ISSN: 2091-2331 (Print) 2091-234X (Online)

Journal of Nobel Medical College

Volume 10, Number 02, Issue 19, July-December 2021, 26-32

Original Article

Predictors of Obesity among Type 2 Diabetes Mellitus Patients Attending a Tertiary Care Center of Province 1, Nepal

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Article Received: 20th August, 2021; Accepted: 15th November, 2021; Published: 31st December, 2021

DOI: https://doi.org/10.3126/jonmc.v10i2.41582

Abstract

Background
Obesity and Diabetes Mellitus type 2 have a known association. Yet, the socio-demographic predictors of obesity in special populations like ours (Asian) who have DM remain unclear. The purpose of this study was to determine the socio-demographic predictors of obesity among newly diagnosed Diabetes Mellitus in adults.

Materials and Methods
This was a descriptive cross-sectional study conducted in endocrine OPD of Nobel medical college. Total 124 subjects were enrolled who were newly diagnosed Diabetes Mellitus over a period of 1 year. Detailed history was taken for demographic and clinical variables. Height, weight, waist circumference and blood pressure were measured. Besides, Body Mass Index, the dependent variable, was calculated. Subjects were considered to have diabetes based on their fasting and postprandial blood sugar level for the first time.

Results
The prevalence of obesity among the study population was 39.5%, overweight was 45.2%. Predictors for this study for obesity were found as abnormal blood pressure and hospital visit after symptoms development.

Conclusion
Obesity is a important risk factor for Diabetes Mellitus and higher prevalence of obesity among type 2 diabetes was observed. Predictors for this study for obesity were found as abnormal blood pressure and hospital visit after symptoms development.

Keywords: *Body mass index, Diabetes mellitus, Obesity*

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Citation
Roy PK, Baral D, Gautam A, Subedi S, Predictors of Obesity among Type 2 Diabetes Mellitus Patients Attending a Tertiary Care Center of Province 1, Nepal, JoNMC. 10:2 (2021) 26-32.

Introduction

Diabetes mellitus (DM) comprises a group of common metabolic disorders that share the phenotype of hyperglycemia. It results from either lack of insulin secretion or decreased sensitivity of the tissues to insulin [1, 2]. Reports show that Asian populations with diabetes tend to have prolonged complications [3]. In 2015, there were 526,000 cases of diabetes in Nepal [4]. In middle and low income countries, the number of people who have DM is increasing exponentially and is considered an eminent threat on health-care systems and resources [5]. Major risk factors for DM include positive family history, race, older age, high blood pressure, dyslipidemia, inactivity and sedentary life style [6]. Many of these factors are connected to obesity which can explain, in part, the association between obesity and DM [7]. Obesity and diabetes are closely related to each other as about 80% diabetics are obese. Obesity is a common finding in DM. There is impaired insulin sensitivity of peripheral tissues such as muscle and fat cells to the action of insulin in obese individuals (insulin resistance). The worldwide obesity rate increased from 2.3% to 19.6% between 1990 and 2000 [8]. In the Pacific Islands, the Middle East, and China, obesity has increased at least threefold since 1980 [9], and the Western Pacific Islands of Nauru and Tonga top the region with an adult obesity rate of around 90% [10]. Almost 75% of adults in Barbados, Mexico, Turkey, and Argentina are overweight. Contradicting popular belief, obesity has become commonplace in many low- and middle-income countries, and the prevalence of cardiovascular risk factors including obesity has increased in such countries, particularly in South Asia [11]. This paper bases its definition of low- and middle-income countries on the World Health Report 2008 [12]. The International Day for Evaluation of Abdominal Obesity Study reported that South Asians have the highest prevalence of abdominal obesity [13]. Likewise, a comparative study of obesity prevalence determined a high obesity burden in India and Pakistan, especially in women [14]. Moreover, obesity increased in women in other South Asian countries, including Nepal and Bangladesh, between 1996 and 2006 (from 1.6% to 10% and from 2.7% to 8.9%, respectively) [15]. Survey done by ministry of health and population government of Nepal in 2008 shows overweight or obese (BMI ? 25 kg/m2) to be 7.2% (4.8-9.5), male 7.3% (4.9-9.6), female 7.1% (4.0-10.2) [16].Weight reduction in obese patients produces improvement in the diabetic state [17]. It is estimated that about 90% of people who have DM aged (16 - 54) years have overweight or obesity which is seriously indicative of a problem in that area [18]. In adults who have overweight or obesity and are at risk for DM, lifestyle modifications can reduce 2.5 to 5.5 kg of body weight in two or more years, cutting the incidence of DM by 30% to 60% [19]. So we intended to see the risk factor and predictor of obesity in this study. We examined the socio-demographic predictors of obesity in new diagnosed DM because of dilemma in available evidence. Correlations between weight and studied socio-demographic variables like age, gender, education, income and employment, stress, hour of sleep, alcohol consumption were not a clear cut positive or negative. On the contrary, correlations were redundant when different populations were studied or when different population characteristics were surveyed. Identifying predictors of obesity in special populations can guide policy makers to lead timely and wise health resource utilization and disease prevention efforts.

