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## Original Research Article

# Incidence of Microalbuminuria in Newly Diagnosed Patients of Type II Diabetes Mellitus: - A Cross-Sectional Study

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## HIGHLIGHTS

1 Microalbuminuria prevalent In new diabetes cases.

2 Earlydetectioncrucial for diabetes management.

3Study highlights microvascular complications onset.

4 Screening recommended for TypeIIDiabetes.

5Cross-sectional study reveals significant findings.

## ARTICLE INFO

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**Key words:**

Microalbuminuria

Diabetes Mellitus Type-II

Glycosylated haemoglobin

## ABSTRACT

**Background:** Diabetes mellitus and hypertension are the two most important lifestyle diseases in India, closely related to chronic kidney disease. India is the "Diabetes Capital" of the world, according to ICMR's largest survey on diabetes and other metabolic diseases in India conducted between October 18, 2008, to December 17, 20201. **Aims and objectives:** To find the incidence of Microalbuminuria, at the time of diagnosis or within one week of diagnosis of Diabetes Mellitus Type-II, to find the overall incidence of Microalbuminuria at the time of diagnosis of Diabetes Mellitus correlation of glycosylated haemoglobin, an indicator of glycaemic status, and the incidence of Microalbuminuria. **Results:** Among the 150 subjects, microalbuminuria was found in 16 (10.7%) subjects. **Materials and methods:** Mann-Whitney Test was used to compare the Glycaemic Parameters based on the Incidence of Microalbuminuria among study subjects. Receiver operating characteristic curve (ROC) analysis was performed to predict the Microalbuminuria using Glycaemic Parameters among study subjects. The level of significance was set at $P < 0.05$. **Conclusion:** The difference is statistically significant at $p < 0.001$. It was found that the predictive value of HbA1c for a cutoff set at > 8.1% has the best chance of correctly predicting microalbuminuria with a sensitivity of 93.8 and specificity of 92.2 (95% Confidence Interval) at a p-value of < 0.001 which is highly significant statistically.

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## INTRODUCTION

Diabetes Mellitus is a disease of metabolic dysregulation, causing long-term complications. The complications that are specific to diabetes mellitus include Retinopathy, Nephropathy, and Neuropathy. These are microvascular complications and cause serious morbidity[2].

Microalbuminuria arises from the increased passage of albumin through the glomerular filtration barrier. This requires ultrastructural changes rather than alterations in glomerular pressure or filtration rate alone. The loss of systemic endothelial glycocalyx (a protein-rich surface layer on endothelium) in diabetics suggests that damage to this layer represents this missing link. Reactive oxygen species, inflammatory cytokines, and growth factors are the key mediators of endothelial dysfunction, which is the most likely initiating step in diabetic microalbuminuria[3].

The study published in 2022, from Karnataka, India, confirmed that the incidence of microalbuminuria increases with the duration of diabetes and poorly controlled blood sugar levels. Ankle-brachial index, Pulse wave velocity, and Augmentation index are simple reliable, and non-invasive methods that can be used for the screening of vascular complications[4].

The India Microalbuminuria Survey 2023, was a large multicentric cross-sectional, national survey to understand the prevalence of microalbuminuria in Indian hypertensive patients with concomitant type-II diabetes mellitus. The study was a subset analysis which included 992 patients from 121 centres across India. The study reported a high prevalence of microalbuminuria in Indian patients with hypertension and concomitant type II diabetes mellitus. Hence early recognition of renal dysfunction through detection of microalbuminuria and to start the treatment without delay will confer future protection from end-stage renal disease as well as hypertension and its complications in type-II diabetes mellitus.

## MATERIALS AND METHODS:

This cross-sectional study was done in the Central Laboratory, the General Medicine OPD and Diabetes clinic, SVRRGGH, Tirupati. Approval to conduct the study was obtained from the Institutional Ethics Committee and study was conducted among newly diagnosed patients of type II diabetes mellitus, who are willing to participate on their own will, who satisfied the inclusion criteria, and who did not have any reason to be excluded as in exclusion criteria. The study was conducted on 150 newly diagnosed Diabetes Mellitus type II patients. Diagnostic criteria for Diabetes Mellitus were taken according to ICMR[6] and WHO[7] Criteria. Microalbuminuria and Macroalbuminuria, according to ADA[8] criteria. The individuals included in the study were in the age group 18 years and above, whose diagnosis of diabetes mellitus type II was already made by all the three glycemic parameters, (fasting plasma glucose, postprandial plasma glucose, and glycosylated hemoglobin) in the central laboratory of the hospital. The diagnosis duration was within one week compulsorily. Individuals of all genders residing within the geographical boundaries of India and without co-morbidities like hepatic, renal, or cardiovascular disorders. The exclusion criteria were delineated to exclude age less than 18 years Type I Diabetes Mellitus, Gestational Diabetes and other Secondary Diabetes Mellitus, known, pre-existing hepatic, renal, or cardiovascular disease, proteinuria due to other causes and refusal to participate.

