A clinico-epidemiological study of diabetes mellitus among urban and rural population of Lucknow

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Abstract
Introduction: The prevalence of Diabetes Mellitus is growing rapidly worldwide and is reaching epidemic proportions. Globally around 366 million people have Diabetes in 2011 and by 2030 this will have risen to 552 million.
Objectives: To estimate prevalence of Diabetes Mellitus and to detect undiagnosed Diabetes in urban and rural areas of Lucknow.
Material and Methods: It was a community based cross-sectional study done in the urban and rural areas of Lucknow, under Department of Community Medicine, Era's Lucknow Medical College and Hospital in subjects aged 20 years and above from August 2017-July 2018.
Results and Observations: The overall prevalence of Diabetes Mellitus was 13.8% which was more in urban (15.8%) as compared to rural (11.7%) areas. Out of total 113 diabetic subjects, 87 (76.9%) knew their diabetic status before the study where as 26 cases (23.1%) were diagnosed Diabetes Mellitus at the time of study. Newly diagnosed cases were more (24.6%) in urban areas as compared to the rural areas (20.9%).
Conclusion: Health policy must be made that include measures to promote Diabetes prevention and control through lifestyle changes, effective but inexpensive drug therapy and comprehensive community health education.

Keywords: Diabetes Mellitus, Cross sectional study, Lifestyle changes.

Introduction
Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels. Several pathogenic processes are involved in the development of Diabetes. These range from autoimmune destruction of the b-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. The basis of the abnormalities in carbohydrate, fat, and protein metabolism in Diabetes is deficient action of insulin on target tissues. Deficient insulin action results from inadequate insulin secretion and/or diminished tissue responses to insulin at one or more points in the complex pathways of hormone action.[1]

Diabetes mellitus, long considered a disease of minor significance to world health, is now taking its place as one of the main threats to human health in the 21st century. The past two decades have seen an explosive increase in the number of people diagnosed with Diabetes worldwide.[1]

The prevalence of Diabetes Mellitus is growing rapidly worldwide and is reaching epidemic proportions.[2,3] Globally around 366 million people have Diabetes in 2011 and by 2030 this will have risen to 552 million. The number of people with type 2 Diabetes is increasing in every country.[4] It is estimated that around 183 million people (50%) with Diabetes are undiagnosed.[5]

As the economy started growing, so did the incidence of Diabetes. The nationwide prevalence of Diabetes in India now tops 9%, and is as high as 20% in the relatively prosperous southern cities. By 2030, the IDF predicts, India will have 100 million people with Diabetes.[6]

Thus it is essential that every country attempts to assess the magnitude of problem and takes steps to control and prevent Diabetes Mellitus and provide appropriate care. Diabetes is a serious disease that can have a significant impact on health, quality of life and life expectancy of individuals, as well as on health care system. Compared with people without Diabetes, Diabetic patients have a higher hospitalization rate, longer hospital stays, and increased ambulatory care visits. The World Health Organization (WHO) suggests population based studies for preventive policies for diseases including Diabetes planning control programmes and carrying out the management and educational services.[17] Quantifying the prevalence of Diabetes and the number of people affected by Diabetes, now and in the future, is important to allow rational planning and allocations of resources.[18]

Despite of having high burden of morbidity contributed by Diabetes mellitus in India, a very few and limited studies have been conducted in Lucknow to assess prevalence of Diabetes mellitus in Lucknow. Such information is very important for prevention of Diabetes mellitus. The present study is aimed at epidemiological study of Diabetes mellitus amongst urban and rural adult population of Lucknow District and to suggest appropriate measures to reduce the prevalence of this non communicable disease.

Aim and Objectives
To estimate prevalence of Diabetes Mellitus and to detect undiagnosed Diabetes in urban and rural areas of Lucknow.

Materials and Methods

It was a community based cross-sectional study done in the urban and rural areas of Lucknow, under Department of Community Medicine, Era's Lucknow Medical College and Hospital in subjects aged 20 years and above from August 2017-July 2018.

