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# PREVALENCE OF MICROALBUMINURIA AMONG PATIENTS WITH TYPE 2 DIABETES IN MOSUL CITY

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**ABSTRACT**

**Background:** microalbuminuria happens when the kidney's glomerulus has excessively high albumin permeability or leaks little amounts of albumin into the urine when The albumin/creatinine ratio is ≥3.5 mg/mmol for females and ≥2.5 mg/mmol for males. An albumin/creatinine ratio between 30 and 300 µg albumin/mg creatinine is considered microalbuminuria. **The aim of the study:** is to estimate the prevalence of microalbuminuria among patients with type two diabetes in Mosul city. **Patients and Methods:** The study is observational, descriptive, and cross- sectional. Data was collected from 109 participants retrospectively over six months to assess the prevalence of microalbuminuria among patients with type two diabetes in Mosul City. Administrative agreements were obtained from the Directorate of Health, the Local Scientific Council of the Arab Board of Health Specializations of Family and Community Medicine in Iraq, Iben Sena Teaching Hospital, Al Mosul General Hospital, and Al Wafa'a Diabetic Center where the study was conducted. The concept and aims of the study were explained to all participants, and verbal consent was obtained. The information was collected by a specifically designed questionnaire comprising four sections: Section One covered socio-demographic parameters, Section Two covered microalbuminuria details, Section Three covered microalbuminuria risk factors, and Section Four covered diabetes mellitus complications, each patient checked for height and weight to calculate body mass index then sends each one to an ophthalmology consultation, and lab investigations for Fasting blood sugar, HbA1c, serum creatinine and albumin/creatinine ratio in urine. **Results:** The study included 109 patients with diabetes mellitus, with microalbuminuria prevalence being 28 out of 109 (25.68%); 15 patients (53.57%) were males and 13 (46.42%) were females. Microalbuminuria was more prevalent among patients of more than 65 years or those with higher BMI and smokers and affected by the duration of diabetes, systolic and diastolic blood pressure, higher fasting blood sugar levels, HbA1c, and serum creatinine levels. **Conclusions:** microalbuminuria prevalence among diabetic patients is affected by many factors, such as poorly controlled diabetes, longer duration of diabetes, advancing age, obesity, hypertension, smoking and diabetic complications. No sex prevalence difference.

**KEYWORDS:** Iraq, microalbuminuria, Mosul, prevalence.

## 1.1 BACKGROUND

A mild rise in the amount of albumin in the urine is referred to as microalbuminuria. It happens when the kidney's glomerulus has excessively high albumin permeability or leaks little amounts of albumin into the urine. Since albumin is typically filtered by the kidneys, its presence in the urine indicates renal illness.[1] Kidney Disease Improving Global Outcomes no longer uses the term microalbuminuria; significantly elevated albuminuria is the new standard.[2]

## 1.2 Epidemiology

The prevalence of diabetes worldwide is increasing rapidly, especially in developing countries. Globally, there will be more than 592 million diabetics by 2035, and this trend is predicted to increase significantly in the developed world. Type 2 diabetes prevalence is rising due in large part to the increased prevalence of obesity worldwide.[3] The progression of diabetic kidney disease can raise the risk of cardiovascular diseases and end-stage renal disease.[4]

### 1.3 Risk factors for diabetic nephropathy

- inadequate serum glucose management.
- Elevated blood pressure (uncontrolled)
- Diabetes mellitus type 1, which appears before age 20.
- Smoking history.
- Diabetic nephropathy positive family history: specific genes linked to the condition have been found. (A direct association has not yet been proven. APOL1, one of these genes, has been linked to nephropathy among African Americans).
- A few racial groups are more vulnerable: Pima Indians, African Americans, and Mexican Americans.[5-9]

### 1.4 Signs and symptoms of diabetic nephropathy

The condition takes five to ten years to start manifesting symptoms. Nighttime urination is a common initial symptom known as nocturia. Additional symptoms include fatigue, headaches, nausea, vomiting, frequent urination during the day, loss of appetite, itchy skin, and swelling in the legs. Patients having diabetes mellitus should be regularly checked for diabetic nephropathy because the condition may develop slowly at first.[10]

### 1.7 Diagnosis and Treatment

Albumin-specific urine dipsticks can be used to quantify the amount of microalbuminuria. Well-being individuals usually have little albumin in their urine because the kidneys maintain it in the bloodstream.[11]

