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Original Research Article

Non-insulin dependent diabetes mellitus and risk factors: a case control study from Andhra Pradesh

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ABSTRACT

Background: It is well known that several factors influence the development of non-insulin dependent diabetes mellitus (NIDDM) such as genetic, environmental and life style factors. Obesity is the strongest modifiable risk factor for NIDDM. Cigarette smoking and alcohol consumption may also have important roles, either indirectly through their effects on obesity or directly through physiological factors related to insulin secretion or insulin resistance. The objective of the study was to study the risk factors of non-insulin dependent diabetes mellitus among the patients attending Chalmeda Anand Rao Institute of Medical Sciences Hospital.
Methods: It is a hospital-based case-control study for risk factors in NIDDM. The study was conducted at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar during the period of June 2010 to May 2011 involving 147 cases and controls each. Data collected and analyzed using SPSS 14 version.
Results: 21.59% of the male cases were in the age group of 46-50 years and 20.97% female cases from 56-60 yrs age. 42% cases and 12% controls had history of diabetes mellitus in one parent. 34% cases and 4.67% controls had history of diabetes mellitus in both the parents. Current smokers (odds ratio-4.24, 95% CI 2.02-9.15) and ex-smokers (odds ratio-1.31, 95% CI 0.65-2.68) exhibited an increased risk of NIDDM. Ex-drinking but not current-drinking was statistically significantly associated with the risk of NIDDM. Sedentary work was associated with an increased risk of NIDDM with an odds ratio of 3.90 (95% CI 2.30-6.63).
Conclusions: Apart from other risk factors, smoking and alcohol consumption are significant lifestyle risk factors for NIDDM in males.

Keywords: Risk factors, NIDDM, Case control

INTRODUCTION

The population in India has increased susceptibility to diabetes. Recent studies have shown that India has largest diabetic population in the world, one fourth of the world's diabetic population. India is thus the "Diabetic capital of the world". The prevalence of disease in adults is found to be 2.4% in rural and 4.0-11.6% in urban dwellers. The number of diabetics in India was 31.7 million in the year 2002 and it is estimated that it could be 79.4 million by 2030. High frequencies of impaired tolerance, shown by various studies, ranging from 3.6-9.1%, indicate the potential for further rise in prevalence of diabetes in coming decades.[1]

Diabetic patients, if undiagnosed or inadequately treated, develop multiple chronic complications leading to irreversible disability and death. Coronary heart disease is more common in diabetics than in the general population. Microvascular complications like diabetic renal diseases

diabetic retinopathy and diabetic neuropathy are serious health problems resulting in deterioration of the quality of life and premature death. Diabetes also destroys the most productive period of patient's lives.[2]

At present, there is global epidemic of non-insulin dependent diabetes mellitus (NIDDM) with projected morbidity and mortality that are both of enormous magnitude.[3] It is well known that several factors influence the development of NIDDM-genetic, environmental and life style factors.[4,5] Obesity is the strongest modifiable risk factor for NIDDM. However, cigarette smoking and alcohol consumption may also have important roles, either indirectly through their effects on obesity or directly through physiological factors related to insulin secretion or insulin resistance.[6,7]

Advancing age, upper body fat distribution and a family history of diabetes are among the well-established risk factors for this condition. Evidence is increasing that in some populations NIDDM shares common causal factors with cardio-vascular diseases and in particular with coronary artery disease, which has given rise to the concept of "common soil" risk factors.[8]

The present study was undertaken to identify risk factors and to quantify the strength of their association with NIDDM.

METHODS

The present study, a hospital-based case-control study, was carried out to study the risk factors for NIDDM and their relative importance. The study was carried out at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar from June 2010 to May 2011 for a total period of one year.