Clinical examination included height, weight and Blood Pressure. Body Mass Index calculated. Fasting plasma glucose and two hours postprandial plasma glucose, glycosylated haemoglobin, Urinary Albumin: Creatinine Ratio are done.

Plasma glucose done by Glucose Oxidase- hydrogen peroxide method[19]. taking fasting plasma glucose ≥126 mg/dl after overnight fasting and two hours postprandial plasma glucose ≥ 200 mg/dl as diagnostic values. Glycosylation haemoglobin done by enzymatic assay method[10] with HbA1C ≥ 6.5% as diagnostic value. In this study, the patients fulfilling all three criteria of fasting and postprandial plasma glucose and HbA1C were included.

Urine Albumin Creatinine Ratio done by Sulfosalicylic acid turbidimetric analysis[11].

UAE (Urinary Albumin Excretion) 30 to 299 mg/24 hours, or UAE 20 to 199 microgram/minute, or UACR (UACR=Urinary Albumin: Creatinine ratio) 30 to 299 microgram Albumin per mg Creatinine in the spot urine on any two out of three urine collections is considered as Microalbuminuria[12].

UAE ≥ 300 mg/24 hours, or UAE ≥ 200 microgram/minute or UACR ≥ 300 microgram Albumin per mg Creatinine in any of the collected urine samples is taken as macroalbuminuria

The UACR concept[13]. is used in this study for virtue of its convenience and simplicity to eliminate the effect of the concentration status of urine.

SPSS (Statistical Package for Social Sciences) software for Windows Version 22.0, Released in 2013. Armonk, New York: IBM Corp, was used to perform statistical analysis. Descriptive analysis of all the explanatory and outcome parameters was done using frequency and proportions for categorical variables, whereas Mean & Standard Deviation for continuous variables. Point estimate and 95% CI were calculated. Chi-Square Test was used to find out the Incidence of Microalbuminuria. Mann-Whitney Test was used to compare the Glycaemic Parameters based on the Incidence of Microalbuminuria among study subjects. Receiver operating characteristic curve (ROC) analysis was performed to predict the Microalbuminuria using Glycaemic Parameters among study subjects. The level of significance was set at $P < 0.05$.

## OBSERVATION AND RESULTS:

Among the 150 subjects, more than 95% of the subjects were diagnosed within three days of the study. (Table 1). The mean fasting plasma glucose was 156.22 ± 28.27 with the range of 128 to 290 mg/ 100 ml. The mean post prandial plasma glucose was 249.65 ± 50.04 with the range of 201 to 451 mg/ 100 ml. The mean glycosylated haemoglobin was 7.66 ± 1.01 with the range of 6.7 to 12.4% The mean UACR was 12.73 ± 30.32 with the range of 0 to 150 mcg/mg. (Table 2). All the glycaemic parameters were significantly higher in subjects with microalbuminuria as compared to subjects without microalbu-

-minuria using Mann Whitney Test. The difference is statistically significant at p = 0.001 (Table 3)

**Table 1**

| Table 1. Distribution of duration of diagnosis of Diabetes Mellitus Type -II, among study subjects | | | |
|---|---|---|---|
| Variable | Category | N | % |
| Duration | Same Day | 79 | 52.7% |
| | 1-3 Days | 66 | 44.0% |
| | 4-5 Days | 5 | 3.3% |

