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Research Article

The Prevalence and Risk Factors of Type 2 Diabetes Mellitus among Adults in Itahari Sub-Metropolitan City of Eastern Nepal

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ABSTRACT

Background & Objectives: Diabetes Mellitus presents a substantial health challenge worldwide. Its prevalence has been increasing more rapidly in low and middle-income countries such as Nepal. Globally, the number of individuals affected by diabetes rose from 108 million in 1980 to 422 million in 2014. The study was aimed to assess the prevalence of Type 2 Diabetes Mellitus (DM) and explore the associated risk factors with Type 2 DM.

Materials and Methods: A community-based cross-sectional study was designed to investigate the adult population of Itahari sub-metropolitan city in Sunsari district, Nepal. The study included individuals aged ≥ 18 years of both genders residing in Itahari sub-metropolitan city, an urban area of Sunsari District. Data collection was conducted through face-to-face interviews using a semi-structured, pre-tested WHO STEPS survey questionnaire. Collected data were entered into Microsoft Excel and then imported into the Statistical Package for Social Sciences (SPSS) for statistical analysis. Bivariate analysis was performed using the chi-square test and Fisher's exact test.

Results: Out of 322 participants, 64 (19.9%) individuals were diagnosed with Type 2 Diabetes Mellitus, either with or without hypertension. Among the diabetic participants, 39 (60%) had

comorbid hypertension, while the remaining 25 (39.06%) did not exhibit hypertension.

Conclusion: Anxiety and depression are common among elderly people living in community in urban Kathmandu. More than one third have both disorders.

Keywords: Adult, Diabetes mellitus, Hypertension, Non-communicable diseases

INTRODUCTION

Diabetes Mellitus presents a significant health challenge on a global scale. Its prevalence has been increasing more rapidly in low and middle-income countries like Nepal. Globally, the number of individuals affected by diabetes rose from 108 million in 1980 to 422 million in 2014. The global prevalence of diabetes among adults over 18 years nearly doubled since 1980, escalating from 4.7% to 8.5%. Between 2000 and 2019, there was a 3% increase in diabetes mortality rates across different age groups. Diabetes accounted for 1.5 million deaths in 2012. By 2019, an estimated 2 million deaths were attributed to diabetes and kidney disease resulting from it. Forty-three percent of these deaths linked to high blood glucose or diabetes occur before the age of 70, with a higher incidence in low and middle-income countries. Diabetes Mellitus type 2 is a metabolic disorder characterized by high blood sugar, insulin resistance, and a relative deficiency of insulin. Diabetes significantly increases the risk of blindness, kidney failure, heart attacks, strokes, and lower limb amputations [3].

In 2002, the World Health Organization (WHO) outlined eight risk factors for diabetes, categorizing them into four behavioral and four biological factors. These factors significantly heighten the risk of mortality from diabetes mellitus. Unhealthy behaviors such as tobacco use, excessive alcohol consumption, inadequate intake of fruits and vegetables, and physical inactivity all exacerbate the likelihood of developing diabetes mellitus. Conversely, adopting a healthy lifestyle characterized by a nutritious diet, regular exercise, maintaining a healthy body weight, and abstaining from tobacco and alcohol can help prevent or postpone the onset of type 2 diabetes [3].

The prevalence of type 2 diabetes is anticipated to escalate significantly in the coming years. Early detection of diabetes plays a crucial role in mitigating the risks associated with blindness, kidney failure, heart attacks, stroke, lower limb amputation, and other complications. Decreasing the incidence of factors such as smoking, alcohol consumption, and obesity would result in a reduction in mortality related to non-communicable diseases (NCDs) caused by diabetes. Thus, the study was aimed to assess the prevalence of Type 2 Diabetes Mellitus (DM) and explore the associated risk factors with Type 2 DM.

MATERIALS AND METHODS

A community-based cross-sectional study was undertaken involving adult individuals aged ≥ 18 years of both genders, residing in the Itahari sub-metropolitan city of Sunsari district in Nepal. Pregnant women and acutely ill participants were excluded from the study. The study spanned one year, from September 2018 to August 2019. Ethical clearance was obtained from the Institutional Review Committee at B.P. Koirala Institute of Health Sciences (BPKIHS) in Nepal (Ref: 290/075/076-IRC). The study involved 322 adult participants, with nearly equal representation of male and female

individuals, comprising 49.1% and 50.9%, respectively. Data collection was conducted through face-to-face interviews, utilizing a semi-structured WHO STEPS survey questionnaire that had been pre-tested.