Sample size

The sample size was computed based on the estimates of the relative risks for important risk factors and their corresponding prevalence in population. Relative risks for risk factors were estimated from the results of the pilot study. The prevalence of exposure in controls (P_0) was obtained from literature (Table 1). The sample size was estimated for 1:1 case-control ratio and considering α=0.05 and β=0.20 by the formula given below.

$$n = \frac{2\mathrm{p} - \mathrm{q} - (Z_\alpha + Z_\beta)^2}{(P_1 - P_0)^2}$$

$p=½ (p_1 + p_0)$

q=1-p

$$P_1 = \frac{P_0 RR}{[1 + P_0(RR - 1)]}$$

Table 1: Variables considered for sample size calculation.

Risk factors	Odds ratio	P0 (%)	n
Family h/o diabetes	11.29	4	35
Past h/o hypertension	3.91	4	147
Smoking	1.15	52.63	3298
Alcohol	2.06	47.37	135
BMI	-	-	33
Exercise	0.85	16	4778

The sample size for the risk factor past history of hypertension, that is, 147 was chosen as it was the largest feasible estimate. This number was rounded up to 150 and equal number of controls was taken.

Selection of cases

A case of NIDDM was defined as a person having fasting plasma glucose levels ≥7.6 mmol/l (>126 mg/dl) and/or a 2-hour post-load plasma glucose level ≥11.1 mmol/liter (>200 mg/dl) according to WHO criteria.[9]

Inclusion criteria

Inclusion criteria were patients attending diabetic clinic; diagnosed by blood sugar examination; newly detected cases, that is, diagnosed within 2 years; age more than 30 years; only NIDDM cases.

Sources of cases

The cases were the patients attending Chalmeda Anand Rao Institute of Medical Sciences Hospital, Karimnagar during the period of June 2010 to May 2011.

Selection of controls

For each case of NIDDM, one control was selected.

Inclusion criteria

Inclusion criteria were non- diabetic admitted patients; blood sugar within normal limits.

Sources of controls

Controls were randomly selected from patients admitted to wards (Surgery, Medicine, Obstetrics and Gynecology, ENT etc.) of Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar. Those patients fulfilling selection criteria for controls were included in the present study.

Matching

Cases and controls were matched for age and sex. Group matching (frequency matching) was done on five years class intervals, that are 31-35 years, 36-40 years, 41-45 years and so on. The number of controls selected was

equal to the number of cases in respective five years age-groups. There were equal number of males and females in the case and control groups.

Data collected and analyzed using SPSS 14 version.

RESULTS

Table 2 depicts age and sex distribution of the study subjects. It showed that majority, that is 19 (21.59%), of the male subjects were in the age group of 46-50 years followed by 51-55 years of age group and 61-65 years of age group (15 cases each, 17.04%), and 56-60 years of age group (12 cases, 13.64%). Together, 72 male cases (81.81%) had age more than 45 years. Among females, majority were in the age group 56-60 years (13 cases, 20.97%) followed by 46-50 years (12 cases, 19.35%) and 51-55 years age group and 41-45 years age group had 10 (16.13%) and 9 (14.52%) cases respectively.

Table 3 shows the risk of NIDDM by history of diabetes mellitus in parents. Thirty-six (14.00%) cases and 125 (83.33%) controls did not have history of diabetes mellitus in either parent, while 63 (42.00%) cases and 18 (12.00%) controls had history of diabetes mellitus in one parent. Fifty-one (34.00%) cases and only 7 (4.67%) controls had history of diabetes mellitus in both the parents. These differences between cases and controls were statistically significant ($p<0.00001$). These observations indicate that a clear familial tendency was exhibited by NIDDM in the present study.

Table 2: Age and sex distribution of the study subjects.

Age group (in years)	Cases				Controls			
	Males	%	Females	%	Males	%	Females	%
31-35	4	4.55	3	4.84	4	4.55	3	4.84
36-40	4	4.55	6	9.68	4	4.55	6	9.68
41-45	8	9.09	9	14.52	8	9.09	9	14.52
46-50	19	21.59	12	19.35	19	21.59	12	19.35
51-55	15	17.04	10	16.13	15	17.04	10	16.13
56-60	12	13.64	13	20.97	12	13.64	13	20.97
61-65	15	17.04	7	11.29	15	17.04	7	11.29
66-70	6	6.82	1	1.61	6	6.82	1	1.61
71-75	3	3.41	1	1.61	3	3.41	1	1.61
>75	2	2.27	0	0	2	2.27	0	0

Cases- Mean age=54.01, SD=9.67, Range=31-78 years; Controls- Mean age=53.17, SD=10.42, Range=32-82 years.

