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Association of Tobacco Products Use and Diabetes Mellitus-Results of a National Survey Among Adults in Saudi Arabia

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ABSTRACT

Objective: To compare the tobacco products use patterns of known diabetics and non diabetics.

Material and Methods: A community-based cross-sectional study using STEPwise approach among adults using a multistage, stratified, cluster random sample. Data was collected using a questionnaire which included sociodemographics; tobacco products use habits, history of diabetes, biochemical and anthropometric measurements.

Results: Of the total of 4654 subjects who participated in the study, 1016 (21.8%) were ever smoked tobacco products users and 65 (1.4%) were ever smokeless tobacco products users. Known Diabetes prevalence was 15.3% (712 known diabetics). There were no significant differences in diabetic status and smokeless tobacco products use for both ever and current use. For smoked products diabetics are fewer in current smokers and more in ex smokers. Diabetics started smoking significantly older, smoked for longer duration and higher intensity than non diabetics.

Conclusion: Diabetes appears to be associated with smoked but not smokeless tobacco products use.

Key Words: Tobacco use, diabetes, adults, Saudi Arabia

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Introduction

Diabetes mellitus (DM) is a multifactorial disease where both genetic and environmental factors have significant roles. It is one of the primary causes of disability and premature death in both the developed and developing world (1). The burden of type 2 diabetes is high in the Kingdom of Saudi Arabia (KSA) in terms of morbidity and mortality (2-5). On the other hand, the harmful consequences of smoking on health are well documented (6, 7). It is estimated that governments would save money and avoid many premature deaths if smoking is prevented (8). The tragedy is that smoking is on the rise in most developing countries, including Saudi Arabia (9).

Some older studies reported that the relationship between past smoking and the risk of DM is still unclear (10-12). However, smoking as a risk factor for type 2 diabetes mellitus was reported from many recent international studies (13-20). These cohort and cross-sectional studies suggest that smoking may be an independent and modifiable risk factor for the development of type 2 diabetes. They showed that smokers had a higher diabetes mellitus incidence rate than non smokers and quitting smoking reduced the incidence of diabetes. Smoking increases insulin resistance, worsens diabetes control and all-cause mortality is higher in those who smoke than in those who do not (21). The association of smoking and diabetes was not studied in KSA previously and previous studies on diabetes in KSA did not discuss smoking as a predictor or risk factor of DM (2-5). This study aims to outline the association of tobacco products use and type2 diabetes mellitus among adults. It is hoped that the results may be of help in designing programs to prevent and control the disease.

Material and Methods

This was a cross-sectional, community based study covering the whole of the Kingdom of Saudi Arabia in 2005 the WHO STEPwise approach to Surveillance (STEPS) of Non-Communicable Diseases (NCD) risk factors was the basis for conducting the survey and collecting data (22, 23).

Study population

The study population was the total Saudi population aged 15-64 years of all the 20 health regions of the country.

Sampling

A multistage stratified cluster random sampling technique was used to recruit the study subjects. Stratification was based on age (Five 10 year age groups), gender (2 groups) and health regions of country. Based upon the proposed methodology of the WHO STEPwise approach, a sample size of 196 was calculated for each of these ten strata. A list of all Primary Health Care Centers (PHCCs) in

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each region was prepared and 10% of these PHCCs were randomly chosen, and a regional sample allocated to them proportionate to the size of their catchment population in sampled PHCCs. To identify the households a map of the health center coverage area was used to choose the houses. Each house was assigned a number and a simple random draw was made.

Data collection

Tool used

Data was collected using the WHO STEPwise approach which includes a questionnaire, physical measurements plus biochemical measurements covering hypertension and other chronic diseases and risk factors. The questionnaire was translated into Arabic by a team of physicians and was back translated to ensure the accuracy of translation. The Arabic instrument was pre-tested on 51 eligible respondents for wording and understanding of the questions, and necessary adjustments were made in the instrument in light of the pre-test. The questionnaire includes sociodemographic data, history of blood pressure and blood pressure measurement in addition to other diseases and risk factors.

Data collectors

Data was collected by 54 male and 54 female collectors who worked in teams. Each field team was made up of four persons - a male data collector, a female data collector, a driver and a female assistant. Data collection teams were supervised by a hierarchy of local supervisor, regional coordinators and national coordinator.

Training of data collectors

All individuals involved in data collection attended comprehensive training workshops that included interview techniques, data collection tools, practical applications and field guidelines.

Definition of Diabetes mellitus

A subject is labeled diabetic if he/she a known diabetic as diagnosed by a health professional and under some form of management, pharmacological or non pharmacological, prescribed by a health professional.

Definitions of tobacco use

An ever daily smoker was defined as someone who had attempted smoking any tobacco product daily in the past Ever smokers can be currently non smokers (ex-smokers) or current smokers, daily or non daily. A never smoker was one who had never smoked.

