Journal Of Medical Science And Clinical Research

IGM Publication   An Official Publication Of IGM Publication

Original Research Article

Comparison of Glycated Haemoglobin (HbA1c) Levels among Urban and Rural Diabetic Mellitus Patients

Authors
Suma.H.R[1], Kavita P Rasalkar[2], Uzma Anjum[3], Sanjay Reddy A C[4], Ramya Raghavan[5] P Nagaraj Sharma[6]

[1]Sakra world Hospital Bangalore India
[2,3]Dept of Biochemistry, PES Institute of Medical Sciences & Research, Kuppam, Chittoor, A.P, India
[4]Center for Diaetes and Endocrine Care, Bangalore, Karnataka, India
[5]Centre for DNA Fingerprinting and Diagnostics, Hydrabad, Telangana, India
[6]Vasavi Health Care, Malleshwaram, Bangalore, Karnataka, India
Corresponding Author
Dr Kavita Rasalkar
Assistant Professor, Department of Biochemistry, PES Institute of Medical Sciences & Research, Kuppam, Chittoor, A.P, India
Email: *drrasalkar27@yahoo.co.in*

ABSTRACT
Introduction: *India, the 'Diabetic Capital of the world', with all the genetic predisposition, diversity of culture and socioeconomic status, it is very important to know the distribution, the prevalence & complications of diabetes mellitus. It is also very important to have an indicator to monitor the disease burden on the society so that the government can focus on the appropriate resource allocation& implementation of various measures to reduce the disease burden on the society & the patient. Glycated haemoglobin-HbA1c has been proven to be the best indicator of long term glycemic control. It has also been observed to be useful to assess the risk of developing vascular complications and death in diabetic patients. In this study the distribution of patients with diabetes is compared among urban & rural patients based on the HbA1c levels to assess the burden of the disease & its complication on these two societies with socioeconomic diversity.*
Objectives: *To categorize the patients attending diabetic clinic into four categories based on HbA1c levels.*
To study the distribution of the urban & rural patients based on these categories with respect to number, age and sex.
Materials & Methods: *The Diabetes Mellitus patients were grouped into four different categories based on their HbA1c levels in both urban & rural study population. The distribution of the patients in different groups among the urban & rural population is compared & studied to assess the burden of the disease with micro & macrovascular complications on these two different societies.*
Results & Conclusion: *In Group III the Patients with high HbA1c are almost two folds more among rural population when compared to urban population and in Group IV the Patients with high HbA1c are almost ten folds more among rural population when compared to urban population. Identification of the factors which may be influencing these populations - is necessary to facilitate change when facing health challenges. There is an immediate need for implementing preventive measures to bring down the high morbidity and mortality and also to decrease the cost burden to the patients and to the society.*
Keywords: *HbA1c, Diabetes mellitus, Distribution among urban & rural population, Micro & Macrovascular complications.*

INTRODUCTION

The International Diabetes Federation (IDF) forecasts a rise to 552 million from 366 million people worldwide by 2030. In 2000, India (31.7 million) ranked first place among the various nations of the world with the highest number of people diagnosed to have diabetes mellitus followed by China (20.8 million) in second place & the United States (17.7 million) in the third place.

The prevalence of diabetes in urban areas of India in 1970s was 2.1% and this has rapidly climbed to 12-16% recently. Previously rough estimates showed that the prevalence of diabetes in rural populations is one-quarter that of urban population of India. Now prevalence in rural population is almost equal to as in urban population. (Kaveeshwar SA)

The etiology of diabetes mellitus in India is multifactorial. The various factors that contribute for development of diabetes mellitus are the genetic factors associated with environmental influences such as obesity, lifestyle changes, and steady urban migration.

The Indian urban population - has access to reliable screening methods and anti-diabetic-medications, whereas for Indian Rural population - such health benefits are not often available. "There is a disproportionate allocation of health resources between urban and rural areas, and in addition poverty in rural areas may be multi-faceted" (Kaveeshwar SA)

Though the incidence of diabetes mellitus in India is so high, there are no nationwide studies conducted. But very few multi-centric studies have been conducted to study the prevalence of diabetes and its complications.