**Table 2**

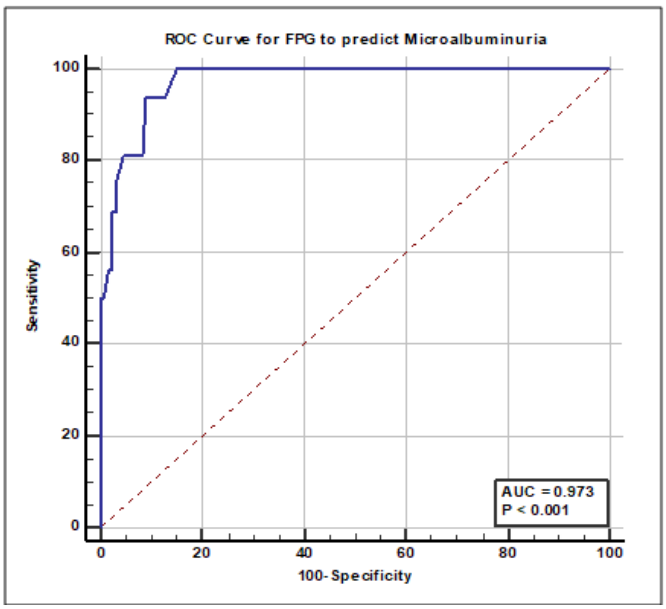
| Table 2. Descriptive analysis of Glycaemic Parameters & UACR among study subjects | | | | | | |
|---|---|---|---|---|---|---|
| Parameters | N | Mean | SD | Median | Min | Max |
| FPG (in mg/100 ml) | 150 | 156.22 | 28.27 | 150 | 128 | 290 |
| PPPG (in mg/100 ml) | 150 | 249.65 | 50.04 | 231 | 201 | 451 |
| HbA1c (in %) | 150 | 7.66 | 1.01 | 7.3 | 6.7 | 12.4 |
| UACR | 150 | 12.73 | 30.32 | 0 | 0 | 150 |

**Note: UACR - Urine Albumin: Creatinine Ratio (mcg Albumin/ mg Creatinine)**

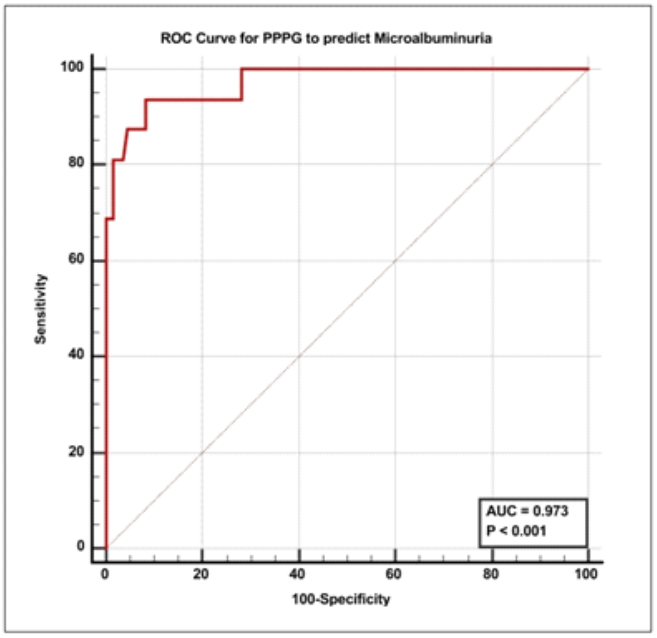
**Table 3**

| Table 3. Comparison of mean values of Glycaemic Parameters based on the Incidence of Microalbuminuria among study subjects using Mann Whitney Test . | | | | | | |
|---|---|---|---|---|---|---|
| Parameters | Microalbuminuria | N | Mean | SD | Mean Diff | p-value |
| FPG | Present | 16 | 213.75 | 33.02 | 64.40 | <0.001* |
| | Absent | 134 | 149.35 | 18.07 | | |
| PPPG | Present | 16 | 356.50 | 57.58 | 119.61 | <0.001* |
| | Absent | 134 | 236.89 | 29.90 | | |
| HbA1c | Present | 16 | 9.86 | 1.28 | 2.45 | <0.001* |
| | Absent | 134 | 7.40 | 0.57 | | |