Data management

Questionnaires collected from the field were reviewed by team leaders assigned to each team before submitting them to headquarters for data entry. Double entry of the questionnaires was performed using EPI-INFO 2000 software and EpiData software developed by the Menzes centre for validation. After data entry, data cleaning was conducted. New variables were defined by adopting the standard Steps variables (STEPS Data Management Manual, Draft version v1.5, October 2003).

Statistical analysis

The statistical analysis was performed using SPSS for Windows, version 17.0. The data were presented as mean±standard deviation for continuous variables and as counts and percentage for categorical variables. The Chi-square test was used for association between categorical variables and the t-test or Mann-Whitney U test and ANOVA or Kruskal Wallis tests were used as appropriate after checking for normality. Logistic regression was used to investigate the associations of the binary dependent variable "Diabetic status" with the independent tobacco use variables. The level of significance was set to be <0.05 throughout the study. The number of participants' responses used in the discrete statistical analyses varied due to missing data for certain variables.

Ethical clearance and confidentiality

The protocol and instrument of surveillance were approved by the Ministry of Health, Center of Biomedical Ethics and the concerned authorities in the Kingdom. Informed consent of all subjects was obtained. Confidentiality of data was assured and that data will be used only for the stated purpose of the survey.

Results

A total of 4654 subjects participated in the study. Table 1 shows age, gender, known diabetics distribution and ever smoking tobacco products use. Females (50.4%) were slightly more than males, with the adolescent 15 -24 years of age (22.5%) almost double the elderly 55-64 years (11.5%). Known diabetics totaled 712, giving a prevalence of 15.3%. Table 2 shows the diabetic status according to smoking habits of

Table 1. Distribution of known diabetics according to age and gender n (%)

Age (years) % of total	15-24 22.5%	25-34 23.7%	35-44 24.5%	45-54 17.8%	55-64 11.5%	Total
Gender			Known diabetics			
Males I 2312 (49.6)	11 (2.1)	13 (2.7)	70 (13.6	132 (31.1)	143 (40.1)	369 (16.0)
Females 2345 (50.4)	12 (2.4)	27 (4.3)	92 (14.7)	124 (30.6)	88 (48.9)	343 (14.6)
Total	23 (3.2)	40 (5.6)	162 (22.8)	256 (40.0)	231 (32.4)	712 (100)

Table 2. Smoking habit of smoked tobacco products according to diabetes mellitus status

Smoking habit	Diabetes status		Total	p value
	Diabetic % (n)	Non diabetic % (n)	100 (4654)	
	15.3 (711)	84.7 (3943)		
Ever smoking status				
Smoker	21.7 (154)	21.9 (862)	21.8 (1016)	0.474
Non smoker	78.3 (557)	78.1 (3081)	78.2 (3638)	
Ever daily smoking status				
Ever smoked in the past	16.2 (115)	12.2 (481)	12.8 (596)	0.001
Never smoked in the past	83.8 (596)	87.8 (3462)	87.2 (4058)	
Current smoking status				
Currently smoking	9.4 (67)	11.9 (470)	11.5 (537)	0.029
Currently not smoking	90.6 (644)	88.1 (3473)	88.5 (4417)	
Current daily smoking status				
Daily smoker	8.6 (61)	11.7 (461)	11.2 (522)	0.015
Non daily smoker	91.4 (650)	88.3 (3482)	88.8 (4132)	

Table 3. Smoking habit of smokeless tobacco products according to diabetes mellitus status with odds ratio and 95% confidence interval

Smoking habit Smokeless tobacco products	Diabetes status		Odds ratio	P value
	Diabetic % (n)	Non diabetic % (n)	(95% Confidence	
	15.3 (711)	84.7 (3943)	Interval C.I)	
Ever smoker	1.3 (9)	1.4 (56)	0.890 (0.458-1.907)	0.747
Never smoker	98.7 (702)	98.6 (3887)		
Current smoker	33.3 (3)	66.1 (37)	0.257 (0.058- 1.142)	0.076
Current non smoker	66.7 (6)	33.9 (19)		

Table 4. Age of initiation of smoking, duration and intensity of tobacco products use and diabetes status

Variable/Diabetic status	Mean±standard deviation		p value
	Diabetic	Non diabetic	
Age of initiation of smoking (years)	23.6±16.7	20.3±12.8	0.016
Total duration of smoking (weeks)	25.4±11.7	15.8±11.3	0.032
Age stopped smoking (years)	42.4±19.4	35.4±19.7	0.476
Number of cigarettes per day	22.6±14.6	17.3±10.9	0.010
Number of shisha per day	3.8±4.3	2.8±1.7	<0.001

smoked tobacco products. Ever smokers were 1016 (21.8%). There was no significant association between the ever smoking habit and known diabetes. There is, however, a significant association with ever daily smoking habit. Known diabetics were significantly more ever daily smokers than non diabetics. The reverse is true for current smoking status, where known diabetics were significantly fewer current smokers than non diabetics. Only 64 (1.4%) subjects ever used smokeless tobacco products. No significant association was found between diabetic status and ever and current smokeless tobacco as depicted in Table 3. Table 4 compares age of initiation of smoking, age of cessation, duration and intensity of smoking among known diabetics and non diabetics. Diabetics started smoking significantly older, smoked for longer duration and at higher intensity than non diabetics. All significant variables in the bivariate analysis were entered in the logistic regression model for predictors of known diabetics, as shown in Table 5. Only the age of initiation of daily smoking was a significant predictor of diabetic status, with diabetics starting smoking at an older age.