The patient must have at least two of the three measurements of microalbuminuria using 24-hour urine collection (between 30 and 300 mg/24 hours) over two to three months.[12]

"Macroalbuminuria," or "albuminuria," in simple terms, is the term used to describe an albumin level that exceeds the 300 mg/24 hours limit.[13]

Examining the relationship between urine albumin and serum creatinine concentrations may correct the fluctuations of urine concentration in spot-check samples. The albumin/creatinine ratio, or ACR, is ≥3.5 mg/mmol for females and ≥2.5 mg/mmol for males. An ACR between 30 and 300 µg albumin/mg creatinine is considered microalbuminuria. Urine ACR sample collection requires caution to diagnose microalbuminuria. Early morning is the ideal sample time.[14,15]

Two days before the test, the patient should avoid doing strenuous exercise. If the initial test for microalbuminuria is positive, a follow-up examination should be conducted three to six months later. Finally, an individual with extremely high or extremely low muscle mass will get a false result; differences in the amount of muscle production of creatinine.[16,17]

### 1.10 Treatment

Controlling associated problems and slowing the progression of renal impairment are the main objectives of treatment. Currently, therapy is focused on four primary areas: blood pressure control, glucose control, cardiovascular risk reduction, and RAAS system inhibition.[18]

### 1.13 AIM OF STUDY

The study aims to estimate the prevalence of Microalbuminuria among patients with type 2 diabetes at Iben Sena Teaching Hospital, Al Mosul General Hospital, and Al Wafa'a Center in Mosul City.

**Specific objectives of the study**

1- To evaluate the possible contributing factors.
2- To study the possible complications of diabetes and the appearance of microalbuminuria.
3- To describe the occurrence of microalbuminuria among both sexes.

## 2. PATIENTS AND METHODS

### 2.2 Study Setting

The study was conducted at three main specialized medical clinics; the first one is a specialized diabetic clinic called Al Wafa'a diabetic clinic, and the second and third belonged to Iben Sena Teaching Hospital and Al Mosul General Hospital at both sites of Mosul City; the center of Nineveh Governorate; and it is located at the north of Iraq.

### 2.3 Data Collection

A prepared questionnaire form was used for data collection, which included patient code, age, sex, BMI, age at diagnosis of diabetes and duration, coronary artery disease, retinopathy and neuropathy symptoms, history of peripheral vascular diseases, smoking history, blood pressure measures, fasting blood sugar, HbA1C, serum creatinine, and albumin to creatinine ratio.

### 2.4 Study Design

An observational, descriptive, cross-sectional study was adopted to achieve the present study's objectives. Data was collected from the participants retrospectively by the non-randomized convenient technique.

### 2.5 The Study Period

Data was collected over six months from the 2nd of January 2024 to the 30th of June 2024.

### 2.6 Study Sample

One hundred-nine participants.

### 2.8 Inclusion Criteria

Patients with type 2 diabetes mellitus, regardless of their age and sex, were included in the study.

### 2.9 Exclusion Criteria

1. Patients with type 1 diabetes mellitus.
2. Patients with acute and chronic kidney disease.
3. Patients with hemolytic anemia.
4. Patients with insufficient data.

5. The patients who disagreed were included in the study.

## 3. RESULTS

### 3.1 Distribution of microalbuminuria among males and females

The study sample was composed of 109 participants; microalbuminuria was prevalent among 28 out of 109 (25.68%); from the 28 patients having microalbuminuria, 15 patients (53.57%) were males, and 13 (46.42%) were females, with a male-to-female ratio of 1.1:1.

**Table 3.1: Distribution of microalbuminuria among males and females (n=109).**

| sex | Microalbuminuria | | No Microalbuminuria | | Total | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Male | 15 | 25.8 | 43 | 74.2 | 58 | 53.57 |
| Female | 13 | 25.4 | 38 | 74.6 | 51 | 46.42 |

This table demonstrates the prevalence of microalbuminuria among males and females, which seems somewhat similar between the two categories.

