Prevalence and determinants of diabetes among the elderly population in the Kathmandu Valley of Nepal

MR Chhetri[1,2] and RS Chapman[1]

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, [2]Nepal Medical College, Kathmandu, Nepal

ABSTRACT

Elderly populations are susceptible to many non-communicable diseases, including diabetes. Lack of awareness regarding disease status and risk factors increase complications and mortality. We conducted a cross-sectional community-based study of 1633 randomly selected participants aged 60 years and above in urban and rural areas in the Kathmandu Valley of Nepal. Study goals were: (i) to determine the prevalence of diabetes in elderly subjects as diagnosed prior to and during the study, and (ii) to identify and compare the determinants of diabetes as diagnosed prior to and during the study. A structured questionnaire was used to collect information regarding prevalence and potential determinants of diabetes diagnosed during and before the survey. Anthropometric measurements, blood pressure measurements and fasting blood sugar tests were also measured. Risk factor analysis was done using multinomial logistic regression; subjects with no diabetes constituted the reference group. We detected an overall diabetes prevalence of 25.9%, 17.3% diagnosed during the survey and 8.6% previously diagnosed. Age, disturbed sleep, and family history of hypertension were marginally significantly ($p<0.10$) associated with diabetes diagnosed in the survey. In contrast, education, exercise, health perception, family history of hypertension, having a caretaker at night, receiving help from friends when seeking health care and mean waist circumference were significantly (p£0.05) or marginally associated with diabetes detected before the survey. The high prevalence of diabetes in the elderly population studied, and the low level of prior diagnosis, identify an important public health problem. There is a need for improved screening of diabetes and improved health care and education in the elderly. There is also need for better understanding of risk factors associated with previously undiagnosed diabetes.

Keywords: Diabetes, elderly, awareness, burden of disease, determinants.

INTRODUCTION

The prevalence of type 2 diabetes is increasing world wide due to change in life style and growing number of aging population.[1] Diabetes was once thought to be a problem exclusively of developed countries and the wealthy. Now it is clear that diabetes imposes a heavy disease burden in both developed and developing countries. In Nepal, for example, diabetes is an endemic disease, and is bringing new challenges in connection with rapid urbanization and modernization.[2] As the population ages, it is expected that prevalence of chronic diseases such as diabetes and hypertension will rise sharply.[3]

Many or most elderly people in Nepal are suffering from diabetes or hypertension, but, for various reasons, diagnosis may be delayed or not made at all. Diabetes and hypertension are significant and related public health problems in those aged 40 or more in urban Nepal.[4] Diabetes mellitus is a common health problem in old age and it was identified that an elderly patient suffering from depression had combined physiological, psychological and social needs.[5] A hospital based study also identified higher blood glucose level among critically ill patient therefore, increased awareness regarding potential harm of hyperglycemia and systemic approach for lowering blood sugar was suggested.[6] Different studies have shown that diabetes and hypertension occur more frequently in the elderly than in younger people.[7]

There are only few published reports of the population prevalence of diabetes in Nepal, and no nationwide diabetes prevalence surveys have been conducted in the elderly. Some hospital-based surveys have revealed an increasing prevalence of diabetes.[8] Reliable statistics regarding the prevalence of diabetes and its determinants are generally not available from Nepal. Similarly, to the best of our knowledge, studies comparing determinants of diagnosed and previously undiagnosed diabetes cases are rare. Therefore, this study was conducted to identify the burden and determinants of diabetes in the elderly population of Nepal. We also identified and compared the determinants of diabetes between cases diagnosed before and during the survey.

MATERIALS AND METHODS

This was a cross sectional study conducted among the elderly population of three districts of Kathmandu valley. Study participants were persons 60 years and above, who

Table-1: Results of bivariate analysis for diabetes diagnosed during and before the survey

