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A Study of extent of Diabetes Mellitus and its association with various risk factors in the Urban Slum population of Gurugram.

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Abstract:

Background & Method

A community based cross-sectional study was carried out from December 2016 to September 2018 in adults aged 20-79 years residing in the selected slums of Gurugram with an aim to study of extent of Diabetes Mellitus and its association with various risk factors in the Urban Slum population of Gurugram.

Results:

The mean age of study participants was 43.79 + 12.84years. Majority 58.5% of the study participants belonged to 40-59years age group (p <0.001) more so in married (p <0.001). About 76.5% participants were illiterate and 58.8% were employed. The prevalence of diabetes mellitus was found to be 20.2% in the present study. The prevalence of diabetes mellitus among males was 33.5% which was higher as compared to prevalence among females i.e.13.5% (p <0.00). About 44.7% were previously diagnosed and were on treatment .The mean blood glucose study participants was 160.10 + 31.31 years. The mean blood glucose level of those diagnosed with diabetes mellitus was found to be 238.28+29.29years. About 67.2% reported of diabetes mellitus in parents. Among them, 47.8% had history of diabetes mellitus in their mother, 29% gave history of paternal diabetes mellitus and rest 23.2% gave history of diabetes mellitus in both parents. None of the females reported of consuming alcohol but 77.8% males consumed alcohol and rest 22.2% did no. About 68.8% study participants were currently consuming tobacco, males 98.5% females 53.9% (p <0.001). Majority of study participants 60.9% were found to have BMI > 25 Kg/m2 i.e. overweight and obese. 62.8% males and 21.8% females were having normal BMI (p =0.001). The prevalence of overweight was higher among females 76% than males 30.3% with higher waist hip Ratio among females 82.2% than males 51.4% (p =0.03).Thus overweight and obesity were found to be significantly associated with diabetes mellitus. The prevalence of diabetes mellitus was higher among those belonging to joint family (34.8%) as compared to those who belonged to nuclear family (15.2%)(p<0.001). The prevalence of diabetes mellitus increased with increase in level of education and employment, highest 70.5% with secondary and above level of education, followed by those with primary level 44.5% and least among those who are illiterate 11.5%. Similarly the socioeconomic status, was found to be highest among those belonging to lower socioeconomic status 62.1%, 41.6% among upper lower socioeconomic status(p <0.001). Family history of diabetes mellitus was found to be associated with diabetes mellitus among the study participant, higher among those with positive family history (p <0.001). About 32.8% reported of weakness, 26.4% reported fatigue, polyuria and polydipsia by 12.6% and 24.7%. About 8.8% reported of tingling sensation in lower extremities, numbness and burning sensation in the lower extremities was reported by only 5% and 2.4%. 74.3% had inadequate physical activity.

Those who were doing moderate type of exercise for at least 150 minutes in a week including any outdoor sports were considered to be engaged in adequate physical activity. About dietary risk factors, 44.5% reported low intake of fruits, 32% had breakfast for more than three times a week and 28.5% consumed breakfast less than three days a week, 7.1% were diagnosed cases of hypertension. Majority 52.8% preferred visiting Government hospital for treatment followed by 24.3% private hospital. The different reasons for preference of treatment as cited by study participants were shorter distance 57.8%, lesser cost 51.9%, trust on doctor 49.5% and lesser waiting period 44.5%.

Conclusion:

In the present study the prevalence of diabetes mellitus among adults was found to be higher as compared to other studies. The male gender, socioeconomic status, family type, family history of diabetes mellitus, higher BMI, higher waist hip ratio, tobacco consumption were found to be significantly associated with diabetes mellitus in the study group.

Keywords: Diabetes Mellitus, risk, Urban, Slum & Gurugram.
Study Design: Observational Study.

