure (5)** the majority (75.8%) of case group have knowledge about the close relation between low physical and diabetes mellitus, in contrast to only (9.3%) of the control who have the same activity knowledge. On the other hand, the majority of control (82.7%) and (72.7%) of the case group accepted the relation between genetic factors and diabetes mellitus. Chi squire test showed a significant statistical association between perception of the respondents about presence of risk factors of diabetes mellitus other than use of tobacco and diabetes mellitus (P value < 0.05).

Discussion

Concerning demographic characteristics of the respondents the most common age among the case group was 25 – 34 years (34%), compared to age group (15 – 24) years which reported among (58%) of the control group, the majority of both case group (93%) and control group (97%) were males compared to only (3%) of case group and (7%) of control who were females, most of

case group (44%) have secondary level of education, while the majority of control group (70%) have university level.

Age, and educational level showed significant statistical association with diabetes mellitus (P value < 0.05), while gender showed no significant association with diabetes mellitus (P value > 0.05). It is clear that age and educational level significantly affect the growing risk of diabetes mellitus among individual using tobacco.

The risk of type II diabetes increases as the individual gets older, especially after age 45. Often, that's because people tend to exercise less, lose muscle mass and gain weight as their age increases. [5]

The findings revealed that the majority of both case group (88%) and the control (97%) currently use tobacco for different frequencies per day, mainly 6 times per day. The types of tobacco used include Shisha, snuff (tomback) and cigarette smoked. The majority of the case group (60.7%) using tobacco for more than 5 years, while (51.5%) of the control practiced it for the same duration. The past use of different types of tobacco (shisha, tomback and cigarette) was observed only among (16%) of case group and (3%) of control with a frequency of more than 6 times per day. Moreover, there is some one who uses tobacco in their home, neighboring or work place, including friends, father, brother mother and sister.

Chi squire test showed a significant statistical association between past use of tobacco, presence of someone in the family or surrounding use tobacco and diabetes mellitus (P value < 0.05), while there is no significant association between the type and duration of use of tobacco and diabetes mellitus (P value > 0.05).

Hypercholesterolemia, hypertension, diabetes mellitus and tobacco use are factors associated with increased risk of atherosclerosis. However, while it is easy to measure lipid and glucose levels, it is far more difficult to estimate a patient's tobacco use. The health risks of smoking are not uniform across all smokers. Risks vary according to amount of tobacco smoked, with those who smoke more at greater risk. Light smoking is still a health risk. Likewise, smoking "light" cigarettes does not reduce the risks. [6]

History of diabetes mellitus in the family as indicated by the results was found to be clearly associated with the risk of diabetes mellitus. The majority of case group (93 %) said that they have a history of diabetes mellitus in the family compared to (40%) of the control group. These relatives include parents, grandfathers, grandmothers, sisters, brothers, aunt and uncles. Chi squire test showed significant statistical association between family history of diabetes and diabetes mellitus (P value < 0.05).

Family history is closely associated with many chronic diseases as is associated with genetics. The risk of type II diabetes increases if a parent or sibling has type II diabetes. Although it's unclear why, people of certain races — including blacks, Hispanics, American Indians and Asian Americans — are more likely to develop type II diabetes. [5]

Findings showed that (27%) of the case group and (2%) of control group complained from atherosclerosis, (27%) of the case group and (1%) of control complained from hypertension, (35%) of case group and (1%) of control complained from peptic ulcer, (37%) of case group and (3%) of control complained from asthma. On the other hand, both case group and control group have knowledge about the close relation between low physical activity, genetic factors, and diabetes mellitus. However, the risk of tobacco use was clearly acknowledged among case group than among control.

Chi squire test showed that there is significant statistical association between atherosclerosis, hypertension, knowledge about the association of physical activity and diabetes mellitus (P value < 0.05), while there is no significant association between peptic ulcer, asthma and diabetes mellitus (P value > 0.05).

Tobacco use is not a well-documented risk factor for type II diabetes, although diabetes and chronic heart disease (CHD) have many common causal factors. A recent review of smoking and diabetes concluded that the evidence that smoking is associated with the develop of diabetes; was still preliminary. However, three large prospective studies suggested that smoking is associated with the development of type II diabetes in men and women, consistent with evidence linking between smoking and insulin resistance. Smoking cessation is often accompanied by substantial weight gain, and obesity is an important risk factor for development of diabetes. It is not clear whether the benefits of giving up smoking outweigh the adverse effect of weight gain. The effect of pipe or cigar smoking (primary or secondary) on the development of diabetes is also not known. [7]

Conclusion

Age and educational level , presence of someone in the family or surroundings who used tobacco, family history with diabetes mellitus, atherosclerosis, hypertension, showed significant statistical association with diabetes mellitus (P value < 0.05), while gender, peptic ulcer and asthma showed no significant association with diabetes mellitus (P value > 0.05).

Recommendations

There is an urgent necessity to increase the awareness of the population about the risk of tobacco use in relation to chronic diseases like diabetes mellitus.

Education programs should be designed to educate population about the possible procedures and practices that help them to stop use of tobacco.

Regular follow up and early detection of disease is a good procedure for suitable intervention and detection of risk factors associated with the problem.

Further studies are highly recommended with emphases on necessity of breaking gender determinants that prevent females to tell the exact situation.

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