PREVALENCE OF, AND FACTORS ASSOCIATED WITH, TYPE 2 DIABETES AND ITS MICROVASCULAR COMPLICATIONS AMONG THE ELDERLY IN KATHMANDU, NEPAL

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ABSTRACT: Diabetes mellitus (DM) has caused global pandemic which principally involves type 2 DM. DM can cause several complications including microvascular complications, that impose a tremendous burden on the individual and on the health care system. The main purpose of this study was to determine the prevalence of type 2 DM and its microvascular complications, and to identify factors associated with these, among the elderly population of Kathmandu, Nepal. A cross-sectional study was conducted among 306 participants aged 60 years and above at Kathmandu district. Firstly, home visits were conducted, where a structured questionnaire was administered by the interviewer. Anthropometric measurements, blood pressure and fasting blood glucose test were done using standard medical tools. Those who were identified as diabetic during home visits were invited to a health camp later, where a detailed physical examination was done to detect microvascular complications. Associations of independent variables with presence of type 2 DM, and of microvascular complications, were assessed in bivariate analysis with binary logistic regression. The study reveals that prevalence of type 2 DM in this study was 23.5% and among all cases of type 2 DM 26.3% were the new cases diagnosed during survey and 43.1% had one or more microvascular complications. Inadequate physical activity, unhealthy diet, frequent visit to fast food centers, family history of type 2 DM, presence of hypertension and history of gestational diabetes mellitus were statistically significantly positively associated with presence of type 2 DM. Above normal waist circumference and DM duration were significantly positively associated with microvascular complications of type 2 DM, as compared to DM without such complications. In conclusion, the prevalence of type 2 DM and its microvascular complication was high in Kathmandu. The burden of undetected cases was also high. This warrants mass screening for diagnosing diabetes. The burden of microvascular complications should also alert olicy makers to devise some strategy to increase access to health care facilities. Health education and cost effective preventive interventions should be promoted on a mass scale in order to prevent the rising trend of type 2 DM.

Keywords: Diabetes mellitus type 2, Microvascular complications, Elderly, Nepal

INTRODUCTION

Diabetes mellitus (DM) is a clinical syndrome characterized by hyperglycemia due to absolute or relative deficiency of insulin [1]. Around 346 million people worldwide have diabetes. The estimated prevalence of diabetes for all age-groups worldwide was around 2.8% in 2000, and is projected to be 4.4% in 2030 [2]. Non communicable diseases (NCDs) have emerged as major causes of mortality and morbidity, not only in economically advanced countries, but also in Low and middle income countries [3].

In Nepal, like other developing countries, the disease pattern is changing from infectious to chronic (epidemiological transition). Burden of infectious diseases is still high; on the top of that it is also facing the problem of NCDs [4]. Furthermore, the population pyramid of Nepal is changing over the time and in future Nepal is going to have a larger elderly population [5]. Hence the concern for non communicable disease and its effect on the population mainly aging population is increasing.

NCDs are major contributors in mortality in Nepal, accounting for 50% of all mortality. Diabetes has become a significant public health problem Nepal especially in urban Nepal. The prevalence of undetected type 2 DM is high especially in low income countries and Nepal is no exception [6]. A previous study among elderly population in Nepal shows that the overall prevalence of type 2 DM was

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around 25.9% and almost half of the cases were diagnosed during the study [7]. Several complications associated with type 2 DM, such as nephropathy, retinopathy, neuropathy, cardiovascular disease, stroke, and death, can be delayed or prevented with adequate and timely treatment of elevated blood glucose [8].

In a resource scarce country like Nepal for many reasons diagnosis of type 2 DM is delayed or not made. Therefore, it is important to find out prevalence of type 2 DM and its microvascular complications among elderly, and to assess factors associated with these disorders. However, very few studies have been done in Nepal related to diabetes and its microvascular complications among elderly. The present study was an effort to find out prevalence of type 2 DM and its microvascular complications (dependent variables), as well as to assess factors associated with them (independent variables).

MATERIALS AND METHODS

A cross-sectional study was conducted to find out prevalence of type 2 DM and its microvascular complication as well as factors associated with them among elderly population of Kathmandu district, Nepal. A two-stage sampling scheme was adopted; first a simple random sampling was done to select study sites from Kathmandu district (2 urban and 2 rural); second, a total of 306 participants were selected by systematic sampling from those 4 study sites.

Data collection was done in two steps: (1) home visits and (2) health camp visit. During home visits a structured interviewer administered questionnaire was used to collect data related to socio-demographic factors, lifestyle factors, history of health check-ups and medical history related to type 2 DM and its microvascular complications. Standard medical protocol was followed to measure height and weight, waist circumference, blood pressure and fasting blood glucose level. All participants diagnosed as diabetic during home visit or on anti-diabetic medication or previously diagnosed as diabetic by a doctor were considered to have type 2 DM. They were also invited to the health camp; this visit included detailed physical examination for peripheral neuropathy, retinal examination and reviewing of medical records to identify these and other microvascular complications.