INTRODUCTION- Diabetes is one of the most dangerous and silent chronic diseases associated with many co-morbidities and mortalities. According to International Diabetes Federation, several risk factors like family history, overweight, unhealthy diet, sedentary lifestyle, increasing age, high blood pressure, stress etc, have been associated with type 2 diabetes.[1] / non-insulin-dependent diabetes (NIDDM). Type 2 diabetes in India as corroborated by many studies; show associations between above risk factors and several others like hyperlipidemia, smoking habits, low education, and recently studied specific genes.[2,3]

Obesity- Many longitudinal studies have reported a strong positive association between obesity and increased risk of developing insulin resistance with type 2 diabetes in both genders.[2-10]

Lipids- An inverse relationship between HDL cholesterol and risk of type 2 diabetes have been documented in several of these [3,4,5,7,9,11], especially in women[6,12]. High plasma triglycerides and low plasma HDL cholesterol levels are both seen in the insulin resistance syndrome, a pre-diabetic state [13,14].

Hypertension - Evidence from cross sectional and cohort studies suggests a strong relation between blood pressure and BMI and risk of type 2 diabetes [15,16,17]. Although studies show that blood pressure increases with increasing BMI, the risk of type 2 diabetes associated with hypertension is independent of BMI and BMI change. A causal relationship between hypertension and type 2diabetes is further strengthened by a recent randomized clinical trial study showing a 14% reduction of risk of diabetes in subjects with glucose intolerance by allocation to 5 year treatment with valsartan, an angiotensin II blocker with antihypertensive properties [18].

Smoking - a meta- analysis including 25 prospective studies showed that current smoking was associated with a 44% increased risk of diabetes[19], stronger for heavy smokers ≥ 20 cigarettes/day [19-21].

Physical inactivity- Prolonged television watching as a surrogate marker of sedentary lifestyle, was reported to be positively associated with diabetes risk in both men and women

[22-24]. Moderate and vigorous physical activity was associated with a lower risk of type 2 diabetes.[25,26,27]

Low education- In a cross sectional study of National Population Health Survey found that people with less than high school diploma were almost twice as likely to report having diabetes as those with a bachelor degree or more [28] who were obese and inactive compared to the more educated [29]. These studies suggest that educational attainment promote an interest in own health and acquisition of knowledge that strongly influence people's ability to reduce risk by successfully adopting a healthier life style.

Dietary pattern- Positive association has been reported between the risk of type 2 diabetes and different patterns of food intake[30-33] especially higher dietary glycemic index in different cohort studies [33]. The relative risk (RR) for type 2 diabetes highest to the lowest glycemic index was; for quintiles 1–5, respectively: 1, 1.15, 1.07, 1.27, and 1.59 (P for trend 0.001), whereas cereal fiber intake was associated with a decreased risk for quintiles 1–5, respectively: 1, 0.85, 0.87, 0.82, and 0.64 (P for trend 0.004)[33].

Genetics- Recent studies have identified positive family history among first degree relatives and variants in 11 genes (TCF7L2, PPARG, FTO,KCNJ11, NOTCH2, WFS1, CDKAL1, IGF2BP2, SLC30A8, JAZF1, and HHEX) to be significantly associated with the risk of type 2 diabetes independently of other clinical risk factors and variants in 8 of these genes were associated with impaired beta-cell function [34,35,36].

Life style- Effect of an urban environment onto the lifestyle pattern in the form of increase in fat consumption, physical inactivity, and substance abuse with associated risk of development of chronic diseases like hypertension and DM[37,38] showed that the individual who resided in urban environment had two times more chance to become overweight and obese[39]. In India, it was found that the prevalence of DM was two and half times higher in urban than in rural area [40]. Especially shift in age of onset to younger age groups is alarming as this could have adverse effects on the nation's economy. Hence, the early identification of at risk individuals and appropriate intervention in the form of weight reduction, changes in dietary habits and increased physical activity could greatly help to prevent, or at least delay the onset of diabetes and thus reduce the burden due to non communicable diseases in India.