The sample size was calculated using the following formula:

$n= (z_\alpha{}^2 p.q/d^2).\delta$

where:

z_α=1.96 (5 % type one error); n=sample size; p=prevalence; q=100-p; d=allowable error=25% of p; δ= design effect ie. 1.5 in this case.

Prevalence is taken as 11% and the value of allowable error is 25% of p

Sample Size= $(1.96)^2$. (11).(100-11)/$(2.75)^2$

=497 x 1.5= 745.6 + 10% data loss = 820.

Study was carried out in 820 adults aged more than 20 years in urban area (four zones) and rural area (two blocks) of Lucknow District. Out of these 820 adult population, 410 adults from Urban and 410 adults from rural areas of Lucknow District were studied. A multi-stage random sampling technique was used to select required sample size.

For multistage random sampling at first stage Lucknow District was divided in Urban and Rural areas. At second stage in urban area we selected 4 zones out of 6 zones and in rural area 2 blocks out of 8 blocks by simple random sampling technique. A list of various wards and blocks were obtained from Lucknow Municipal Corporation. At third stage 2 wards were selected from each of 4 zones and 4 villages from each block. At fourth stage through simple random sampling technique one house from each ward was selected and starting from house no.1 till 51 adults were found. Similarly in rural areas at fourth stage through simple random technique one house from each village was selected and study was carried out and starting from house no.1 till 102 adults are found.

A pre designed pre tested interview schedule was used to interview a person. An informed written consent was obtained prior to data collection. We asked additional questions to the key informant of each household to assess the socio-economic status of the households. Anthropometric measurements and blood pressure of each participant were recorded. Blood glucose meter was used to analyze fasting blood samples and from all participants for estimation of fasting plasma glucose.

Adult subjects aged 20 years or more with or without family history of Diabetes mellitus and who were cooperative were included in the study. However those who were non cooperative were excluded. All pregnant and lactating females were also excluded.

Information on gender, age, anthropometric measurements including height, weight, waist and hip measurement were obtained using a standardized questionnaire by a structured interview.

A prior information was given to all study subjects and fasting blood sample was collected for biochemical investigations after an overnight fast of at least 10 hours. If the patient was a diagnosed case of Diabetes mellitus sampling was done before taking any oral hypoglycemic agent or insulin. Biochemical analysis was done by a standardized glucose meter.

Definitions and diagnostic criteria

Diabetes was defined by physician diagnosis of diabetes and current use of medications for diabetes (insulin or oral hypoglycemic agents) and/or fulfillment of criteria laid down by the WHO/IDF Consultation Group Report (2006), i.e., capillary fasting blood glucose ≥126 mg/dl or 2 h capillary post-glucose value ≥200 mg/dl.[9]

Impaired fasting glucose was defined based on WHO criteria, i.e., if fasting capillary blood glucose ≥110 and <126 mg/dl.[9]

Statistical analysis

Statistical analysis was done by software (Statistical Package for the Social Sciences) SPSS 20 version. The prevalence rates were given as percentages. Discrete data was analyzed using Pearson's Chi-square test. Two tailed *P* values less than 0.05 were considered significant.

Results and Observations

Table 1: Distribution of study subjects according to Bio-social characteristics

Bio-social characteristics	Urban(n=410)		Rural(n=410)		Total(n=820)	
	No.	%	No.	%	No.	%
Age in years						
20-29	84	20.5	96	23.4	180	22
30-39	112	27.3	112	27.3	224	27.3
40-49	84	20.5	74	18	158	19.3
50-59	60	14.6	51	12.4	111	13.5
60-69	47	11.5	46	11.2	93	11.3
>70	23	5.6	31	7.6	54	6.6
Mean±SD	43±15	NA	43±16	NA	43±16	NA
Gender						
Male	203	49.5	213	52	416	50.7
Female	207	50.5	197	48	404	49.3
Marital status						