Variables	Diabetes diagnosed				Overall likelihood Ratio Test (2 degrees of freedom)	
	During survey		Before survey			
	Odds ratio	P-value	Odds ratio	P-value	χ^2	P-value
SOCIO DEMOGRAPHIC						
Age in years	1.02	0.038	0.98	0.150	7.35	0.025
Female vs. Male	1.02	0.856	0.67	0.024	5.36	0.068
Urban vs. Rural	0.99	0.939	1.12	0.509	0.46	0.793
Migration vs. permanent resident	0.81	0.199	1.02	0.906	1.78	0.410
Education (6 levels, low to high)	1.00	0.905	1.32	<0.001	23.35	<0.001
Occupation(factor,6categories)					19.47	0.035
Caste(4 levels ,low to high)	1.01	0.795	1.00	0.978	0.07	0.965
Non Hindu vs. Hindu	0.70	0.315	1.16	0.699	1.36	0.504
Nuclear family vs. Other	1.27	0.118	0.85	0.477	3.28	0.193
Married currently vs. others	0.86	0.277	1.26	0.244	2.97	0.226
BEHAVIORAL						
Current smoking	0.84	0.220	0.87	0.442	1.89	0.389
Past smoking	1.14	0.365	1.08	0.713	0.87	0.647
Any smoking	0.95	0.696	0.92	0.664	0.29	0.862
Current alcohol drinking	0.97	0.876	1.11	0.658	0.24	0.886
Past alcohol drinking	1.02	0.927	2.15	0.001	10.45	0.005
Any alcohol drinking	0.97	0.846	1.67	0.006	7.79	0.020
Exercise	1.24	0.153	2.50	<0.001	24.22	<0.001
Fruit consumption (5 levels, low to high)	1.12	0.063	1.08	0.323	4.05	0.132
Vegetarian	1.20	0.201	0.86	0.457	2.49	0.287
Vegetable consumption(3 levels , low to high)	1.03	0.613	1.09	0.357	1.02	0.599
Meat consumption(5 levels, low to high)	0.99	0.866	1.13	0.080	3.30	0.080
Fast food consumption	0.88	0.330	0.81	0.232	2.09	0.352
HEALTH PERCEPTION						
Health perception (3 levels, good to poor)	1.00	0.962	2.08	<0.001	26.08	<0.001
Mental tension	1.04	0.867	1.50	0.165	1.92	0.383
Takes medicine for tension	0.80	0.625	2.23	0.048	3.97	0.137
LIFE STYLE						
Care taker at night	0.97	0.857	0.50	0.031	5.53	0.063
Sleep < 6 hours vs. Longer	1.02	0.916	0.99	0.600	0.31	0.856
Disturbed sleep(3levels, low to high)	1.15	0.129	1.08	0.522	2.43	0.296
Relation with family(3 levels good to poor)	1.19	0.131	0.96	0.802	2.45	0.296
Social participation(3 levels , low to high)	1.03	0.439	1.14	0.013	6.17	0.046
Religious activities (5 levels ,low to high)	0.99	0.895	1.11	0.209	1.73	0.420
Receives help from family (3 levels, low to high)	0.83	0.073	1.50	0.027	9.97	0.007
Visits health centre regularly	0.93	0.587	1.77	0.002	10.99	0.004
Family helps visit health centre	0.74	0.057	1.10	0.676	3.54	0.170
Friends help visit health centre	1.14	0.672	1.99	0.038	3.78	0.151
Visits health centre without help	1.23	0.282	0.90	0.717	1.39	0.497
MEDICAL HISTORY						
History of Diabetes in blood relations	0.86	0.734	3.04	0.003	7.89	0.019
History of diabetes in non blood relations	0.46	0.101	1.14	0.088	3.57	0.168
Hypertension ever	0.87	0.285	1.50	0.030	6.78	0.034
Any family history of hypertension	0.60	0.055	2.53	<0.001	21.92	<0.001
ANTHROPOMETRIC						
BMI	1.00	0.619	1.08	<0.001	16.00	<0.001
WHR	0.83	0.807	11.59	0.013	6.36	0.041
Waist circumference	1.00	0.920	1.04	<0.001	26.50	<0.001

were residents of the selected areas at the time of the study. Sample size calculations were made using Epi-Info 6.04. For describing diabetes prevalence with 95.0% confidence, assuming 15±3 percent prevalence, the necessary sample size was calculated at 463. For risk factor analysis with 95.0% confidence and 80% power, assuming diabetes prevalences of 15.0% and 8.0% in urban and rural subjects, respectively, and a 1 to 1 ratio of subjects, the required sample size was calculated at 706. Assuming diabetes prevalences of 20.0% and 10.0% in overweight/obese and non-overweight subjects, respectively, and a 1 to 9 ratio, the required sample size was 1100. We included 1633 subjects to ensure sufficient sample size. A list of all elderly people was prepared from voter lists in the study area (Kathmandu Metropolitan City ward number 35, Chapagoan VDC of Lalitpur and Jhoukhel VDC of Bhaktapur). All the elderly people living in study sites were compiled and each was assigned a code numbers/household number. Then the 1633 subjects were randomly selected. A standardized structured questionnaire was developed and field-tested for reliability and clarity. A two-day orientation program was conducted. This covered study objectives, procedures, confidentiality, ethics and rights of the subject, and the written informed consent process. The research team collected information in the local Nepali language.