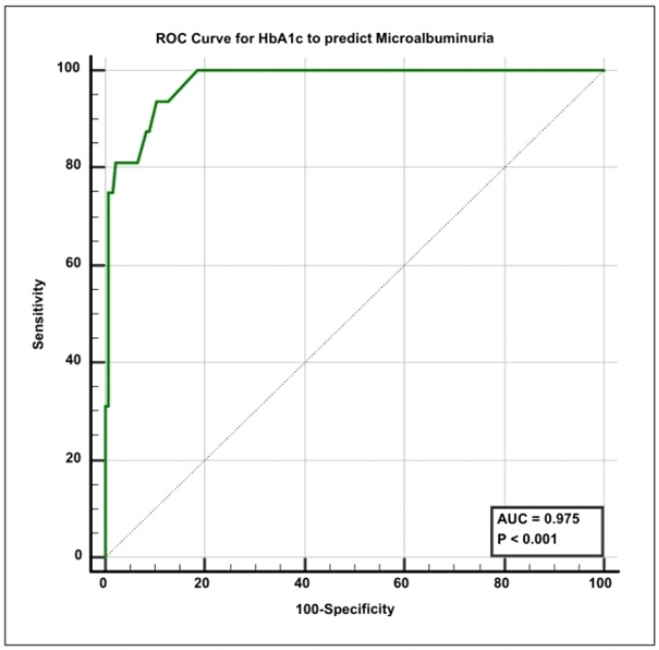
* - Statistically Significant



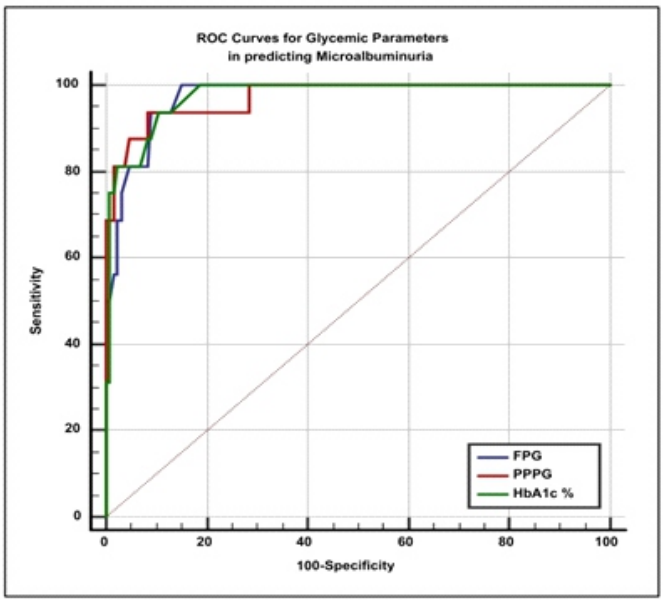

**Graph:1**




**Graph:2**




**Graph:3**




**Graph:4**

Table 4

| Table 4. ROC Curve analysis for Glycaemic parameters in predicting Microalbuminuria among study subjects . | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | AUC | Std. Error | 95% Conf. Interval | | p-value | Cut off | Sn (%) | Sp (%) |
| | | | Lower | Upper | | | | |
| FPG | 0.97 | 0.01 | 0.93 | 0.97 | <0.001* | > 168 | 100.0 | 85.1 |
| PPPG | 0.97 | 0.02 | 0.93 | 0.97 | <0.001* | > 287 | 93.8 | 91.8 |
| HbA1c | 0.98 | 0.01 | 0.94 | 0.99 | <0.001* | > 8.1 | 93.8 | 92.2 |

* - Statistically Significant

## DISCUSSION

The incidence of microalbuminuria in the study was found to be 10.7%. All the glycaemic parameters were significantly higher in those subjects with microalbuminuria as compared to those without microalbuminuria. The difference is statistically significant at $p < 0.001$. Thus, this study confirms and establishes the previous observations of earlier researchers. The need is thus felt for aggressive and effective awareness and screening programs at the community level. Strict control of glycaemic parameters is required for the prevention of complications, which can be potentially predicted by the presence of microalbuminuria.

In a study at Haveri, Karnataka in 2021, Rashmi GS et al. Compared the type 2 diabetes mellitus subjects with the healthy controls. They found statistically elevated levels of FBS, PPBS, and HbA1C in the diabetics. The glycosylated haemoglobin positively correlated with urinary microalbuminuria. The study concluded that continuous monitoring of HbA1C and urinary albumin excretion were useful for the progression and treatment of patients with diabetes mellitus type II. [14] The results of this study clearly establish the need for aggressive and effective Diabetes Mellitus awareness and screening programs at the community level.