Married	333	81.2	330	80.5	663	80.9
Unmarried	64	15.6	52	12.7	116	14.1
Widow/ Divorced	13	3.1	28	6.9	41	5.0
Religion						
Hindu	289	70.5	256	62.4	545	66.5
Muslim	93	22.7	121	29.5	214	26.1
Sikh/ Christian	28	6.8	33	8.0	61	7.4
Caste						
General	321	78.3	276	67.3	597	72.8
OBC	79	19.3	107	26.1	186	22.7
SC/ST	10	2.4	27	6.6	37	4.5
Type of family						
Nuclear	221	53.9	191	46.6	412	50.2
Joint	189	46.1	219	53.4	408	49.8
Socio-economic status*						
I	228	55.6	0	0	228	27.8
II	141	34.4	89	21.7	230	28.0
III	38	9.3	167	40.7	205	25.0
IV	2	0.5	96	23.4	98	12.0
V	1	0.2	58	14.1	59	7.2

*According to Modified B.G. Prasad classification for Socio Economic status 2013.

Table 1 shows that a total of 820 subjects were studied with mean age of 43 years. Out of these 410 were from urban areas and 410 were from rural with mean age of 43 years in either group. Almost one third (27.3%) of study subject were in the age group of 30-39 years while only 6.6% were in age group >70 years.

The gender distribution was almost equal (males 416, females 404). Almost similar distribution was seen in urban and rural areas. The majority (80.9%) of the study subjects were married and only 14.1% were unmarried followed by 5.0% divorced/widowed and almost similar distribution was observed in the urban and rural areas.

The majority of the subjects were Hindus (66.5%) and there were only 26.1% Muslims. The percentage distribution of others was small. Among the study subjects of urban areas 70.5% were Hindus 22.7% were Muslims and others were 6.8%. where as in rural areas 62.4% were Hindus 29.5% were Muslims and others were 8%. The majority of study subjects belonged to General caste (72.8%) and about one fifth (22.7%) belonged to OBC. There was almost similar distribution of caste among urban and rural areas.

Almost half (50.2%) of the study subjects were having nuclear type of family with slight urban(53.9%) and rural(46.6%) variation. 28% of study subjects belonged to SES II while 27.8% belonged to SES I class. One fourth (25%) of the subjects belonged to SES III and 12% belonged to SES IV. Only 7.2% belonged to SES V class. The distribution of SES level in urban and rural subjects was variable.

Table 2: Distribution of study subjects according to education and occupation

Bio-social characteristics	**Urban(n=410)**		**Rural(n=410)**		**Total(n=820)**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Education						
Illiterate	3	0.7	46	11.2	49	6.0
Primary-Middle school	27	6.6	126	30.7	153	18.7
High school-Intermediate	137	33.4	235	57.3	372	45.3
Graduation- Professional	243	59.2	3	0.7	246	30
Occupation						
Unemployed/Housewife	228	55.6	268	65.4	496	60.5
Unskilled worker	1	0.2	41	10	42	5.1
Semi skilled worker	5	1.2	57	13.9	62	7.6
Skilled worker	13	3.2	34	8.3	47	5.7
Clerk/Business/Shopkeeper	45	11	7	1.7	52	6.3
Semi professional	63	15.4	2	0.5	65	7.9
Professional	55	13.4	1	0.2	56	6.8

Table 2 shows that 45.3% of study subjects were educated up to high school/ intermediate level and almost one third (30%) were having graduation/ professional qualification. Only 18.7 % were educated up to primary/ middle school level. 6.0% of study subjects were illiterate. The educational status of study subjects were higher in urban than in rural areas.

More than half (60.5%) of study subjects were unemployed/ housewives. 7.9% were semi professional and 7.6% were semi skilled workers.

Table 3: Area wise distribution of prevalence of Diabetes Mellitus

Place of residence	Number of subjects	Prevalence			χ^2 test (p value)
		No. of Diabetics	%	95% CI	
Urban	410	65	15.8	12.27,19.33	2.628 (0.105)
Rural	410	48	11.7	8.59,14.81	
Total	820	113	13.8	11.44,16.16	

Table 3 shows that the overall prevalence of Diabetes Mellitus was 13.8% which was more in urban (15.8%) as compared to rural (11.7%) areas.