MATERIALS AND METHODS- A community based cross-sectional study was carried out from December 2016 to September 2018 in adults aged 20-79 years residing in the selected slums of Gurugram. **Inclusion and exclusion criteria: R**esidents (of either sex) of the selected slums aged 20-79 years, who give consent, will be included in the study. Patients who are not willing to give consent for the study, type 1 diabetics and terminally ill patients and pregnant women will be excluded.

After Institutional ethical committee clearance and the informed consent from each participant, a face to face interview was conducted. Information regarding socio demographic profile, personal and family history, marital status and income, utilization of health services, morbidities, physical activity and awareness regarding symptoms of diabetes mellitus was obtained. A through general examination, weight, height and BP measurement and blood glucose estimation was done. Individuals were subjected to a random blood sugar (RBS) screening by glucometer (Optium exceed by Abbott Healthcare).

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RESULTS

Table 1.Distribution of study participants according to physical activity			
Physical Activity	Male	Female	Total
Adequate	71(50.7%)	37(13.2%)	108(25.7%)
Inadequate	69(49.3%)	243(86.7%)	312(74.3%)
Total	140	280	420

Above table 1 shows the distribution of study participants according to physical activity

Table 2.Distribution of study participants according to family history of Diabetes mellitus			
Family history of DM	Male	Female	Total
Present	62	76	138(32.8%)
Absent	78	204	282(67.2%)
Total	140	280	420

Above table 2 shows the family history of Diabetes mellitus among study participants

Table 3.Distribution of male participants according to history of alcohol consumption (N=140)			
Alcohol intake	User	Non user	Total
	109(77.8%)	31(22.2%)	140

Above table 3 shows the distribution of male participants according to alcohol consumption.

Table 4.Distribution of study participants according to history of tobacco consumption			
Tobacco user	Male	Female	Total
User	138(98.5%)	151(53.9%)	289(68.8%)
Non user	02(1.5%)	129(46.1%)	131(31.2%)
Total	140	280	420

Above table 4 shows the distribution of study participants according to tobacco consumption.

Table 5.Distribution of study participants according to Body mass index			
Body Mass Index	Male	Female	Total

Underweight	09(6.4%)	06(2.2%)	15(3.5%)
Normal	88(62.8%)	(21.8%)	149(35.4%)
Overweight and obese	43(30.3%)	213(76%)	256(60.9%)
Total	140	280	420

Above table 5 shows the distribution of study participants according to body mass index.

Table 6.Distribution of study participants according to Waist Hip ratio			
Waist Hip Ratio	Male	Female	Total
Normal WHR	68(48.6%)	50(17.8%)	118(28.1%)
High WHR	72(51.4%)	230(82.2%)	302(71.9%)
Total	140	280	420

Above table 6 shows the distribution of study participants according to waist hip ratio.

Table 7.Association between gender and Diabetes mellitus			
	Diabetes mellitus present	Diabetes mellitus absent	Total
Male	47(33.6%)	93(66.4%)	140
Female	38(13.6%)	242(86.4%)	280
Total	85(20.2%)	335(79.8%)	420
X^2 =21.91,df = 1, p <0.001			

Above table 7 shows the association between gender and Diabetes Mellitus.

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Table 8.Association between age and Diabetes mellitus			
Age	Diabetes mellitus present	Diabetes mellitus absent	Total
20-39years	12(14.2%)	128(38.2%)	140
40-59years	62(72.9%)	184(54.9%)	246
60-79years	11(12.9%)	23(6.9%)	34
Total	85(20.2%)	335(79.8%)	420
X^2 =18.65,p<0.001			

Above table 8 shows the association between age and Diabetes mellitus.

Table 9.Association between marital status and Diabetes mellitus			
	Diabetes mellitus present	Diabetes mellitus absent	Total
Married	55(64.7%)	281(83.8%)	336
Unmarried/divorced/separated	30(35.3%)	54(16.2%)	84
Total	85(20.2%)	335(79.8%)	420
X^2 =14.4,p<0.001			

Above Table 9 shows the association between marital status and Diabetes mellitus.