Table 3: Risk of NIDDM by history of diabetes in parents.

History of DM	Cases		Controls		OR	(95% CI)
	N	%	N	%		
Both parents	51	34.00	7	4.67	10.52	4.47-28.43
One parent	63	42.00	18	12.00	5.31	2.85-10.15
Neither parent	36	14.00	125	83.33	0.06	0.03-0.11
Total	150	100	150	100		

$x^2=107.6$, df=2, $p\leq0.0000001$.

Table 4: Association of smoking and NIDDM in male subjects.

Smoking status	Cases	Controls	Total
Smokers	69	38	107
Non-smokers	19	50	69
Total	88	88	176

$x^2=22.91$, p=0.000001, OR=4.77 (95% CI=2.35-9.81).

Table 4 shows the distribution of the male subjects according to the history of smoking. Females were excluded from analysis as no female smoked. Out of the 176 male subjects (88 cases and 88 controls), 19 (21.59%) cases and 50 (56.82%) controls never smoked, 28 (31.81%) cases and 23 (26.13%) controls were ex-smokers while 41 (46.60%) cases and 15 (17.05%) controls were currently smoking. Current smokers (odds ratio-4.24, 95% CI 2.02-9.15) and ex-smokers (odds ratio-1.31, 95% CI 0.65-2.68) exhibited an increased risk of NIDDM when compared with the never-smokers (odds ratio-0.20, 95% CI 0.10-0.42). The categories of current smokers and ex-smokers were therefore combined

assuming that those cases who have given up smoking will have been classified as ex-smokers.

Table 5: Association of alcohol intake and risk of NIDDM in male subjects.

Alcohol drinking status	Cases	Controls	Total
Drinker	50	30	80
Never drinker	38	58	96
Total	88	88	176

X^2=9.17, df=1, p=0.0025, OR=2.54 (95% CI=1.324.91).

Table 5 shows the distribution of the study according to the history of alcohol intake. Again, females were excluded from this analysis as no females had history of alcohol intake. Out of the 88 male subjects in each study group, 38 (43.18%) cases and 58 (65.91%) controls were non-drinkers. Thirty-three (37.50%) cases and 19 (21.59%) controls were ex-drinkers whereas, 17 (19.32%) cases and 11 (12.50%) controls were current-drinkers. Compared with the non-drinkers the odds ratio for ex-drinkers was 2.65 (95% CI 1.25-5.66) while the current-drinkers had an odds ratio of 2.36 (95% CI 0.92-6.11).

The present study meant that ex-drinking but not current-drinking was statistically significantly associated with the risk of NIDDM.

Table 6: Distribution of study subjects according to physical activity.

Grade of physical activity	Cases		Controls	
	No.	%	No.	%
Sedentary	116	77.33	70	46.67
Moderate	32	21.33	79	52.66
Heavy	2	1.34	1	0.67
Total	150	100	150	100

x^2 =31.61, df =2, p<0.0001 OR =3.90, (95%CI=2.30-6.63).

Table 6 shows the distribution of study subjects according to the physical activity. Overall, 139 (92.67%) cases and 138 (92.00%) controls were currently or previously employed, the remaining subjects were unemployed.

Using the classification of physical activity suggested by Gopalan et al it was observed that 116 (77.33%) cases and 70 (46.67%) controls were engaged in sedentary type of work, 32 (21.33%) cases and 79 (52.66%) controls were involved in moderate type of work while two (1.34%) cases and one (0.67%) controls were doing heavy physical work.[10] The overall, x^2 was 31.61 with a highly significant (p<0.0001) indicating that physical activity as measured by the type of work the subjects were engaged in was a significant risk factor for NIDDM. Specifically, sedentary work was associated with an increased risk of NIDDM with an odds ratio of 3.90 (95% CI 2.30-6.63).