Materials and Methods

This was a descriptive cross-sectional study of 124 subjects who were newly diagnosed DM conducted in Endocrine OPD of Nobel medical college over a period of 1 year (January 2020 - February 2021). This study was started after acquiring approval from the Institutional Review Committee of Nobel Medical College (IRC). Written consent was acquired after the patient or patient party was explained about the study, its advantages, procedures and disadvantages. Subjects meeting the criteria for DM based on American Diabetes Association (ADA) for fating blood sugar (FBS) ? 126mg/dl, postprandial blood sugar (PP) ? 200mg/dl and age ? 18 years were enrolled in this study. All known case of Diabetes Mellitus, type-1 dm, age below 18 years and those not ready to give consent were excluded from this study. Blood glucose was performed in the laboratory (Glucose oxidase and peroxidase method). Detailed history was taken for demographic and clinical variables like age, sex, religion, ethnicity, employment, income, education, family history of DM, smoking, alcohol consumption per week, stress frequency per week, hours of sleep. Height, weight, waist circumference and blood pressure were measured using standard procedure. Besides, Body Mass Index (BMI), the dependent variable, was calculated by formula, BMI = kg/m2 where kg is a person's weight in kilograms and m2 is their height in meter squared. Asian criteria-based BMI was used as follows: <18.5 for underweight, 18.5-22.9 for normal-weight, 23.0-27.5 for

overweight, and >27.5 for obese.
Using n=z2× p (1-p) / e2with 5 % margin of error, and prevalence of obesity 7.2% (Ministry of health survey Nepal, 2008), sample size was calculated to be 101. However we collected total 124 cases in one year duration. All data was tabulated and statistically analysed using SPSS 11. Descriptive analyses were expressed as percentages, mean±standard deviation (SD), median with minimum and maximum values. A descriptive, inferential, and multivariate binary logistic regression was used to find out the predictors of obesity.

Results

Table 1: Sociodemographic characteristics of respondents: n=124

Characteristics	Categories	No of Respondents	Percentage
Gender	Male	61	49.2
	Female	63	50.8
Mean age in years ±SD (Min – Max)		50.6 ±12.4 (Range: 17 – 81)	
Religion	Hindu	118	95.2
	Others	6	4.8
Ethnicity	Brahman/Chettri	56	45.2
	Janajati	29	23.4
	Dalit	15	12.1
	Madhesi	24	19.4
Education level	Illiterate	41	33.1
	Primary	25	20.2
	Secondary	21	16.9
	Higher Secondary	20	16.1
	Bachelor and above	17	13.7
Family income in NRs per month	≤30000	75	60.5
	>30000	49	39.5
Occupation	Unemployed	50	40.3
	Business	28	22.6
	Skilled worker	28	22.6
	Professional	18	14.5
Marital status	Married	110	88.7
	Others	14	11.3

Socio demographic characteristics presented in Table 1. Approximately equal distribution in gender (male 50.8%) and their average age in years was 50.6 ± 12.4 years (Range 17 - 81). Most of them were Hindu (95.2%) by region, in ethnicity Brahmin and Chhetri cover (45.5%), one third of the patients were illiterate (33.1%), about 40.3% were unemployed with low family income and the maximum patient were married (88.75).