As per the WHO definition, individuals with fasting plasma glucose levels ≥ 7.0 mmol/L (126 mg/dl), or 2-hour plasma glucose levels ≥ 11.1 mmol/L (200 mg/dl), or HbA1c levels ≥ 6.5% were categorized as diabetic, encompassing both type 1 and type 2 diabetes. Additionally, individuals previously diagnosed with diabetes and undergoing treatment were classified as diabetic, regardless of their current blood glucose levels. Blood glucose levels were measured using a glucometer.

The data were inputted into Microsoft Excel and subsequently transferred to the Statistical Package for the Social Sciences (SPSS) for statistical analysis. Presentation of the data was achieved through frequency distribution tables, showcasing frequencies and percentages.

Bivariate analysis was conducted using the chi-square test with tabular presentations made accordingly. Independent variables with a p-value < 0.20 from the bivariate analysis were selected for inclusion in multiple logistic regression analysis. The results were interpreted using odds ratios, 95% confidence intervals, and p-values, with significance determined at $p < 0.05$.

RESULTS

A total of 322 participants were included in the study. The largest proportion of participants, 149 (46.30%), fell within the 41-60 age group, followed by 101 (31.40%) in the 18-40 age group and 72 (22.40%) aged 61 years and above.

Out of all 322 participants, 64 (19.9%) were diagnosed with Type 2 Diabetes Mellitus, either with or without hypertension. Among these, 39 (60%) had diabetes accompanied by hypertension, while the remaining 25 (39.06%) had diabetes without hypertension. Diabetes was more prevalent among males compared to females. Of the total male participants (158), 23.4% were diagnosed with diabetes, while among the total female participants (164), 16.5% had diabetes.

The distribution of male and female participants was nearly equal, with 49.1% being male and 50.9% female, respectively. Among the participants, 100 (31.1%) were smokers, while 222 (68.9%) had never indulged in smoking. Of the smokers, 55 (55%) were presently smoking, while 45 (45%) were former smokers. As for smokeless tobacco usage, 56 (17.4%) were current users, 5 (1.6%) had ceased using it, and 216 (81.1%) had never tried smokeless tobacco. Among all participants, 141 (43.8%) were current alcohol consumers, 21 (6.5%) had stopped drinking, and 160 (49.7%) had never consumed alcohol. Furthermore, most participants (192 or 59.6%) engaged in a high level of physical activity, exceeding 3000 MET-minutes per week, whereas only 54 (16.8%) participants engaged in low levels of activity weekly. Additionally, the majority (279 or 86.6%) of participants exhibited a high waist-to-hip ratio (Table 1).

An upward trend in diabetes was noted with advancing age. Diabetes was notably more common in individuals aged 61 years and above, and it exhibited higher among males compared to females. Diabetes appeared to be more prevalent among participants who had a history of smoking compared to those who had never smoked. Specifically, among current smokers, diabetes was more common

Table 1: Socio demographic profile, behavioral and anthropometric characteristics of participants (n=322)