Collected data were edited and coded, and analysis was done using SPSS version 17. The prevalence of type 2 DM and prevalence of microvascular complications of type 2 DM among diabetic elderly were presented by using frequency and percentage. Bivariate analysis was done to assess the association between each independent variable and the dependent variables. In assessing risk factors for DM, non-diabetics were the reference group. In assessing risk factors for microvascular complications, DM patients without such complications were the reference group. Bivariate analysis was done using logistic regression with $p<0.05$ taken to indicate statistical significance.

ETHICAL CONSIDERATION

This research and its measurement tools was reviewed and approved by Nepal Health Research Council (NHRC), Ministry of Health and Population (MoHP). Informed consent forms were was signed by all the participants.

RESULTS

In this study population had median age of 71 years with maximum number of participants in the age bracket of 60 – 69 years. The prevalence of type 2 DM was 23.5%. Among all cases of type 2 DM 19 (26.3%) were the new cases diagnosed during survey and 43.1% have one or more of the microvascular complications. Furthermore, among diabetic participants with microvascular complications 31.9% had retinopathy, 18.1% have nephropathy and 22.2% have neuropathy.

Descriptive analysis showed that elderly aged above 80 years, unhealthy diet, inadequate physical activity, heavy smoking, heavy drinking have higher percentage of type 2 DM. Participants having, hypertension, family history of type 2 DM also have higher percentage of type 2 DM than those without such history. Among female participants those having history of gestational diabetes mellitus (GDM) have higher percentage of type 2 DM. Similarly, microvascular complications was higher among participants with age above 80 years, no physical activity, heavy smoking, heavy alcohol drinking, obesity hypertension, family history of type 2 DM and DM Duration more than 10 years.

Table 1, smoking status (never, past and current smoker), current smokers (light, moderate and heavy smokers), alcohol drinking (never, past and current drinker), current alcohol drinking (social, healthy and heavy drinker), diet (healthy and unhealthy food habit), fast food center visits, family history of type 2 DM, GDM, hypertension, body mass index (BMI) and waist circumference were positively and significantly associated with type 2 DM. Whereas, variables like age, gender, residential area, marital status, caste, education level, physical activity, and health check-ups were statistically insignificant.

Table 1 Associations between independent variables and presence of type 2 DM*

Variables	Odds Ratio (OR)	*p-value*
Smoking Status		0.034†
Never Smoker (Ref)	1.00	
Past Smoker	1.61	0.137
Current Smoker	2.36	0.011
Current Smokers		0.002
Not Current Smoker (Ref)	1.00	
Light Smoker	0.79	0.651
Moderate Smoker	1.62	0.342
Heavy Smoker	6.96	<0.001
Current Alcohol Consumption		0.001†
No current Drinking (Ref)	1.00	
Light to Moderate Drinking	1.25	0.466
Heavy Drinking	4.32	<0.001
Diet		
Healthy Diet (Ref)	1.00	
Unhealthy Diet	2.55	0.001
Fast Food Center Visit		<0.001
Never Visit (Ref)	1.00	
<1 times/ week	1.41	0.332
1-2 times/ week	3.19	0.001
>2 times/ week	14.90	<0.001
Family History of type 2 DM		
No Family History (Ref)	1.00	
Family History	5.28	<0.001
Gestational Diabetes Mellitus (GDM) (n = 157)		
No GDM History (Ref)	1.00	
GDM History	14.40	<0.001
Hypertension		
No Hypertension (Ref)	1.00	
Hypertension	3.62	<0.001
Body Mass Index (BMI)		0.006†
Normal or low BMI (Ref)	1.00	
Overweight	4.81	0.002
Obesity	4.57	0.004
Waist Circumference (WC)		
Normal WC (Ref)	1.00	
Above Normal WC	2.19	0.007

* The reference group is partiipants without diabetes.

† *P-value* for the entire factor.

Table 2 Associations between independent variables and microvascular complications*

Variables	Odds Ratio (OR)	*p-value*
Family History of DM (FHDM)		
No FHDM (Ref)	1.00	
FHDM	4.23	0.005
Hypertension		
No Hypertension (Ref)	1.00	
History of Hypertension	3.12	0.024
Waist Circumference (WC)		
Normal WC (Ref)	1.00	
Above Normal WC	3.32	0.039
Anti-Diabetic Medications		
DM with Medication (Ref)	1.00	
DM without Medication	0.30	0.033
DM Duration		<0.001†
< 5 Years (Ref)	1.00	
5 – 10 Years	6.30	0.007
>10 years	19.04	<0.001

* The reference group was type 2 DM without microvascular complications.

† *P-value* for the entire factor.

Table 2, independent variables such as family history of type 2 DM, waist circumference, hypertension, and DM duration were positively and significantly associated with presence of microvascular complications. Whereas, variables like age, gender, residential area, marital status, caste, education level, physical activity, diet, smoking, alcohol drinking, body mass index and health check-ups were statistically insignificant. In this analysis diabetic with no microvascular complications were the reference group. In contrast, taking anti-diabetic medication (OR = 0.30) was negatively and significantly associated with presence of microvascular complications.