### 3.2 Distribution of microalbuminuria according to different age groups

**Table 3.2: Distribution of microalbuminuria according to different age groups (n=109).**

| Age group | Microalbuminuria | | No microalbuminuria | | Total | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| 45-≥55 years | 4 | 8.9 | 41 | 91.1 | 45 | 41 |
| 55-≥65 years | 16 | 30.7 | 36 | 69.3 | 52 | 48 |
| 65 and above | 8 | 66.7 | 4 | 33.3 | 12 | 11 |

This Table shows the distribution of microalbuminuria among different age groups. Microalbuminuria was more prevalent among the age group of more than 65 years (66.7%). Moreover, microalbuminuria was prevalent among (30.7%) of the 55 to less than 65 age group and (8.9%) among the 45 to less than 55 age group.

### 3.3 Prevalence of microalbuminuria among different BMI categories

**Table 3.3: Prevalence of microalbuminuria among different BMI categories (n=109).**

| BMI | Microalbuminuri a | | No Microalbuminuria | | Total | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Overweight (25-29.9) | 4 | 14.2 | 28 | 87.5 | 32 | 29 |
| Obese category 1(30- 34.9) | 3 | 9.1 | 30 | 90.9 | 33 | 30 |
| Obese category 2(35- 39.9) | 11 | 39.2 | 17 | 60.7 | 28 | 26 |
| Obese category 3(≥40) | 10 | 62.5 | 6 | 37.5 | 16 | 15 |

This table demonstrates the prevalence of microalbuminuria among different BMI categories. Microalbuminuria was prevalent among (62.5%) of obesity category 3 and (39.2%) of obesity category 2. Furthermore, it was prevalent among (14.2%) of overweight and (9.1%) of obesity category 1.

### 3.4 Comparison of demographic and social parameters between subjects with microalbuminuria and those with no microalbuminuria

**Table 3.4: Comparison of demographic and social parameters between subjects with microalbuminuria and those with no microalbuminuria (n=109).**

| Variable | Microalbumin uria *(n = 28, 26%)* | No microalbuminu ria *(n=81, 74%)* | P value |
|---|---|---|---|
| Current age in years, Mean (±SD) | 61.4 (±4.9) | 54.8 (±5.5) | **<0.001** |
| Age at diagnosis, Mean (±SD) | 48.5 (±3.9) | 48.1 (±4.9) | 0.367 |
| BMI category:<br>- Overweight, n (%)<br>- Obesity grade 1, n (%)<br>- Obesity grade 2, n (%) | <br>4 (14%)<br>3 (11%)<br>11 (39%)<br>10 (36%) | <br>28 (35%)<br>30 (37%)<br>17 (21%)<br>6 (7%) | <br>**<0.001**<br>**<0.001**<br>**<0.001**<br>**<0.001** |

| | | | |
|---|---|---|---|
| - Obesity grade 3, n (%) | | | |
| Smoking history, n (%) | 18 (64%) | 24 (30%) | **0.001** |

This Table compares demographic and social parameters between subjects with microalbuminuria and those without microalbuminuria. Subjects with microalbuminuria have a higher mean current age. A comparison of different BMI categories showed statistically significant differences found in the obesity categories 2 and 3 among the microalbuminuria group compared to controls ($p<0.001$). Patients with microalbuminuria had statistically significant differences in smoking history. No difference was shown in age at diagnosis.

**3.5 Comparison of diabetes and other medical parameters between subjects with microalbuminuria and those without microalbuminuria**

**Table 3.5: Comparison of diabetes and other medical parameters between subjects with microalbuminuria and those without microalbuminuria (n=109).**

| Variable | Microalbuminuria *(n = 28, 26%)* | No microalbuminuria *(n=81, 74%)* | P value |
|---|---|---|---|
| Duration of DM, Mean (±SD) | 12.9 (±2.4) | 6.7 (±2.3) | **<0.001** |
| Systolic BP in mm Hg, Median (IQR) | 150 (126-160) | 120 (110-130) | **<0.001** |
| Diastolic BP in mm Hg, Median (IQR) | 95 (80-110) | 78 (70-80) | **<0.001** |
| Fasting blood sugar, Median (IQR) | 159 (±32) | 105 (±21) | **<0.001** |
| % HbA1c, Mean (±SD) | 9.4 (±1.4) | 6.8 (±1.0) | **<0.001** |
| Serum creatinine, Mean (±SD) | 1.3 (±0.6) | 0.8 (±0.1) | **<0.001** |
| Coronary heart disease, n (%) | 9 (32%) | 7 (9%) | **0.002** |
| Retinopathy, n (%) | 11 (39%) | 0 (0%) | **<0.001** |
| Neuropathy, n (%) | 20 (71%) | 12 (15%) | **<0.001** |
| Peripheral vascular disease, n (%) | 7 (25%) | 1 (1%) | **<0.001** |