Table 2: Family and personal history of co-morbidity and others: n=124

Co-morbidity	Status	No of Respondents	Percentage
Family history of DM	Present	50	40.3
	Absent	74	59.7
Blood Pressure	Normal	87	70.2
	High	32	25.8
	low	5	4.0
Stress	Present	50	40.3
	Absent	74	59.7
Frequency of stress per week (n=50)	1	3	6.0
	2	9	18.0
	3	8	16.0
	4	30	60.0
Reason for visit hospital	Regular/Routine	56	45.2
	Suggested by family	10	8.1
	Suggested by doctor	30	24.2
	Symptoms developed	28	22.6
Sleeping hours per day	<6	23	18.5
	6 – 7	59	47.6
	≥8	42	33.9
Mean height in Centimeter ± SD		156.256 ± 8.574 (Range: 134.60 – 174.50)	
Mean weight in Kilogram ± SD		65.598 ± 11.778 (Range: 39.500 – 109.000)	
Mean WC in Centimeters ± SD		96.27 ± 10.47 (Range: 65.70 – 130.10)	
Mean BMI ± SD		26.812 ± 4.022 (Range: 17.600 – 39.600)	
Body Mass Index	Normal	19	15.3
	Over weight	56	45.2
	Obesity	49	39.5

The family and patients' clinical characteristics are presented in table 2. Less than half of the patient's had a family history of DM (40.5%) and 29.8% patients had blood pressure abnormality. The stress was presented 40.3% of the patients. Out of them 60.0% had more than 4 episodes in a week. Maximum patients were visited the hospital for regular routine (45.2%) check-up. And about one third patient slept less than 8 hours per night. The prevalence of obesity among the study population was 39.5%.

Table 3: Personal habits of the respondent: n=124

Personal Habit	Categories	No of Respondents	Percentage
Smoking	Never	83	66.9
	In past	27	21.8
	Currently	14	11.3
No of smoke (n=41) per day	On occasion	6	14.6
	1 – 4	5	12.2
	>4	30	73.2
Alcohol intake	Never	79	63.7
	In past	19	15.3
	Currently	26	21.0
Median intake per week in unit of alcohol (IQR)		2 (IQR: 1 – 7) (Range:1 – 28)	
Type of alcohol (n=45)	Non-distillery	28	62.2
	Distillery	17	37.8

In personal habit 33.1% had ever smoker whereas two third were never smoker and approximately similar percentage had never intake of alcohol (63.7%)

Table 4: Laboratory finding of the respondent: n = 124

Parameters	FBG	PP
Mean	198.000	321.610
Standard deviation	90.625	113.828
Minimum value	92.000	169.000
Maximum value	629.000	695.000

The mean values of FBS and PP were quite high among the DM patients.

Table 5: Association between obesity and sociodemographic variables:

In sociodemographic characteristics no variables were found to be significant with obesity.

Characteristics	Categories	Obesity (n, %) Non obese (n=75)	Obesity (n, %) Obese (n=49)	P value
Gender	Male	37 (60.7)	24 (39.3)	0.969
	Female	38 (60.3)	25 (39.7)	
Mean age in years ±SD		50.07±13.22	51.43±10.98	0.551
Religion	Hindu	73 (61.9)	45 (38.1)	0.212
	Others	2 (33.3)	4 (66.7)	
Ethnicity	Brahman/Chettri	33 (58.9)	23 (41.1)	0.512
	Janajati	15 (51.7)	14 (48.3)	
	Dalit	10 (66.7)	5 (33.3)	
	Madhesi	17 (70.8)	7 (29.2)	
Education level	Illiterate	24 (58.5)	17 (41.5)	0.939
	Primary	16 (64.0)	9 (36.0)	
	Secondary	14 (66.7)	7 (33.3)	
	Higher Secondary	11 (55.0)	9 (45.0)	
	Bachelor and above	10 (58.8)	7 (41.2)	
Family income in NRs per month	≤30000	50 (66.7)	25 (33.3)	0.081
	>30000	25 (51.0)	24 (49.0)	
Occupation	Unemployed	30 (60.0)	20 (40.0)	0.812
	Business	16 (57.1)	12 (42.9)	
	Skilled worker	19 (67.9)	9 (32.1)	
	Professional	10 (55.6)	8 (44.4)	
Marital status	Married	67 (60.9)	43 (39.1)	0.786
	Others	8 (57.1)	6 (42.9)	

In sociodemographic characteristics no variables were found to be significant with obesity.

The blood pressure status (p= 0.010) and reason for visit hospital (p=0.037) were found to be significant with obesity.