The Indian population is heterogeneous with respect to culture, ethnicity, and socio- economic conditions, as a result the studies that have been undertaken are prone to potential error and the extrapolation of regional results for the whole country may give inaccurate estimates.

Glycated hemoglobin-HbA1c has long been associated with long term glycemic control in diabetic patients. *(The Diabetes Control and Complications Trial Research Group)*

"COMPARISON OF HbA$_{1c}$ LEVELS AMONG URBAN AND RURAL DIABETIC POPULATION":

The American Diabetes Association recommends to lower glycated hemoglobin levels less than 7%. In patients with low risk of hypoglycemia even lower goals may be set. HbA1c – is a much better indicator of long-term glycemic control than blood and urinary glucose determinations. Hyperglycemia may lead to long term complications in multiple organs (Gerstein et al, Irene et al). Non-linear relationship has been observed between mean HbA1c & the risks of developing macrovascular events, microvascular events and death. There are evidence of 'thresholds', such that no significant change in risks (all $p > 0.8$) below HbA1c levels of 7.0% for macrovascular events and death, and 6.5% for microvascular events. The risks rises significantly above these thresholds: every 1% rise in HbA1c level was associated with a 38% more risk of a macrovascular event, a 40% more risk of a microvascular event and a 38% more risk of death (all $p < 0.0001$) (S. Zoungas et al).

Assuming that the HbA1c can be used to assess the risk of development of Diabetes mellitus complications, it can be used to compare burden of the diabetes & its complications among different populations. Till date there are no studies available which compare the HbA1c levels among Indian urban and rural population to predict the burden of the disease especially with respect to its complications.

AIM

To compare HbA1C levels between urban and rural population

OBJECTIVES

To categorize the patients attending diabetic clinic into four categories based on HbA1c levels

To study the distribution of the urban & rural patients based on these categories with respect to number, age and sex.

MATERIALS AND METHODS

A cross-sectional observational study

On 1800 diabetic patients belonging to Urban (Bangalore; n= 900) and rural (Kuppam; n=900) population who attended diabetic clinic at a tertiary care center PESIMSR(Kuppam) and Center for Diabetes and Endocrine Care (Bangalore) for three months forms the study group. (May 2015 – July 2015).The study groups were further classified into subcategories based on HbA$_{1c}$ levels.

Group I = Patients with HbA1c <7% (Threshold for development of Macro& Micro vascular complications & early death)

Group II= Patients with HbA1c 7.1-10 % (Up to 50% risk of developing Macro & Micro vascular complications & early death)

Group III=Patients with HbA1c 10.1-14% (50 - 100% risk of developing Macro & Micro vascular complications & early death)

Group IV=Patients with HbA1c >14% (Almost 100% risk of developing Macro & Micro vascular complications & early death)

All Patients who attended the Diabetic clinics of both urban & rural centers for diabetes care (diet, exercise, antidiabetic medications or insulin), who has been newly diagnosed or known cases on treatment were included in the study.

Pregnant women. Patients with history of renal insufficiency with a creatinine level >1.5mg/dl, patients who received a blood transfusion within the past 30 days, also patients with known underlying illness, such as malignancy, hemoglobinopathies were excluded from the study.

HbA1c was analyzed using Biorad D10 equipment {HPLC Method} at both the centers (using the same IQC & EQAS materials for Quality assurance); hence the   data collected from the Urban & Rural centers were comparable

Statistical Analysis: Statistical analyses were performed with the R package. Group comparisons were done by Fisher's exact test. *P* <0.05 was regarded as statistically significant.
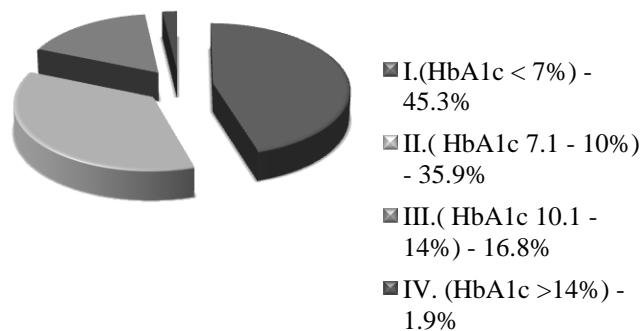
RESULTS & DISCUSSION