Characteristic	Categories	Frequency (322)
Gender	Male	158 (49.1%)
	Female	164 (50.9%)
Ethnicity	Madhesi	24 (7.5%)
	Janajati	104 (32.3%)
	Brahmin/Chhetri	194 (60.2%)
Religion	Hindu	314 (97.5%)
	Others	8 (2.5%)
Marital Status	Single (unmarried, widow, widower, divorced)	35(10.9%)
	Married	287(89.1%)
Types of Family	Joint/ three generation family	113(35.1%)
	Nuclear	209(64.9%)
Education	Illiterate	81(25.2%)
	Class ≤5	26(8.1%)
	Class 6 – 8	31(9.6%)
	Class 9 – 10	98(30.4%)
	Class ≥10	86(26.7%)
Occupation	Farmer	20(6.2%)
	Unemployed	23(7.1%)
	Housewife	108(33.5%)
	Business	110(34.2%)
	Others	61(18.9%)
Poverty index	Below poverty line (<1.9 US Dollar)	118(36.6%)
	Above poverty line (≥1.9 US Dollar)	204(63.4%)
Smoking Status	Current Smokers	55 (17.1%)
	Ex-Smokers	45 (14.0%)
	Never	222 (68.9%)
Smokeless Tobacco Use	Current Users	56 (17.4%)
	Ex-Users	5 (1.6%)
	Never	216 (81.1%)
Alcohol Consumption Status	Current Drinkers	141 (43.8%)
	Past Drinkers	21 (6.5%)
	Never	160 (49.7%)
Level of Physical Activity	Low Level Activity (<600 MET)	54 (16.8%)
	Moderate Level Activity (600-3000 MET)	76 (23.6%)
	High Level Activity (>3000 MET)	192 (59.6%)

in those who had quit smoking compared to those who were currently smoking, although this difference did not reach statistical significance (p=0.449). Conversely, for individuals who were former smokers, the prevalence of diabetes was significantly higher compared to those who had never smoked (p=0.001).

Regarding the use of smokeless tobacco, the prevalence of diabetes appeared to be similar between individuals who had never used tobacco and those who had ever used it, with no statistically significant difference observed (P=0.429). Similarly, among current users of smokeless tobacco, the prevalence of diabetes did not significantly differ between current non-users and current users (P=0.962).

Table 2: Association between sociodemographic & behavioural characteristics of participants with diabetes (n=322)

Characteristic	Categories	Diabetes Type 2		Total	P-value
		DM 2 present	DM 2 absent		
Age Group (Years)	18-40	9(8.9%)	92(91.1%)	101	<0.001
	41-60	33(22.1%)	116(77.9%)	149	
	≥61	22(30.6%)	50(69.4%)	72	
Gender	Male	37(23.4%)	121(76.6%)	158	0.126
	Female	27(16.5%)	137(83.5%)	164	
Religion	Hindu	62(19.7%)	252(80.3%)	314	0.661
	Others	2(25%)	6(75%)	8	
Ethnicity	Madhesi	3(12.5%)	21(87.5%)	24	0.822
	Janajati	22(21.2%)	82(78.8%)	104	
	Brahmin/Chhetri	39(20.1%)	155(79.9%)	194	
Education	Illiterate	18(22.2%)	63(77.8%)	81	0.511
	Class ≤ 5	4(15.4%)	22(84.%)	26	
	Class 5 – 8	6(19.4%)	25(80.6%)	31	
	Class 9- 10	23(23.5%)	75(76.5%)	98	
	Class ≥10	13(15.1%)	73(84.9%)	86	
Marital status	Single(unmarried, widow, widower, divorced)	7(20%)	28(80%)	35	0.984
	Married	57(19.9%)	230(80.1%)	287	
Occupation	Farmer	4(20%)	16(80%)	20	0.108
	Unemployed	8(34.7%)	15(65.21%)	23	
	Housewife	23(21.3%)	85(78.7%)	108	
	Business	15(13.6%)	95(86.4%)	110	
	Others	14(23%)	47(77%)	61	
Types of family	Joint family/ three generation family	27(23.9%)	86(76.1%)	113	0.184
	Nuclear family	37(17.7%)	172(82.3%)	209	
Poverty index	Below poverty line (<1.9 US Dollar)	26(22%)	92(78%)	118	0.460
	Above poverty line (≥1.9 US Dollar)	38(18.6%)	166(81.4%)	204	
Smoking Status	Never Smokers	38(17.1%)	184(82.9%)	222	0.065
	Ever Smokers	26(26%)	74(74%)	100	
Current Smokers	Yes	9(16.4%)	46(83.6%)	55	0.474
	No	55(20.6%)	212(79.4%)	267	
Ex- Smokers	Yes	17(37.8%)	28(62.2%)	45	0.001
	No	47(17%)	230(83%)	277	
Smokeless Tobacco Use	Never Use	51(19.5%)	210(80.5%)	261	0.755
	Ever Use	13(21.3%)	48(78.7%)	61	
Current Smokeless Tobacco Use	Yes	11(19.6%)	45(80.1%)	56	0.962
	No	53(19.9%)	213(80.1%)	266	
Ex- Smokeless Tobacco Use	Yes	2(40%)	3(60%)	5	0.260
	No	62(19.6%)	255(80.4%)	317	