Table 6: Association between obesity with family, personal history of co-morbidity and others:

History and comorbidity condition	Categories	Obesity (n, %) Non obese (n=75)	Obesity (n, %) Obese (n=49)	P value
Family history of DM	Present	31 (62.0)	19 (38.0)	0.777
	Absent	44 (59.5)	30 (40.0)	
Blood Pressure	Normal	59 (67.8)	28 (32.2)	0.010
	Abnormal	16 (43.2)	21 (56.8)	
Stress	Present	27 (54.0)	23 (46.0)	0.225
	Absent	48 (64.9)	26 (35.1)	
Frequency of stress per week (n=50)	1	2 (66.7)	1 (33.3)	0.858
	2	4 (44.4)	5 (55.6)	
	3	5 (62.5)	3 (37.5)	
	4	16 (53.3)	14 (46.7)	
Reason for visit hospital	Regular/Routine	37 (66.1)	19 (33.9)	0.037
	Suggested by family	8 (80.0)	2 (20.0)	
	Suggested by doctor	19 (63.3)	11 (36.7)	
	Symptoms developed	11 (39.3)	17 (60.7)	
Sleeping hours per day	<6	16 (69.6)	7 (30.4)	0.503
	6 – 7	36 (61.0)	23 (39.0)	
	≥8	23 (54.8)	19 (45.2)	

Table 7: Association between obesity and personal habits of the respondent:

Personal habits	Categories	Obesity (n, %) Non obese (n=75)	Obesity (n, %) Obese (n=49)	P value
Smoking	Never	45 (54.2)	38 (45.8)	0.040
	In past	19 (70.4)	8 (29.6)	
	Currently	11 (78.6)	3 (21.4)	
No of smoke (n=41) per day	On occasion	5 (83.3)	1 (16.7)	0.458
	1 – 4	4 (80.0)	1 (20.0)	
	>4	21 (70.0)	9 (30.0)	
Alcohol intake	Never	49 (62.0)	30 (38.0)	0.663
	In past	11 (57.9)	8 (42.1)	
	Currently	15 (57.7)	11 (42.3)	
Median intake per week in unit of alcohol (IQR)		2 (1 – 5)	2 (1 – 7)	0.501
Type of alcohol (n=45)	Non-distillery	15 (53.6)	13 (46.4)	0.463
	Distillery	11 (64.7)	6 (35.3)	

Association was found to be between smoking status (p=0.040) with obesity.

Table 8: Relationship between Obesity and laboratory finding of the respondent:

Parameters	Obesity (n, %) Non obese (n=75)	Obesity (n, %) Obese (n=49)	P value
FBS	214.43 ± 101.98	172.86 ± 62.81	0.012
PP	337.52 ± 117.73	297.27 ± 104.09	0.048

Both fasting and PP sugar level found to be significant with obesity and p values were 0.012 and 0.048 respectively.

Statistical role

p values less than 0.200 that variables are consider for multivariate logistic regression to find out the predictors of Obesity. The variables were family income, blood pressure, reason for visit hospital, smoking, blood sugar (fasting and PP). The variable level of significant p<0.200 were selected for multivariate logistic regression to find out the predictors for obesity. The regression analysis found to be significant in reason for hospital visit in symptom development as considered to reference categories of family suggestion with AOR = 9.435 (95% CI 1.362 - 65.367) and abnormal blood pressure with AOR= 3.078 (95% CI 1.252 - 7.567). Therefore, predictors for this study for obesity were found as abnormal blood pressure and hospital visit after symptoms development.

Table 9: Multivariate logistic regression analysis of the predictors for obesity

Variable in equation	Categories	β coefficient	p value	AOR	95% C.I. for AOR	
					Lower	Upper
Family income in NRs per month	≤30000	Ref.				
	>30000	0.449	0.312	1.567	0.656	3.741
Smoking	Never	Ref.				
	Ever smoker	0.798	0.095	2.221	0.871	5.665
	Regular/Routine	1.023	0.267	2.782	0.457	16.937
Reason for visit hospital	Suggested by family	Ref.				
	Suggested by doctor	0.789	0.417	2.200	0.327	14.796
	Symptoms developed	2.244	0.023	9.435	1.362	65.367
Blood Pressure	Normal	Ref.				
	Abnormal	1.124	0.014	3.078	1.252	7.567
FBG		-0.010	0.068	0.990	0.980	1.001
Post Prandial sugar		0.002	0.697	1.002	0.994	1.009
Constant		-1.327	0.247	0.265		