DISCUSSION

Age wise distribution

Abahusain et al studied 107 patients of NIDDM and it was found that mean age at onset was 43 years (±9.6).[11] Acemoglu et al studied 2,062 patients of NIDDM (50.6% females, 49.4% males).[12] They found the prevalence to be 1.28% in 30-39 years, 5.03% in 40-49 years, 5.59% in 50-59 years and 7.59% over 60 years of age group. The prevalence of type 2 DM increased by the increases at ages (p=0.0001). Adler AI et al observed that 30.9% of the 55 Alaskan subjects with glucose intolerance were males whereas the remaining 69.1% were females.[13] Fagot-Campagna et al in a cohort study observed that during a mean follow up of 10 years the incidence of NIDDM was 50% in males and 43.9% in females.[14] These studies indicate a slightly higher prevalence of diabetes in males as compared to females as observed in the present study.

Smoking and NIDDM

The combined odds ratio for smokers was 4.77 (95% CI 2.35-9.81) and this was statistically significant (p<0.0001). Thus, the present study demonstrated a significant association between smoking and NIDDM.

Manson et al observed that smokers had a dose-dependent increased risk of developing type 2 diabetes mellitus: compared with never smokers, the age adjusted relative risk was 2.1 (95% CI 1.7-2.6) for current smokers of >20 cigarettes per day, 1.4 (95% CI 1.0-2.0) for current smokers of <20 cigarettes per day, and 1.2 (95% CI 1.0-4) for past smokers.[15] Nakanishi et al observed that the relative risk for type 2 diabetes mellitus compared with never smokers was 1.08 (95% CI 0.34-3.42) for ever smokers.[16] Persson et al observed that the odds ratio of type 2 diabetes mellitus was 2.6 (95% CI 1.1-5.9) for former as well as current cigarettes smokers when compared with never smokers.[17]

All these studies have shown a positive association between smoking and NIDDM which were comparable with the observations of the present study.

Alcohol intake and NIDDM

The combined analysis found that alcohol intake was significantly associated with the risk of NIDDM (p=0.0025) with an odds ratio of 2.54 (95% CI 1.32-4.91). Alcoholics are at an increased risk for diabetes, perhaps because of pancreatitis or hepatic dysfunction, but the effects of moderate alcohol intake are uncertain. Both deterioration and improvement in glucose tolerance after moderate alcohol administration have been observed in short term experiments.

Ajani et al observed an inverse association between light to moderate alcohol consumption and subsequent risk of

type 2 diabetes (RR 0.74, 95% CI 0.62-0.89).[18] Carlsson et al on other hand observed a positive association between high consumption of alcohol and the risk of NIDDM in men (OR-2.1, 95% CI 1.0 -4.5).[19] Wei et al also observed a positive association between alcohol intake and the risk of NIDDM (OR-2.4, 95% CI 1.4-4.4).[20] The present study also demonstrated a significantly high risk of NIDDM in alcoholics.

Physical activity and NIDDM

Okada et al observed that men who engaged in vigorous activity at least once a week had a multiple adjusted relative risk of type 2 diabetes of 0.55 (95% CI 0.35-0.88) compared with sedentary men.[21] Fulton et al in a case control study observed that persons with recently diagnosed NIDDM reported significantly lower levels of physical activity than control subjects.[22] Hu et al observed that time spent in watching television, a major sedentary behavior was significantly associated with higher risk of diabetes and increasing physical activity is associated with a significant reduction in risk for diabetes (p for trend <0.001).[23]

CONCLUSION

From the present study, it can be concluded that increasing age and family history of diabetes are important non-modifiable risk factors for NIDDM.

In the present study it is identified that both smoking and alcohol consumption are significant lifestyle risk factors for NIDDM in males.

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