In a house-to-house survey, all participants received a brief medical evaluation including history, physical examination, and fasting venous blood glucose test to diagnose diabetes. Blood pressure was also measured. Blood was drawn by trained medical technicians. Subjects with fasting blood glucose e”126 mg/dl were considered to have diabetes. Previously diagnosed diabetes was recorded from subjects’ treatment records and from their questionnaire responses.

The anthropometrics height and weight were measured using a standard calibrated height and weight machine. Waist circumference was measured in the horizontal plane, halfway between the iliac crest and the costal margin in the mid-axillary line, after exhaling with the subject in standing position. Hip circumference was measured at the level of the greater trochanter with the subject in standing position and both feet together, using a non stretchable fiber measuring tape in the horizontal plane, without compression of skin.[9]

Venous blood samples were drawn in the morning by standard 2.5 ml disposable syringe, after subjects had fasted 8-10 hours overnight. Drawn blood was transferred to a test tube (with sodium fluoride preservative added), which was kept in an icebox for transportation. Blood samples were were transferred to the laboratory within one hour of collection, and centrifuged at 3000 RPM for 10 minutes. Then serum samples were analyzed for blood glucose using a Hitachi Boeringer Mannheim 902 automatic analyzer and Elecys 1010. Quality control and standardization were achieved through the analysis of internal and external quality assurance materials provided by the Nepal Public Health Laboratory. Disposal of the used syringes and needles was done according to the hospital guidelines from the Nepal Public Health Laboratory.

Bivariate analysis of diabetes in relation to 43 independent variables was carried out using multinominal logistic regression. There were 3 possible

Table-2: Final multivariable model for diabetes diagnosed during and before the survey

Variables	Diabetes diagnosed				Overall likelihood Ratio Test (2 degrees of freedom)	
	During survey		Before survey			
	Odds ratio	P-value	Odds ratio	P-value	χ^2	P-value
Age in years	1.02	0.054	0.98	0.215	5.89	0.052
Education (6 levels, low to high)	1.00	0.945	1.20	0.005	7.89	0.019
Exercise	1.26	0.175	1.56	0.045	5.10	0.078
Health perception (3 levels, good to poor)	0.99	0.943	2.61	<0.001	35.46	<0.001
Care taker at night	0.96	0.848	0.54	0.076	3.58	0.166
Disturbed sleep (3 levels, low to high)	1.20	0.055	0.96	0.765	3.90	0.142
Social participation(3 levels, low to high)	1.04	0.397	1.11	0.104	3.02	0.221
Friends help visit health centre	1.15	0.660	1.90	0.075	2.92	0.232
Family history of diabetes in blood relations	1.06	0.896	1.96	0.113	2.34	0.310
Hypertension ever	0.84	0.211	1.31	0.189	3.79	0.150
Any family history of hypertension	0.58	0.052	1.70	0.036	9.81	0.007
Waist circumference	1.00	0.547	1.04	<0.001	15.34	<0.001

outcomes, no diabetes, diabetes diagnosed during the survey, and diabetes diagnosed before the survey. Diabetes diagnosed both during and before the survey was considered as diabetes. The reference group was subjects with no diabetes. Independent variables having p-value d"0.20 for diabetes diagnosed either before or during the survey, or for the overall likelihood ratio chi-square, were selected for subsequent multivariable analysis, again using multinomial logistic regression. A second multivariable model included independent variables for which pd"0.20 in the first model, and a third and final model included the 12 variables for which pd"0.20 in the second model. SPSS computer software was used for data analysis.

RESULTS

We detected 422 cases of diabetes (25.9%). Of these, many more were diagnosed during the survey (282 cases, 17.3%) than before it (140 cases, 8.6%). This indicates an important burden of undetected diabetes in the study area.

The final 12-variable multivariable model is summarized in Table-2. P-values for variables that were statistically significantly (pd"0.05) or marginally significantly ($0.05<p<0.10$) associated with risk of diabetes, as diagnosed either during or before the survey, are shown in bold-face type.

None of the 12 independent variables was significantly associated, and only 3 variables were marginally significantly associated, with risk of diabetes as diagnosed during the survey. In contrast, 5 variables were significantly associated, and 2 variables were marginally associated, with diabetes as diagnosed before the survey. Age and disturbed sleep revealed marginal positive associations with risk of diabetes diagnosed during the survey ($p=0.054$ and 0.055, respectively). Family history of hypertension was marginally negatively associated with diabetes diagnosed during the survey ($p=0.052$).