Alcohol Consumption Status	Never Drinkers	17(11.48%)	131(88.5%)	148	0.654
	Ever Drinkers	47(27.1%)	127(72.98%)	174	
Current Drinkers	Yes	24(17.6%)	112(82.4%)	136	0.391
	No	40(21.5%)	146(78.5%)	186	
Ex-Drinkers	Yes	23(60.5%)	15(39.5%)	38	<0.001
	No	41(14.4%)	243(85.6%)	284	
Fruits and Vegetable Consumption	Adequate Consumers*	20(22.7%)	68(77.3%)	88	0.432
	Inadequate Consumers*	44(18.8%)	190(81.2%)	234	
Level of Physical Activity(MET)/Week	Low Level Activity (<600)	37(38.9%)	58(61.1%)	95	<0.001
	Moderate Level Activity (600-3000)	13(20.6%)	50(79.4%)	63	
	High Level Activity (>3000)	14(8.5%)	150(91.5%)	164	
Body Mass Index(BMI)	Normal (18.5 - <22.9)	20(19.8%)	81(80.2%)	101	0.399
	At risk / Pre-obese (23-24.9)	24(17.1%)	116(82.9%)	140	
	Obese (≥25)	20(24.7%)	61(75.3%)	81	
Waist to Hip Ratio	Normal (<0.9M, <0.85F)	4(9.3%)	39(90.7%)	43	0.062
	High (≥0.9M, ≥0.85F)	60(21.5%)	219(78.5%)	279	

However, among former users of smokeless tobacco, the prevalence of diabetes was higher in ex-users compared to those who had never used smokeless tobacco, and this difference reached statistical significance (P=0.260).

Concerning alcohol consumption, diabetes appeared to be more prevalent among individuals who had ever consumed alcohol compared to those who had never consumed it. Among current drinkers, diabetes was more common in current non-drinkers compared to current drinkers, although this disparity was not statistically significant (p=0.391).

However, among former drinkers, the prevalence of diabetes was higher in ex-drinkers compared to those who had never consumed alcohol, and this difference was statistically significant (P < 0.001). The association of diabetes with age, physical activity, and BMI was found to be statistically significant. However, the association of diabetes with sex, ethnicity, religion, education, marital status, family types, economic status, fruit and vegetable consumption, and high waist-to-hip ratio was not statistically significant (Table 2).

Table 3 depicts the multiple logistic regression analysis, variables that showed significant associations with diabetes in the bivariate analysis (with a p-value less than 0.20) were included. The findings were interpreted using odds ratios and 95%

Table 3: Multiple logistic regression analysis for association of different variables with diabetes (n=322):

Characteristic	Categories	β	P-value	Adjusted Odds Ratio	95% C.I. for AOR	
					Lower	Upper
Age in years	18- 40			REF		
	41 – 60	.747	.102	2.111	.863	5.16
	≥61	1.346	.018	3.844	1.257	11.756
Gender	Male			REF		
	Female	-.098	.788	.907	.444	1.851
Types of family	Joint family			REF		
	Nuclear family	-.505	.203	.603	.277	1.313
Smoking Status	Never Smokers			REF		
	Ever Smokers	.433	.348	1.542	.582	4.085
Ex- Smokers	No			REF		
	Yes	-.834	.138	.434	.144	1.308
Ex-drinker	No			REF		
	Yes	-1.946	<.001	.143	.063	.322
Level of Physical Activity(MET)/Week	Low Level Activity (<600)			REF		
	Moderate Level Activity (600-3000)	-.932	.023	.394	.176	.881
	High Level Activity (>3000)	-1.802	<.001	.165	.076	.358
Waist to Hip Ratio	Normal (<0.9M, <0.85F)			REF		
	High (≥0.9M, ≥0.85F)	-1.086	.089	.338	.097	.881

confidence intervals. According to the analysis, the odds of having diabetes increased with advancing age and decreased with increasing physical activity. Females were 0.9 times less likely to have diabetes compared to males (p=0.788), and individuals from nuclear families were 0.6 times less likely to have diabetes compared to those from joint families or three-generation families (p=0.203). Furthermore, smoking participants were 0.6 times less likely to have diabetes compared to those who never smoked (p=0.39). Participants with a high waist-to-hip ratio (≥0.9M, ≥0.85F) were 0.3 times less likely to have diabetes compared to those with a normal waist-to-hip ratio (<0.9M, <0.85F).