Table 10.Association between type of family and Diabetes mellitus			
	Diabetes mellitus present	Diabetes mellitus absent	Total
Nuclear	47(15.2%)	264(84.8%)	311
Joint	38(34.8%)	71(65.2%)	109
Total	85(20.2%)	335(79.8%)	420
X^2 = 18.3,p <0.001			

Above table 10 shows the association between type of family and Diabetes mellitus.

Table 11.Association between education level and Diabetes mellitus			
	Diabetes mellitus present	Diabetes mellitus absent	Total

Illiterate	37(11.5%)	285(88.5%)	322
Primary	36(44.5%)	45(55.5%)	81
Secondary and above	12(70.5%)	5(29.5%)	17
Total	85(20.2%)	335(79.8%)	420
X^2 =71.36,p<0.001			

Above table 11 shows the association between education level and Diabetes mellitus.

Table 12.Association between employment status and Diabetes mellitus			
	Diabetes mellitus present	Diabetes mellitus absent	Total
Employed	46(18.6%)	201(81.4%)	247
Unemployed	39(22.5%)	134(77.5%)	173
Total	85(20.2%)	335(79.8%)	420
X^2= 0.74,p =0.38			

Above table 12 shows the association between employment status and Diabetes mellitus.

Table 13.Association between Socioeconomic status and Diabetes mellitus			
	Diabetes mellitus present	Diabetes mellitus present	Total
Upper	02(25%)	06(75%)	08
Upper middle	18(24.3%)	56(75.7%)	74
Lower middle	40(19.2%)	168(80.8%)	208
Upper Lower	42(41.6%)	59(58.4%)	101
Lower	18(62.1%)	11(37.9%)	29
Total	85(20.2%)	335(79.8%)	420
X^2 =33.92,p<0.001			

Above table 13 shows the association between socioeconomic status and Diabetes mellitus.

Table14.Association between alcohol consumption and Diabetes mellitus among male study participants

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	Diabetes mellitus present	Diabetes mellitus absent	Total
User	38(34.9%)	71(65.1%)	109
Non user	09(29%)	22(71%)	31
Total	47(33.5%)	93(66.5%)	140
$X^2 = 0.15, p = 0.6$			

Above table 14 shows the association between alcohol consumption and Diabetes mellitus among male participants.

Table 15.Association between tobacco use and Diabetes mellitus

	Diabetes mellitus present	Diabetes mellitus absent	Total
User	74(25.6%)	215(74.4%)	289
Non user	11(8.4%)	120(91.6%)	131
Total	85(20.2%)	335(79.8%)	420
$X^2 = 15.49, p<0.001$			

Above table 15 shows the association between tobacco use and Diabetes mellitus.

Table 16.Association between family history of DM and Diabetes mellitus

	Diabetes mellitus present	Diabetes mellitus absent	Total
Family history	69(50%)	69(50%)	138
No family history	16(5.7%)	266(94.3%)	282
Total	85(20.2%)	335(79.8%)	420
$X^2= 110, p<0.001$			

Above table 16 shows the association between family history of Diabetes mellitus and Diabetes mellitus among study participants.

Table 17.Association between family history and Diabetes mellitus

	Diabetes mellitus present	Diabetes mellitus absent	Total

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Maternal history	31(47%)	35(53%)	66
Paternal history	16(40%)	24(60%)	40
Both parents	22(68.8%)	10(31.2%)	32
Total	69(50%)	69(50%)	138
X^2= 6.34,p =0.04			

Above table 17 shows the association between family history of Diabetes mellitus and current status of Diabetes mellitus

Table 18.Association between Body mass index and Diabetes mellitus			
	Diabetes mellitus present	Diabetes mellitus absent	Total
Under weight	02(13.4%)	13(86.6%)	15
Normal	18(12.1%)	131(87.9%)	149
Overweight and obese	65(25.4%)	191(74.6%)	256
Total	85(20.2%)	335(79.8%)	420
X^2= 10.8,p =0.004			

Above table 18 shows the association between body mass index and Diabetes mellitus.