SD = standard deviation IQR = interquartile range

This Table compares diabetes and other medical parameters between subjects with microalbuminuria and those without microalbuminuria. Subjects with microalbuminuria showed statistically significant effects by duration of diabetes, systolic and diastolic blood pressure, higher fasting blood sugar, HbA1c, and serum creatinine levels compared to those without microalbuminuria, with $p < 0.001$. These findings suggest a potential link between poorly controlled diabetes and hypertension with the presence of microalbuminuria. Moreover, complications such as coronary heart disease, retinopathy, neuropathy, and peripheral vascular disease were shown to be statistically different among individuals with microalbuminuria than those without microalbuminuria, with ($p < 0.001$ in all). This further confirms the impact of these conditions on the development of microalbuminuria.

## 4. DISCUSSION

### 4.1 Demographic distribution of study population

#### 4.1.1 Overall prevalence and sex distribution of study population

The study sample was composed of 109 participants, with microalbuminuria prevalence among 25.68%; 53.57% of the studied sample were males, and 46.42% were females, with male to female ratio of 1.1:1. Haidar M. Almaamari et al. studied the prevalence of microalbuminuria among type 2 diabetes patient in Yaman, he found it (44.8%).[19] Moreover, Abdulrhman Aldukhayel et al. studied the prevalence of diabetic nephropathy among type 2 diabetic patients in some Arab countries, and he reported that about 16.1% of type 2 diabetic patients in Iraq had microalbuminuria, the prevalence was 30.8% in the United Kingdom, while it was 31% in Mexican Americans. Finally, he found that in Asian countries, the prevalence rate of microalbuminuria ranged from 14.2% in Iran, 24.2% in Pakistan, and 36.3% in India.[20] Moyad Jamal Shahwan et al. had a comparable male-to-female ratio.[21] This difference in distribution may be due to the small number of patients in our study and the different races in others.

#### 4.1.2 Ages of study population

Regarding the age distribution of the study population, this study found that microalbuminuria prevalence progresses with advancing age; this may be related to the prolonged duration since diabetes diagnosis, by which microalbuminuria is affected. Comparable findings were obtained from Abdulqawi Ali Al-Shammakh et al., who found that the prevalence of diabetic nephropathy increased with age over 50 years.[22] Muhammad Ahsan Sana et al. also concluded that the urinary spot for albumin: creatinine ratio was increased with longer duration since diagnosis.[23] Moreover, the study found that subjects with microalbuminuria have a higher mean current age; a comparable finding was found by Shahad

Turkey Mana et al. She mentioned that increasing age is considered a major non-modifiable risk factor for developing T2DM, and she found a gradual increase in the prevalence of T2DM among individuals over the age of fifty with corresponding increasing rates of micro and macrovascular diabetes complications.[24] Tayyab Mumtaz Khan et al. also concluded in their study that the incidence of microalbuminuria among patients with type 2 diabetes was significantly increased with increasing age.[20] The older age group is the most prevalent may be due to the long duration of diabetes.

#### 4.1.3 Anthropometric parameters effect of microalbuminuria

The study shows that the prevalence of microalbuminuria increased as obesity increased, with significant differences among patients with BMI grades 2 and 3 compared to non-microalbuminuria patients. Near finding was obtained from Gnanasegaran Selvalaxmi et al., who evaluated microalbuminuria in type-2 diabetes mellitus under oral hypoglycemic agents, he concluded that microalbuminuria was associated with BMI; in contrast, he found no significant difference between the sexes and microalbuminuria.[25] Furthermore, Shan Gao et al., who studied the association between obesity and microvascular diseases in patients with type 2 diabetes mellitus, evaluated obesity regarding fat mass index (FMI) and its effect on microvascular diseases in patients with type 2 diabetes mellitus and compared the magnitude of associations of FMI, body mass index, and waist circumference with the risk of microvascular diseases. After he adjusted the confounding factors, he found that patients in the highest FMI quartile had a higher risk of CKD progression.[26]