DISCUSSION

This study investigated the prevalence of, and factors associated with, type 2 DM and its microvascular complications. In this study type 2 DM was seen in 72 (23.5%) of all the participants which is similar to other studies conducted in Kathmandu, Nepal. A different study among 1710 elderly participants in Kathmandu has shown 25.9% as the prevalence of type 2 DM [7]. The total number of new cases of type 2 DM diagnosed during the present study was 19 (26.3%) among all 72 type 2 DM cases. A study in Gaddap town, Pakistan, reported that the prevalence of new cases of type 2 DM was 33.3% (419) out of 1,258 cases of type 2 DM [9]. In contrast prevalence study at Thailand shows 4.8% as newly diagnosed case of type 2 DM [10]. Better health system of Thailand can be the reason for such variance. In these three studies the participants were of different age groups so it may be difficult to draw an exact inference. However, it tells us that there is a huge burden of undiagnosed cases of type 2 DM. Out of all 72 cases of type 2 DM in this study 43.1% (31) have one or more of the microvascular complications and among them 31.9% have retinopathy, 18.1% have nephropathy and 22.2% have neuropathy. A population based study in Thailand among diabetic participant with mean DM duration of 7 years shows that the prevalence of diabetic nephropathy and diabetic retinopathy were 33.9% and 22.8% respectively [11]. These findings emphasize that microvascular complications are common among patients with type 2 DM.

In this study age was not significantly associated with type 2 DM. Unhealthy diet shows significant positive association with type 2 DM (OR 2.55; *p-value* 0.001) i.e. with unhealthy food habits (high in fatty food, low in fruits and vegetables) the odds of having type 2 DM will be 2.55. In a Finnish cohort study with 23 year follow up among 4,304 participants (age group 40 - 69 years) shows that diet rich in vegetables and fruits protective factor against type 2 DM (Relative Risk (RR) 0.72), whereas diet rich in potatoes, whole milk, butter, etc. enhance the risk of type 2 DM (RR: 1.49) [12]. In this study GDM was statistically significant and positively associated with type 2 DM with the OR of 14.40 and *p-value* of <0.001. In China a group of women were studied 5 – 10 years after delivery who were diagnosed as GDM in their previous pregnancies shows that 33.3% develop type 2 DM [13]. In this study, hypertension was significantly positively associated with type 2 DM (OR 3.62 *p- value* <0.001). Another study in Nepal also shows that Hypertension was significantly associated with type 2 DM [7]. Waist circumference was significantly positively associated (OR: 2.19; *p-value* 0.007) with type 2 DM during bivariate analysis. Increase in intra-abdominal fat leads to increase in waist circumference. Intra- abdominal fat is more strongly associated with insulin resistance than fat elsewhere in the body [14].

Microvascular complications associated with type 2 DM is a major cause of disability among elderly. In this study waist circumference was significantly positively associated with prevalence of one or more microvascular complications (OR 3.32; *p-value* 0.039). A prospective study at Montes de Barbanza public health center, Spain where 376 diabetic patients participated shows that those type 2 DM participants who had above normal waist circumference tend to have Microvascular complications; mean waist circumference of type 2 DM patient with microvascular complication was 103+ 12 which was statistically significant too [15]. A comparison between current study and study at Montes de Barbanza public health center is hard to make as the studies were conducted in different settings. Nevertheless, some inference can be drawn, as mean age of participants in both studies were similar. Both the studies indicate that having waist circumference above normal range can increase the risk of microvascular complication among type 2 DM patients. History of hypertension was significantly positively associated with prevalence of one or more than one microvascular complications in this study during bivariate analysis (OR: 3.12; *p-value* 0.024). Population based Sri Lankan study also shows that hypertension is significantly associated with microvascular complications with retinopathy OR: 2.0, neuropathy OR: 2.01 and nephropathy OR 1.53 [16]. In this study Anti-diabetic medication was significantly negatively associated with microvascular complication in bivariate analysis.

Several studies suggest that better glycemic control can be preventive against microvascular complications [17- 19]. In this study such variation may be due to the fact that out of all diabetic in this study 48 took medication and 24 did not. Among those 24 cases 19 were new cases diagnosed during the study. This could be cited as a reason why no medication is protective against microvascular complication as studies had proved that duration of type 2 DM is one of the important predictor of microvascular complications [14]. In the present study, duration of diabetes was longer in diabetics with microvascular complications than in other diabetics. Several literatures do prove that duration of type 2 DM as a very important predictor of microvascular complications among type 2 DM patient. Risk of microvascular complications increases as the duration of type 2 DM increases and usually in second decade of type 2 DM microvascular complications becomes more evident [14].

In conclusion this study highlights the fact that prevalences of type 2 DM and its microvascular complication are high in Kathmandu, and that the frequency of previously undetected type 2 DM cases is high. The burden of type 2 DM and its microvascular complications should alert policy makers to devise some strategy to increase access to health care facilities. Health education and cost effective preventive interventions must be promoted to prevent the rising trend of type 2 DM.

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