Table 4: Distribution of study subjects according to Fasting Plasma glucose status

Place of residence	Gender	Number of subjects	Fasting plasma glucose status					
			Diabetes		Impaired fasting glycemia		Normal	
			No.	%	No.	%	No.	%
Urban	Male	203	42	20.7	38	18.7	123	60.6
	Female	207	23	11.1	31	15.0	153	73.9
	Total	**410**	**65**	**15.9**	**69**	**16.8**	**276**	**67.3**
Rural	Male	213	28	13.1	42	19.7	143	67.1
	Female	197	20	10.2	29	14.7	148	75.1
	Total	**410**	**48**	**11.7**	**71**	**17.3**	**291**	**71.0**
Total	Male	416	70	16.8	80	19.2	266	63.9
	Female	404	43	10.6	60	14.9	301	74.5
	Total	**820**	**113**	**13.8**	**140**	**17.1**	**567**	**69.1**

Table 4 shows that out of the total adults aged 20 years and above, 13.8% were diabetics; 17.1% had impaired fasting glycemia and 69.1% were normoglycemics. In urban areas the prevalence of Diabetes was more (15.9%) than rural areas (11.7%); while impaired fasting glycemia was more in rural areas (17.3%) than urban areas (16.8%).

Table 5: Subject's awareness of their diabetic status

Place of residence	Total cases	Previously known cases		Newly diagnosed cases	
		No.	%	No.	%
Urban	65	49	75.4	16	24.6
Rural	48	38	79.1	10	20.9
Total	113	87	76.9	26	23.1

Table 5 shows that out of total 113 diabetic subjects, 87 (76.9%) knew their diabetic status before the study where as 26 cases (23.1%) were diagnosed Diabetes Mellitus at the time of study. Newly diagnosed cases were more (24.6%) in urban areas as compared to the rural areas (20.9%).

Discussion

In the present study, the prevalence of Diabetes in persons aged 20 years and above was found to be 13.8%. Whereas ICMR (2004)[10] after a meta-analysis for estimating the prevalence of Diabetes in India by reviewing the prevalence studied from 1990-2002 reported a comparatively lower (6.25%) prevalence of Diabetes in adults (≥ 20 years) in India. Maroof Khan Amir et al (2005)[11] in their cross sectional study from Lucknow also reported a lower prevalence of Diabetes (9.5%) in persons aged 20 years and above. The above difference could be attributed to the change in lifestyle patterns, rapid urbanization and increase awareness about Diabetes over the last decade.

The prevalence of Diabetes in urban area was 15.9% in the present study. Similar findings were reported from various studies in different part of India. In a multicentric study, Anjana *et al.* (2011)[12] reported a slightly similar prevalence of Diabetes mellitus (14.2%) among urban population, aged 20 years and above in Chandigarh. In another community based cross sectional survey Ravikumar P et al. (2010)[13] in urban population of Chandigarh reported almost similar prevalence of Diabetes (15.7%). A study conducted by Kumar P et al. (2013)[14] in Bankura District of West Bengal among all police personnel reported the prevalence of Diabetes mellitus 15% which is slightly lower than the present study. This difference may be due to study conducted among specified occupational group which is regularly involved in high physical activity and also includes lower age group.

In the present study, it was observed that 76.9% of diabetics were aware of their diabetic status but 23.1% were diagnosed as diabetics during the study. Rather contrasting observations were seen by Maroof Khan Amir et al (2005)[11] in their study from Lucknow who reported that 55.75% of diabetics were aware of their diabetic status while 44.25% were diagnosed during the study. Aekplakorn W et. al

(2003)[15] also reported similar findings in Thai adults. This difference could be attributed due to the increasing awareness about Diabetes over the last decade.

Conclusion

The prevalence of Diabetes Mellitus came out to be 13.8% in Lucknow District, which is a major public health problem. In urban area prevalence of Diabetes was found to be 15.9%. The situation in rural area was much grim with prevalence being 11.7%.

At present, Diabetes is often not perceived by the Diabetic or community or the health services as a public health problem. There are six interlinked target groups, forming two main divisions; the first concerned with the practical management of the diabetic and high risk individual; the second overall awareness of the problem with particular emphasis on the economic and preventive aspects.

Health policy must be made that include measures to promote Diabetes prevention and control through lifestyle changes, effective but inexpensive drug therapy and comprehensive community health education.

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Conflict of interest

None.

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