Table 19.Association between WHR and Diabetes mellitus			
	Diabetes mellitus present	Diabetes mellitus absent	Total
Normal WHR	12(10.2%)	106(89.8%)	118
High WHR	73(24.2%)	229(75.8%)	302
Total	85(20.2%)	335(79.8%)	420
X^2= 4.24,p =0.03			

Above table 19 shows the association between waist hip ratio and Diabetes mellitus.

Table 20. Self-reported symptoms for diabetes mellitus among study participants		
	Number	**Percentage (%)**
Polyuria	**53**	**12.6**

Polydipsia	**104**	**24.7**
Weight loss	**76**	**1.7**
Fatigue	**111**	**26.4**
Weakness	**138**	**32.8**
Blurring of vision	**21**	**5**
Tingling in lower extremities	**37**	**8.8**
Numbness in lower extremities	**21**	**5**
Burning sensation of foot	**10**	**2.4**

Above table 20 shows the self-reported symptoms of diabetes mellitus among study participants.

Above table 21 shows the prevalence of different modifiable risk factors for Diabetes mellitus

Table21.Prevalence of modifiable risk factors for diabetes mellitus among study participants	
RISK FACTORS	**Number(N=420)**
>3 days /week fast food	134(32%)
<3days /week breakfast	120 (28.5%)
Low intake of fruits	187(44.5%)
<3 days/week salads	145(54.5%)
Inadequate physical activity	312(74.3%)
Current tobacco user	289(68.8%)
Current alcohol consumption	109(25.9%)
BMI > 25Kg/m^2	256(60.9%)
High Waist Hip ratio	302(72%)
Hypertension	30(7.1%)

Table 22. Distribution of the subjects according to the system of treatment preference

	Number	Percentage
Government Hospital	222	52.8%
Private hospital	102	24.4%
Ayush and Indian system of medicine	46	11%
Quacks	25	6%
Home remedies	25	6%

Above table 22 shows the distribution of study participants on the basis of preference of system of treatment.

Table 23.Various reasons cited for preference of treatment		
Reasons	Number	Percentage
Distance is shorter	243	57.8%
Reliability/Trust on doctor	208	49.5%
Less waiting time	187	44.5%
Lesser cost	218	51.9%

Above table 23 shows the various reasons cited by study participants for the preference of treatment.

DISCUSSION- The prevalence of diabetes among males was 33.5% which was higher as compared to females i.e.13.5%.The difference in prevalence in both the genders was found to be statistically significant($p<0.001$). Among those who were diagnosed with diabetes in the present study, about 44.7% were previously diagnosed and were on treatment .The mean random blood glucose level was found to be 238.28+29.29mg/dl. The prevalence of diabetes was highest 72.9% among 40-59 years age group (both genders), followed by 14.2% in 20-39 years age group and 12.9% in 60-79years age group ($p <0.001$). Among the modifiable risk factors, prevalence of diabetes was higher 25.6% among tobacco users as compared to non users; 8.4% ($p<0.001$). The prevalence highest 25.4% among those overweight and obese ($P<0.001$), 24.2% among those with higher waist hip ratio ($p =0.03$). Individuals having waist circumference >90 cm in males and >80 cm in females had a risk of diabetes. The prevalence of diabetes was higher 68.8% among those with history of diabetes in both parents, followed by 47% with maternal history of diabetes and least 40% with only paternal history ($p =0.04$). Majority 32.8% reported of weakness, 26.4% reported fatigue, 12.6% polyuria and polydipsia and 24.7%, 8.8% reported of tingling sensation in lower extremities, numbness and burning sensation in the lower extremities by 5% and 2.4%. Among health-care-seeking behavior was defined as: formal, when professional help was sought from health care services and/or