Distribution of age:

DISTRIBUTION OF CATEGORIES

Groups	Urban.	Rural.
Group I	53.7%	45.3%
Group II	37.3%	35.9%
Group III	8.8%	16.8%
Group IV	0.2%	1.9%

RURAL

- I.(HbA1c < 7%) - 45.3%
- II.(HbA1c 7.1 - 10%) - 35.9%
- III.(HbA1c 10.1 - 14%) - 16.8%
- IV. (HbA1c >14%) - 1.9%

URBAN

- I. (HbA1c < 7%) - 53.7%
- II. (HbA1c 7.1-10%) - 37.3%
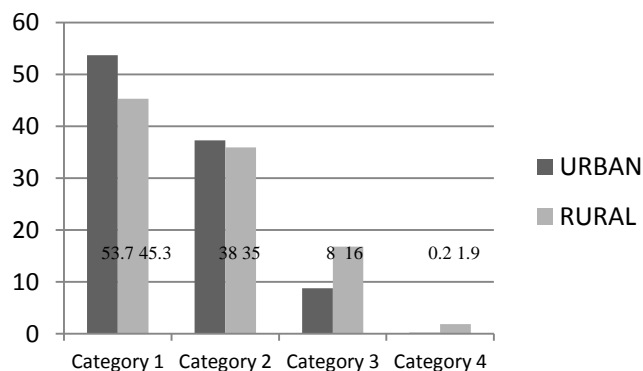- III.(HbA1c 10.1 - 14%) 8.8%
- IV. (HbA1c > 14 %) - 0.2%
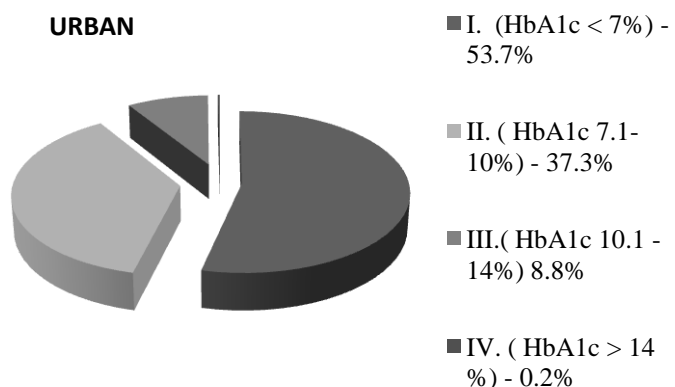
RURAL/URBAN COMPARISON OF DISTRIBUTION: Fisher's exact test is done for association of rural/Urban and HbA1c levels. The P-value is <0.001 and is statistically significant.

In Group III the Patients with high HbA1c are almost two folds more among rural population when compared to urban population and in Group IV the Patients with high HbA1c are almost ten folds more among rural population when compared to urban population.
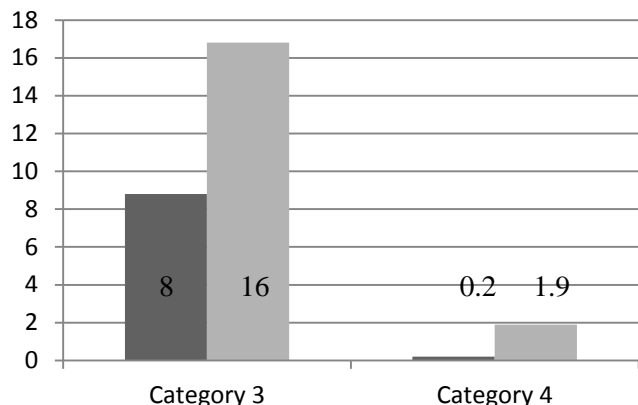
Similar findings have been found among earlier prevalence studies such as (Ramachandran A et.al, Nafisa C Vas et.al,)