Education showed a strong positive association with diabetes diagnosed before the survey ($p= 0.005$). In contrast, health perception was highly negatively associated with risk of diabetes diagnosed before the survey (higher risk associated with worse health perception, $p<0.001$). Subjects having larger waist circumference had higher risk of diabetes as diagnosed before the survey ($p<0.001$).

DISCUSSION

A distinct majority of diabetes cases were not diagnosed before the survey. This indicates a substantial burden of undetected diabetes, and that actual diabetes prevalence can be very high.

In the present study, the prevalence of diabetes increased with age, even though all subjects were e"60 years old. Higher prevalence of diabetes was also found in older age group in other studies.[10,11] It was documented that high prevalence of diabetes in the elderly population and also a poor glycemic control among adults aged 65 or more.[12]

Higher proportion of diabetes was demonstrated in male (27.1%) than the females (24.8%). Bivariate analysis of diabetes diagnosed before the survey and detected in the survey identified that previously diagnosed cases of diabetes were found more in the males rather than females. It might be due to the reason of disparity in between males and females in health seeking behavior and access to care. The participants also indicated that the chance and choice of diagnosis and treatment prevails more in males than females.

Diabetes was detected higher among widowed/ divorced than married subjects. Strong statistical association of education with diabetes diagnosed before the survey was found. However, no statistical association of education was established with diabetes detected in the survey, which focused the importance of education in symptoms recognition, regular checkup and screening of the disease**.** Regarding diabetes, different occupation did not vary significantly, which suggests all occupational groups are at equal risk of diabetes. Other studies such as.[13] It was also identified the association of socio-economic status, married, higher education, and higher income with diabetes.[14] A study conducted in Nepal, identified that majority of the people were aware that diabetes as a preventable disease and knowledge about diabetes increased with age.[15]

Consistent with other studies,[16] significant statistical association of exercise was observed with diabetes diagnosed before the survey whereas, only weak association was established with the diabetes detected in the survey. This could be due to cultivating the habit of exercise only after diagnosis, in an effort to control diabetes severity. A population-based exercise program might help in reducing incidence of new diabetes, and in reducing severity of existing diabetes. A significant association was observed between health perception and diabetes diagnosed before the survey. Studies about the health perception, mental tension and medicine for tension in relation to diabetes and hypertension are very limited. Thus, it is difficult to evaluate our results regarding health perception in relation to the existing scientific literature. Further research regarding whether poor health perception increases risk of disease, or the disease increases risk of poor health perception, or possibly both, is recommended.

Support from friends for health centre visits was marginally associated with previously diagnosed diabetes. Kawakami's study to investigate the association between sleep disturbance and onset of type 2 diabetes revealed that subjects who had sleep disturbance were at higher risk of diabetes.[17]

The present study identified a significant relationship of waist circumference with diabetes diagnosed before the survey. Okusun revealed the strong association of waist size with diabetes and also added the possibility of substantial reduction in diabetes is achievable by the reduction of waist circumference.[18] Regular exercise, keeping body weight normal, and eating diet low in sugars and fat may reduce the prevalence of diabetes.[19] Consistent with the present finding, prevalence of diabetes was reported higher among overweight and obese people.[20] Some studies even identified 5 fold higher prevalence of diabetes among over weight and obese people than the normal weight people.[21]

In summary, age, disturbed sleep, family history of hypertension are marginally significant with diabetes in the survey; however, education, exercise, health perception, family history of hypertension and increased waist circumference are significantly associated with diabetes detected before the survey. Overall likelihood ratio test reveals significant differences in education, health perception, family history of hypertension and waist circumference between diabetes cases detected during and before the survey.

On balance, there is a need of regular screening of diabetes in the community and improved health care and education in the elderly. Also, it appears that risk factors for previously undetected diabetes are not well understood. Further research is necessary to explain these risk factors, in Nepal and elsewhere, and to assess the comparability of risk factors in different locations.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Prof. Dr. SK Rai and Nepal Medical College Research Committee for the partial financial support. Thanks go to Managing Director, Dr. SP Bhattarai, Dr. SB Rizyal, Founder Principal for their suggestions and valuable support. My sincere thanks goes to Assoc Prof. S Pongpanich, Assoc Prof. W Aekplakorn, Assist Prof. R Somrongthong, P Hongsrangon and A Entz for their valuable support. Thanks also go to study participants and the study team.

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