Table 5. Multiple logistic regression analysis for tobacco use predictors of diabetes mellitus

Predictors						95.0% C.I.O.R.**	
	B	S.E.	Wald	Sig.	O.R.*	Lower	Upper
Number of cigarettes per day	.002	.060	.001	.973	1.002	.891	1.127
Ever daily smoking	.630	.409	2.377	.123	1.878	.843	4.186
Duration of smoking	-.077.	.063	1.490	.222	.926	.819	1.048
Initiation age of smoking	-.031.	.011	7.568	.006	.970	.949	.991
Constant	2.691	.756	12.660	.000	14.751		

O.R.* =Odds Ratio, 95.0% C.I.O.R. ** = 95% Confidence Interval for Odds Ratio

Discussion

The magnitude of tobacco products use as a public health challenge is growing in terms of morbidity andmortality, with large demands on health care systems and increasing cost (24-26). The prevalence of ever smoked tobacco products was nearly 22% among adults in this study, confirming the seriousness of the problem. Smokeless tobacco prevalence is minimal and this is not unexpected as the habit is mostly localized in limited geographical locations, particularly the southern area (23). The prevalence of diabetes in this study is lower than other surveys and this also is not unexpected as our study population consists of only known diabetics under some form of treatment. Newly discovered diabetics during the survey were not included. No significant association was found between diabetes and smokeless tobacco products use in this study. Some studies reported similar findings, while others found that current or lifetime smoking or use of smokeless tobacco is very likely to cause the disease (27, 28). The apparent inconsistency of the results may be due, in addition, to possible confounders, to differences in methods, sampling, assessment of smoking status and biased recall. Diabetics are significantly more ever smoked tobacco products users than non diabetics but significantly fewer current smokers that non diabetics. This could be due to smoking cessation advice among diabetics. This study found that longer durations and higher intensity of smoked tobacco products use were significant risk factors for diabetes among adults in the KSA. This is in agreement with a number of studies which reported that smoking could be independently associated with glucose intolerance, impaired fasting glucose, and development of type 2 diabetes (13-20, 29-32). These studies showed a dose-response relationship between smoking and incidence of diabetes, that cigarette smoking is an independent and modifiable determinant of type 2 diabetes mellitus and that smokers who quit may derive substantial benefit from doing so (33). Health and research authorities in some countries included smoking as a variable in a score of variables predicting diabetes (34).

In general, this study showed that daily smoked tobacco products use appears to be a significant risk factor for diabetes among adults. There is theoretical, biological plausibility that smoking may lead to insulin resistance or inadequate compensatory insulin secretion, impaired glucose tolerance, with a direct effect on beta cells and chronic pancreatitis (31, 32, 35, 36). Other possible explanations for this association can be due to unhealthy habits such as lack of physical activity, poor fruit and vegetable intake (37-39).

There are some inconsistencies in the results of this study. These include lack of association of smokeless tobacco use and diabetes and starting smoking at an older age, which is a significant predictor of diabetes among known diabetics. There is a need for studies that include detailed measurement and adjustment for potential confounding factors such as socioeconomic status, education, and exercise, with a goal of establishing whether there is a real association between diabetes and smoking tobacco use and whether the association is causal.

Whether tobacco products use is associated with smoking or not, it needs to be controlled due to its many other proven health risks. This calls for intervention strategies aiming at the prevention of acquiring the habit of smoking, reversing it if acquired, or reducing intensity by cessation programs. This effort is multisectorial involving, in addition to health authorities, education, youth and media authorities. In the meantime, all physicians and other health professionals should enquire about smoking habits in all clients generally and in diabetic patients particularly in order to offer quitting services for smokers.

Study limitations

The study sample consistd of only known diabetics and hence unknown diabetics may not show the same association with tobacco products. Smoking habits were self reported by subjects themselves and were not biochemically verified.

Conclusion

Diabetes appears to be significantly associated with daily smoked tobacco products but not with smokeless tobacco products use. Further studies are needed to confirm and quantify this association, taking in consideration possible confounders. Studies concentrating on smokeless tobacco products use and diabetes may be needed particularly in areas where the habit is prevalent.

Conflict of Interest

No conflict of interest was declared by the authors.

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