Discussion

The prevalence of obesity among the study population was 39.5% and overweight was 45.2%. Similar but slightly lower prevalence of overweight and higher obesity was seen in different study done in Nepal. A study done in Dharan showed overweight prevalence of 32.9% and obesity of 7.2%. this lower percentage of obesity could be due to cut off of >30 for obesity in their study and the study was done in general population [20]. But we did this study in DM patient who are usually obese and our cutoff was lower ?27.5 for obesity. Study done in Kathmandu (2008) showed higher frequency of obesity in female compared to male (1.98% vs 10.14%) unlike our study which showed almost same frequency of obesity in both sex [21]. Data from jarad et.al (2018) [22] showed similar result as ours and had no influence of either sex in BMI prediction. Surveillance done by ministry of health and population (2008) showed that mean BMI didn't change with age or sex. Education was not a significant predictor of BMI . This finding was not quite consistent with the general population studies where the association between BMI and education was significant but redundant between positive and negative per surveyed socioeconomic stratum of developed versus developing countries [23,24,25]. Those discrepancies may be attributed, at least partially, to socioeconomic status (SES) variability of different societies.

In sociodemographic characteristics like literacy, marital status, education level, religion, ethnicity, income, occupation, no variables were found to be significant with obesity. Income had good influence on overweight and obesity in other studies done before in our country. But we didn't find any association between income and obesity. A study done in Jordan (2018) showed low household income were 2 times more likely to have obesity compared to clients with an average or higher household income which too contradict various finding which showed obesity and higher income had positive relation [22]. Study done in Dharan Nepal, highlights the varied prevalence of overweight and obesity in different ethnic clusters, whereas our study contradicts those finding. We saw same prevalence of obesity and overweight in all ethnic groups. This may be due to change in community of all ethnic group, migration to urbanized area and change in living style of all the ethnic group and sharing common community. Employment had no association with BMI in our study whereas one study showed Unemployed clients were 2.3 times more likely to have obesity when contrasted to employed ones, similar to renowned general population studies [22]. No significant difference in obesity was seen in subjects who had family history of dm or not, likewise sleep hour per day and stress level per week too had no association with obesity. In our study, the occurrence of obesity was less in smokers as compared to nonsmokers. Similarly same finding was found in a study done in Saudi Arabia (2019) [26]. The relationship between smoking and obesity is poorly understood. Some previous studies have revealed no significant association between smoking status and BMI

[27], whereas other studies have shown that smoking may be associated with lower BMI [28] and ex-smokers were associated with increased BMI [29, 26].

In our study, hypertension was significantly associated with obesity. However, hypertension cannot be considered as a predictor of obesity but it is a consequence and that is why it was significantly associated with obesity. Alchohol intake was seen more in non obese than obese subjects however it was not statistically significant. We didn't find any association between obesity and sleeping hours per day. Unlike our result other studies showed that getting <6 or >8 hours of sleep in adults and adolescents [30] is associated with weight gain. Both fasting and PP sugar level found to be significant with obesity and p values were 0.012 and 0.048 respectively. Mean blood sugar was higher in non obese compared to obese population. Which is against some author where it was found that obesity was associated with high blood sugar and dm? One study reported urban residency, having a higher socio-economic status and a higher BMI as risk factors for diabetes [31]. This could be because of lower population in this study. If more subjects could have been there, may be we would get same result.

The variable level of significant p<0.200 were selected for multivariate logistic regression to find out the predictors for obesity. The regression analysis found to be significant in reason for hospital visit in symptom development as considered to reference categories of family suggestion with AOR = 9.435 (95% CI 1.362 - 65.367) and abnormal blood pressure with AOR= 3.078 (95% CI 1.252 - 7.567). Therefore, predictors for this study for obesity were found as abnormal blood pressure and hospital visit after symptoms development.

Conclusion

Obesity is a important risk factor for DM and other chronic diseases. In the present study, illustration of higher prevalence of obesity among type 2 diabetes was made. Predictors for this study for obesity were found as abnormal blood pressure and hospital visit after symptoms development.

Limitation

The study population was less in number, so study including large number of subjects would give more accurate association. Specific population was included which may not reflect the whole country. Other parameters could have been including including dietary pattern, exercise level, fruits and vegetable consumption etc.

Conflicts of interests: None declared.

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