DISCUSSION

Diabetes is a major public health challenge in developing nations. In this study, overall prevalence of diabetes was found to be 19.9%. Behavioral factors significantly contribute to the onset of chronic diseases. Similar prevalence rates have been documented in various other studies. A systematic review and meta-analysis spanning Nepal from 2000 to 2014 revealed a prevalence ranging from 1.4% to 19%[4].

Comparable prevalence rates of diabetes (20%) were observed among Chinese individuals residing in Singapore and Mauritius [9]. However, different prevalence of diabetes was shown in different studies. Research within the Saudi community in Saudi Arabia reported a prevalence of 30% [11], whereas studies among secretariat employees in Bangladesh indicated a prevalence of 12.3% [22]. Prevalence of diabetes was 11.77% in Pakistan, as per a systematic review and meta-analysis [8], 11.7% in the semi-urban area of Lekhnath municipality in 2017, and 8.1% in a national socioeconomic survey in Thailand [7]. The prevalence among ethnically diverse populations in the U.K was 5.8% [20], while it was reported as 4% according to the NCD STEPs survey 2013 conducted by the Nepal Health Research Council[1], and 5.77% in a systematic review and meta-analysis in Nigeria[19].

This underscores the significant public health importance of diabetes as a prevalent health condition. Given the widespread nature of diabetes risk factors, addressing these issues collectively at individual, household, community, and policy levels is crucial to prevent further deterioration of health conditions and implement effective preventive and promotive care within the community.

In this study, the prevalence of diabetes increased with advancing age, with rates of 8.9% among individuals aged 18-40 years, 22.1% among those aged 41-60 years, and 30.6% among those aged 61 years and above. The study revealed a significant association between age groups and diabetes, with a p-value <0.001. Age emerges as a crucial predictor in diabetes, with numerous studies indicating a linear trend between diabetes and increasing age [21]. This phenomenon could be attributed to the gradual decline in the body's ability to uptake and utilize glucose from the bloodstream as individuals age, resulting in decreased sensitivity to insulin in body tissues. This finding is consistent with research conducted by Natraj V et a l[13]. and Anita T et al [12].

In this study, socioeconomic status was not found to be associated with diabetes, which aligns with findings from other studies where no significant association was observed between socioeconomic status and diabetes [14]. However, a study conducted by Daniel J et al. reported an association between socioeconomic status and diabetes [15].

Smoking represents a major risk factor for diabetes. In this study, the prevalence of diabetes among ex-smokers is higher than among never smokers. Ex-smokers exhibit a significant positive association with diabetes in bivariate analysis (p=0.001); however, after adjusting for confounders in multivariate analysis, ex-smokers were not found to be significantly associated with diabetes (p=0.138). This result mirrors findings from studies conducted by White WB et al. [23] and Sigdel KR et al [22].

Physical activity was significantly associated with diabetes in bivariate analysis (P<0.001). However, after adjusting for confounders in multivariable logistic regression analysis, physical activity was found to be negatively associated with diabetes. In bivariate analysis, individuals with low levels of physical activity exhibited the highest incidence of diabetes compared to those with moderate and high-level activity. This outcome aligns with findings from the study conducted by White WB et al [23].

CONCLUSION

The prevalence of diabetes was notably high affecting both males and females in Itahari sub-metropolitan city. An increase in the prevalence of diabetes was observed with advancing age, indicating that being elderly is a risk factor for diabetes. Individuals with a past history of smoking and alcohol consumption were at a higher risk for diabetes. However, many of them may have changed their health risk behaviors, such as smoking, alcohol consumption, dietary habits, and physical inactivity, which could help mitigate the risk of diabetes over time.

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