#### 4.1.4 Smoking effect on microalbuminuria

Smoking is shown in the study to be an important risk to microalbuminuria. Interestingly, Haili Xu et al. had a meta-analysis about cigarette smoking and the risk of albuminuria in patients with type 2 diabetes; he found that the summary relative risk of albuminuria was 1.43 for ever- smokers, 2.61 for current smokers, and 1.86 for former smokers.[27]

#### 4.1.5 Chronic 3medical diseases' effect on microalbuminuria

Diabetes-related macrovascular and microvascular consequences, including coronary heart disease, stroke, peripheral artery disease, heart failure, diabetic retinopathy, chronic kidney disease, and autonomic neuropathy, are responsible for a significant amount of the health burden associated with diabetes.[28] This study illustrates that the presence of coronary heart disease, retinopathy, neuropathy, and peripheral vascular disease is significantly higher among individuals with microalbuminuria, indicating a potential association between these conditions and the development of microalbuminuria. A microvascular consequence of diabetes affects the kidneys and causes a slight decrease in their ability to filter waste materials from the bloodstream. Its major clinical significance is shown by the fact that it has been recognized globally as a primary contributor to the development of end-stage renal disease.[29] Elisa Dal Canto et al. did an overview of global trends of macro and micro vascular diabetes mellitus complications; she showed that the leading cause of mortality and morbidity among people with diabetes, particularly those with type 2 diabetes mellitus, is cardiovascular disease. She added that adults with diabetes have a cardiovascular risk that is 2-4 times higher, and this risk increases as glycemic control deteriorates. Adult mortality rates have been linked to a 75% rise in death rates due to diabetes, with cardiovascular disease contributing significantly to this excess mortality. She concluded that reduced quality of life, disability, and early death linked to diabetes are caused by macrovascular and microvascular complications related to diabetes, such as coronary heart disease, cerebrovascular disease, heart failure, peripheral vascular disease, chronic renal disease, diabetic retinopathy, and neuropathy.[30] Moreover, Fu- Shun Yen et al. showed that in the matched cohorts, diabetic neuropathy was significantly associated with stroke development, and diabetic retinopathy had a significant association with heart failure compared to diabetic nephropathy.[31]

On the other hand, elevated systolic and diastolic blood pressure were found in the study to be significantly associated with microalbuminuria. Mohsin Ali Hassni et al. found that both pre-hypertensive and hypertensive patients had a significant positive association with microalbuminuria and diabetes-related complications, including nephropathy and cardiovascular events; he added that proper evaluation and treatment of microalbuminuria might lead to early diagnosis and decrease the progression of hypertension, diabetes mellitus type 2 and their related complications.[32] Additionally, our study showed that HbA1c was significantly higher in the microalbuminuria group compared to the no-microalbuminuria. This was similarly significantly higher fasting blood glucose. Noor-Ahmed Jatoi et al. found that microalbuminuria was significantly associated with age, diabetes duration, systolic blood pressure, HbA1C%, fasting blood glucose, and triglyceride levels.[33] Hozan Jaza Hama Salh et al. studied the Association between Albuminuria and glycated Hemoglobin with comorbidities in type 2 diabetes patients; he found that the incidence of albuminuria in elderly patients with type 2 diabetes mellitus was high in patients with poor diabetes control, a long duration of diabetes, and comorbidity conditions, particularly in patients with hypertension.[34]

Serum creatinine was shown in the study to be associated significantly with microalbuminuria; a near result was illustrated by Reham Khaldoon Ibrahim et al., which found that significant differences were found in the serum creatinine levels between patients with normoalbuminuria, microalbuminuria, and

macroalbuminuria and healthy controls.[35]

## CONCLUSIONS

this study concluded that

1- Microalbuminuria prevalence among diabetic patients was affected by many factors, such as poorly controlled diabetes, longer duration of diabetes, advancing age, obesity, hypertension, and smoking.
2- Microalbuminuria is more prevalent among patients with diabetic complications, such as coronary artery disease, retinopathy, neuropathy, and peripheral vascular disease.
3- There is no sex difference in the prevalence of microalbuminuria.

### 5.2 Recommendations

1- Managing modifiable risk factors of microalbuminuria among diabetic patients has an important role in decreasing the overall disease burden and improving the prognosis of diabetes mellitus type 2.
2- Implementing a program for early detection and management of microalbuminuria among diabetic patients is a particularly important step to improve patient outcomes.

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