providers (physicians, psychologists); informal when help was sought from members of their social network (parents, friends, teachers, trusted persons. Majority 52.8% preferred visiting Government hospital for treatment followed by 24.3% private hospital. About 11% depended on AYUSH and Indian systems of medicine. Rest 12% depended either on quacks or on home remedies. The different reasons for preference of treatment as cited by study participants were shorter distance 57.8%, lesser cost 51.9%, trust on doctor 49.5% and lesser waiting period 44.5%.

CONCLUSION- The mean age of study participants was 43.79 + 12.84years. Majority 58.5% of the study participants belonged to 40-59years age group ($p < 0.001$) more so in married ($p < 0.001$). About 76.5% participants were illiterate and 58.8% were employed. The prevalence of diabetes mellitus was found to be 20.2% in the present study. The prevalence of diabetes mellitus among males was 33.5% which was higher as compared to prevalence among females i.e.13.5% ($p < 0.00$). About 44.7% were previously diagnosed and were on treatment .The mean blood glucose study participants was 160.10 + 31.31 years. The mean blood glucose level of those diagnosed with diabetes mellitus was found to be 238.28+29.29years. About 67.2% reported of diabetes mellitus in parents. Among them, 47.8% had history of diabetes mellitus in their mother, 29% gave history of paternal diabetes mellitus and rest 23.2% gave history of diabetes mellitus in both parents. None of the females reported of consuming alcohol but 77.8% males consumed alcohol and rest 22.2% did no. About 68.8% study participants were currently consuming tobacco, males 98.5% females 53.9% ($p < 0.001$). Majority of study participants 60.9% were found to have BMI > 25 Kg/m^2 i.e. overweight and obese. 62.8% males and 21.8% females were having normal BMI ($p = 0.001$). The prevalence of overweight was higher among females 76% than males 30.3% with higher waist hip Ratio among females 82.2% than males 51.4% ($p = 0.03$).Thus overweight and obesity were found to be significantly associated with diabetes mellitus. The prevalence of diabetes mellitus was higher among those belonging to joint family (34.8%) as compared to those who belonged to nuclear family (15.2%)($p<0.001$). The prevalence of diabetes mellitus increased with increase in level of education and employment, highest 70.5% with secondary and above level of education, followed by those with primary level 44.5% and least among those who are illiterate 11.5%. Similarly the socioeconomic status, was found to be highest among those belonging to lower socioeconomic status 62.1%, 41.6% among upper lower socioeconomic status($p < 0.001$). Family history of diabetes mellitus was found to be associated with diabetes mellitus among the study participant, higher among those with positive family history ($p < 0.001$). About 32.8% reported of weakness, 26.4% reported fatigue, polyuria and polydipsia by 12.6% and 24.7%. About 8.8% reported of tingling sensation in lower extremities, numbness and burning sensation in the lower extremities was reported by only 5% and 2.4%. 74.3% had inadequate physical activity. Those who were doing moderate type of exercise for at least 150 minutes in a week including any outdoor sports were considered to be engaged in adequate physical activity. About dietary risk factors, 44.5% reported low intake of fruits, 32% had breakfast for more than three times a week and 28.5% consumed breakfast less than three days a week, 7.1% were diagnosed cases of hypertension. Majority 52.8% preferred visiting Government hospital for treatment followed by 24.3% private hospital. The different reasons for

preference of treatment as cited by study participants were shorter distance 57.8%, lesser cost 51.9%, trust on doctor 49.5% and lesser waiting period 44.5%.

Thus, in the present study the prevalence of diabetes mellitus among adults was found to be higher as compared to other studies. The male gender, socioeconomic status, family type, family history of diabetes mellitus, higher BMI, higher waist hip ratio, tobacco consumption were found to be significantly associated with diabetes mellitus in the study group.

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