Though the prevalence of diabetes mellitus is slightly higher in urban population, the Prevalence of the complications is higher in rural population. Higher prevalence of the complications in low socio-economic groups may be due to due to lack of good control of glycaemia and hypertension and also due to behavioral factors. Both the direct cost and indirect costs involved in the treatment of the Diabetes mellitus specially when associated with the vascular complications are enormous. Hence there is an urgent need to implement measures to prevent & reduce the high morbidity and mortality, also to reduce the cost burden to the patients and to the society.

OVER ALL GENDER DISTRIBUTION
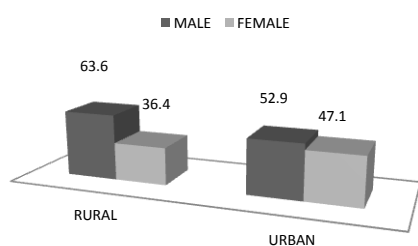
Fisher's exact test is done for association of gender and HbA1c levels. The P-value is 0.033 and is statistically significant.

The prevalence of diabetes did not differ significantly between men and women, but men were found to have slightly higher prevalence of diabetes than women. Similar observations were done in previous studies- DECODA Study (Gang Hu).
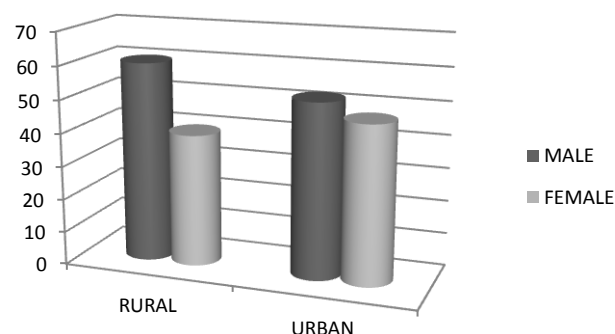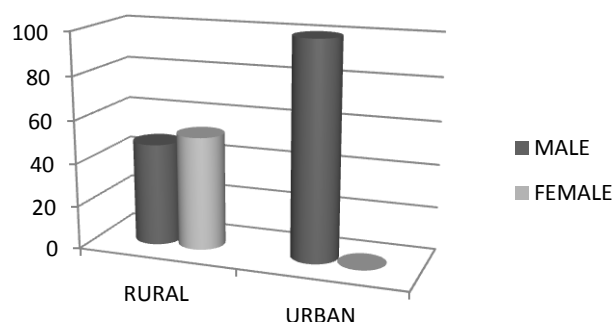
Category 1:
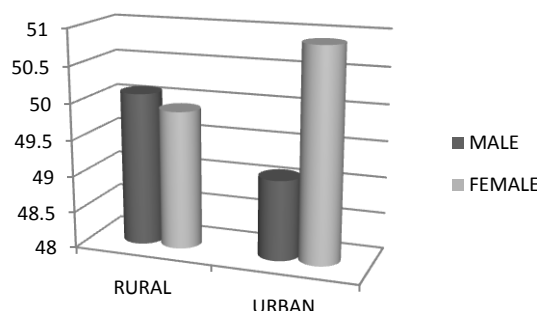
In Category I – Women are more in number than Men, could be due to higher prevalence of impaired fasting glucose (IFG) in women than in men in India – as observed in DECODA Study (> Waist/Hip ratio, > BMI among women) (Gang Hu).