## CONCLUSION

The incidence of microalbuminuria in newly diagnosed patients of type II diabetes mellitus was 10.7%. All the glycaemic parameters were significantly higher in those subjects with microalbuminuria as compared to those without microalbuminuria. The difference is statistically significant at $p < 0.001$. It was found that the predictive value of HbA1c for a cutoff set at > 8.1% has the best chance of correctly predicting microalbuminuria with a sensitivity of 93.8 and specificity of 92.2 (95% Confidence Interval) at a p-value of < 0.001 which is highly significant statistically.

## REFERENCES


1. India has over 100 million diabetics & 136 million pre-diabetics, says new ICMR study; Goa tops the list, UP records lowest prevalence[internet]. Available at https://economictimes.indiatimes.com/magazines/panache/india-has-over-100-mn-diabetics-136-mn-pre-diabetics-says-new-icmr-study-goa-tops-the-list-up-records-lowest-prevalence/articleshow/100866686.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst. Last accessed on Dec 5, 2023.
2. David M. Nathan, Long-Term Complications of Diabetes Mellitus, N Engl J Med 1993 JUN; 328:1676-1685. DOI: 10.1056/NEJM199306103282306
3. Satchell SC, Tooke JE. What is the mechanism of microalbuminuria in diabetes: a role for the glomerular endothelium? Diabetologia. 2008 May;51(5):714-25. Doi: 10.1007/s00125-008-0961-8. Epub 2008 Mar 18. PMID: 18347777; PMCID: PMC2292427.
4. Mamatha K, Patil S, Jawalkar S, Patil V. Incidence of Microalbuminuria and its Correlation with Ankle Brachial Index, Sugar Levels and Duration of Type 2 Diabetes Mellitus with Special Emphasis to Predict Vascular Complications J Clin of Diagn Res.2022; 16(7):EC47-EC51.
5. BHARAT SABOO, KAPIL DEV MEHTA, AAFREEN NAIK; 439-P: Microalbuminuria and Hypertension among Indian Patients with Type 2 Diabetes—A Community-Based Cross-Sectional Study. Diabetes 20 June 2023; 72 (Supplement_1): 439–P. https://doi.org/10.2337/db23-439-P
6. ICMR Guidelines for Management of Type 2 Diabetes 2018[internet]. Available at https://main.icmr.nic.in/. Last accessed on Dec 05, 2023.
7. WHO publications 21 April 2019[internet]. Available at https://www.who.int/publications/i/itm/classification-of-diabetes-mellitus. Last accessed on Dec 05, 2023.
8. American Diabetes Association; Nephropathy in Diabetes. Diabetes Care 1 January 2004; 27 (suppl_1): s79–s83.
9. McMillin JM. Blood Glucose. In: Walker HK, Hall WD, Hurst JW, editors. Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd edition. Boston: Butterworths; 1990. Chapter 141. Available from: https://www.ncbi.nlm.nih.gov/books/NBK248/
10. Weykamp C. HbA1c: a review of analytical and clinical aspects. Ann Lab Med. 2013 Nov;33(6):393-400. Doi: 10.3343/alm.2013.33.6.393. Epub 2013 Oct 17. PMID: 24205486; PMCID: PMC3819436.
11. Ambulugala Gamage Rajika Greshamali Jinadasa, Lanka Acharige Shalka Madushan Srimantha, Indika Deepani

Siriwardhana, Kalani Buddika Gunawardana, Anoja Priyadarshani Attanayake, "Optimization of 25% Sulfosalicylic Acid Protein-to-Creatinine Ratio for Screening of Low-Grade Proteinuria", International Journal of Analytical Chemistry, vol. 2021, Article ID 6688941, 9 pages, 2021.

12. Prasad RM, Bali A, Tikaria R. Microalbuminuria. [Updated 2023 May 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK563255
13. Yang CY, Chen FA, Chen CF, Liu WS, Shih CJ, Ou SM, Yang WC, LINCC, Yang AH. Diagnostic Accuracy of Urine Protein/ Creatinine Ratio Is Influenced by Urine Concentration. PloS One. 2015 Sep 9;10(9):e013746
14. Basavaraj R G S, Malladad R, Correlation of glycosylated hemoglobin with urinary albuminuria for early detection and progression of nephropathy in patients with type 2 diabetes mellitus. Indian J Pathol Oncol 2021;8(4):433-436