Category 2:
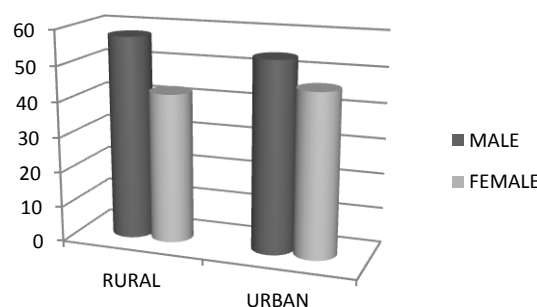
Category 3:

Category 4:

Female patients in category 4 were comparatively very less in number in the urban study population (also associated with additional influence of life style) which could be due to 'survivor' bias .Many studies have shown the gender differences in cardiovascular disease, which is mainly associated with higher morbidity and mortality among women with diabetes mellitus when compared to men with diabetes mellitus (Chin-Hsiao Tseng).

India currently faces an uncertain future in relation to the potential burden of diabetes, which may impose upon the country. Many influences affect the prevalence of disease throughout a country – culture & ethnicity, socio-economic conditions, disproportionate allocation of health resources, impact of knowledge, awareness about the disease, previous HbA1c levels & its influence on self-monitoring. Identification of those factors is necessary to facilitate change when facing health challenges.

Limitations of the study & further scope

Cross sectional Observational study – no data on actual prevalence of the disease & its complications. The data related to various factors that may influence were not studied.

CONCLUSION

Group 3 & 4 shows two fold& ten folds increase in number of patients with higher risk of developing vascular complications & early death among the rural population compared to urban population Identification of the factors which may be influencing these populations - is necessary to facilitate change when facing health challenges.

There is an immediate need for implementing preventive measures to bring down the high morbidity and mortality and also to decrease the cost burden to the patients and to the society.

REFERENCES

1. Bernd Stratmann, Katrin Richter, Ruichao Wang, Zhonghao Yu, Tao Xu, Cornelia Prehn, et al. "Metabolomic Signature of Coronary Artery Disease in Type 2 Diabetes Mellitus", International Journal of Endocrinology Volume 2017, Article ID 7938216, 9 pages http://dx.doi.org/10.1155/2017/7938216.

2. Chin-Hsiao Tseng, MD, PhD, "Sex Difference in the Distribution of Atherosclerotic Risk Factors and Their Association with Peripheral Arterial Disease in Taiwanese Type 2 Diabetic Patients"- Circ J 2007; 71: 1131–1136.

3. H. C. Gerstein . J. Pogue . J. F. E. Mann . E. Lonn . G. R. Dagenais . M. McQueen . S. Yusuf .[HOPE investigators], "The relationship between dysglycaemia and cardiovascular and renal risk in diabetic and non-diabetic participants in the HOPE study: a prospective epidemiological analysis", Diabetologia (2005) 48: 1749–1755.

4. Irene M Stratton, Amanda I Adler,H Andrew W Neil,David R Matthews,Susan E Manley, Carole A Cull et.al, "Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study" ,BMJ 2000 August 12th, VOLUME 321 : 405 – 412.

5. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. AMJ 2014, 7, 1, 45-48. http//dx.doi.org/10.4066/AMJ.2014.1979

6. Gang Hu, AmbadyRamachandran, Snehalathachamukuttan, Hairong Nan [THE DECODA STUDY GROUP], "Age- and Sex-Specific Prevalence of Diabetes and Impaired Glucose Regulation in 11 Asian

Cohorts" Diabetes Care,2003, 26:1770–1780.

7. Nafisa C Vaz, AM Ferreira, MS Kulkarni, Frederick S Vaz, NR Pinto, "Prevalence of Diabetic Complications in Rural Goa, India", Indian Journal of Community Medicine, 2011 October ,Vol 36, Issue 4-283 – 286.

8. Ramachandran A, Snehalatha C, Vijay V, Impact of poverty on the prevalence of diabetes and its complications in urban southern India. King H.Diabet Med. 2002 Feb;19 (2):130-5.

9. S. Zoungas& J. Chalmers & T. Ninomiya& Q. Li & M. E. Cooper & S. Colagiuri& G. Fulcher et al. "Association of HbA1c levels with vascular complications and death in patients with type 2 diabetes: evidence of glycaemic thresholds", Diabetologia (2012) 55:636–643.

10. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long term complications in insulin-dependent diabetes mellitus. *N Engl J Med 1993;329:977*-986.