# Prevalence of Microalbuminuria among Type 2 Diabetic Patients Attending Al–Thawra Hospital and Saref Medical Center in Sana'a City, Yemen

# انتشار الالبومين الدقيق (Microalbuminuria) بين مرضى السكري من النوع الثاني المترددين لمستشفى الثورة ومركز صرف الطبي في مدينة صنعاء، اليمن


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## ABSTRACT

**Background**: Diabetes mellitus has become increasingly common worldwide, with many serious complications. Diabetic nephropathy is one such complication that affects the kidney and leads to end-stage renal failure worldwide. Microalbuminuria represents an abnormal elevation in urine albumin levels, which is an early marker of diabetic nephropathy. It is likely to be found in one-third or more of diabetic patients. Early recognition of microalbuminuria in diabetic nephropathy permits successful therapeutic intervention and significant postponement of terminal renal failure.

**Objective**: To investigate the prevalence of microalbuminuria in type 2 diabetes patients attending AL-Thawra Hospital and Saref Medical Centre in Sana'a City.

**Materials and Methods**: This study was carried out in AL-Thawra Hospital and Saref Medical Center in Sana'a City, during the period (from 1 February to 30 April 2021). 125 Type 2 diabetic patients (diagnosed according to American Diabetes Association (ADA) criteria for diagnosis of diabetes) were selected). Medical records were used to collect data on duration of diabetes, gender, age and body mass index (BMI). Microalbuminuria was assessed using mispa-i3 kits in spot of the morning urine samples.

**Results**: The prevalence of microalbuminuria and macroalbuminuria among type 2 diabetic patients was 44.8% and 12 %, respectively. Microalbuminuria had a statistically significant association with longer duration (P = 0.031), and no statistically significant association was found between microalbuminuria and gender (P = 0.419), age (P = 0.299) and body mass index (P = 0.390).

**Conclusion**: The prevalence of microalbuminuria in this study was considerably high (44.8%) in type 2 diabetes. 44.8% (nearly half) of type 2 diabetic patients in this study are at risk of developing kidney disease due to their high microalbuminuria level. This calls for regular and early screening for microalbuminuria is recommended for all diabetic patients, as early treatment is critical for reducing the progression to the late stage of diabetic nephropathy (overt proteinuria and end-stage renal disease).

**Keywords**: Diabetes Mellitus type 2, Microalbuminuria, Diabetic nephropathy.

**الملخص:**

**الخلفية:** يعد مرض داء السكري من أكثر الامراض شيوعا في جميع أنحاء العالم والذي يصاحبه مضاعفات خطيرة عديدة. اعتلال الكلية السكري هو أحد هذه المضاعفات، وقد يؤدي إلى مرض الكلى المزمن، وينتهي على الصعيد العالمي بالفشل الكلوي في المراحل النهائية. يعتبر الالبومين الدقيقة (micro-albuminuria) العلامة الأكثر حساسية للتشخيص المبكر لاعتلال الكلية السكري (diabetic nephropathy) والذي يوجد في حوالي 30% من هؤلاء المرضى أو أكثر والتشخيص المبكر له قد يساعد في عملية العلاج وتفادي الاصابة بالفشل الكلوي.

**الهدف:** تهدف هذه الدراسة لتقدير نسبة انتشار الالبومين الدقيق (microalbuminuria) لدى مرضى السكري من النوع الثاني الذين يترددون على مستشفى الثورة ومركز صرف الطبي في مدينة صنعاء.

**الطريقة والمواد:** أجريت هذه الدراسة في مستشفى الثورة ومركز صرف الطبي بمدينة صنعاء في الفترة ما بين 1 فبراير إلى 30 أبريل 2021. حيث شملت هذه الدراسة عدد 125 مريضاً بالسكري من النوع الثاني (تم تشخيصهم وفقاً للجمعية الأمريكية للسكري (ADA)). تم استخدام الاستبيان لجمع بيانات عن مدة الإصابة بمرض السكري والجنس والعمر ومؤشر كتلة الجسم. سحبت منهم عينات بول صباحي لتقدير مستوى الالبومين الدقيق (microalbuminuria) بواسطة جهاز Mispa-i3.

**النتائج:** تبين من خلال النتائج ان معدل انتشار الالبومين الدقيق (microalbuminuria) والالبومين الكبير (macroalbuminuria) بين مرضى السكري من النوع الثاني 44.8% و12%، على التوالي. حيث وجدت علاقة ارتباط ذو دلالة إحصائية بين الالبومين الدقيق ومدة الإصابة بداء السكر فكانت قيمه ($p = 0.031$). كما تبين انه لا توجد علاقة ارتباط ذو دلالة إحصائية بين الالبومين الدقيق (microalbuminuria) والجنس ($P = 0.419$) والعمر ($P = 0.299$) ومؤشر كتلة الجسم ($P = 0.390$).

**الاستنتاج:** نستنتج من هذه الدراسة ان معدل انتشار الالبومين الدقيق (microalbuminuria) مرتفعًا إلى حد كبير (44.8٪) لدى مرضى السكري من النوع الثاني. وأن 44.8% (النصف تقريباً) من مرضى السكري من النوع الثاني في هذه الدراسة معرضون لخطر الإصابة بأمراض الكلى بسبب ارتفاع مستوى الالبومين الدقيق (microalbuminuria) لديهم. عليه يوصى بإجراء فحص منتظم ومبكر لـ الالبومين الدقيق (microalbuminuria) لجميع مرضى السكري، حيث أن العلاج المبكر أمر بالغ الأهمية للحد من التقدم إلى المرحلة المتأخرة من اعتلال الكلية السكري (الالبومين الكبير ومرض الكلى في المرحلة النهائية).

**الكلمات المفتاحية:** داء السكري من النوع الثاني، الالبومين الدقيق، اعتلال الكلية السكري.

## INTRODUCTION

Diabetes mellitus (DM) is associated with the derangement of the normal metabolism of carbohydrates, lipids, and proteins. The primary cause of morbidity and mortality in DM is macrovascular and microvascular complications [1]. Long-term complications of diabetes can lead to visual impairment (retinopathy), blindness, kidney disease (nephropathy), nerve damage, amputation, heart disease, and stroke [2]. Diabetic nephropathy (DN) is a common complication in diabetic patients characterized by persistent albuminuria, a progressive decline in glomerular filtration rate (GFR), and raised arterial blood pressure [3]. Diabetic nephropathy is the leading cause of end-stage renal disease and premature mortality in diabetic patients due to its insidious onset [4]. Approximately one-third to half of patients with diabetes develop renal manifestations [5].

According to studies, 20 to 40% of type 2 DM patients eventually develop nephropathy [6]. The development of DN consists of several stages, the earliest being microalbuminuria, which can progress to overt proteinuria and ultimately end-stage renal disease (ESRD) [7]. Microalbuminuria (MA) remains the best-documented predictor of the high risk of the development of diabetic nephropathy in DM patients [8].

MA in diabetic patients is more likely to progress to overt proteinuria and, eventually, renal failure [9]. Typically, diabetic nephropathy advances irreversibly from the onset of clinical proteinuria to ESRD. However, it has been demonstrated that early detection, medical care, and appropriate lifestyle changes can stop or reverse the progression from micro- to macroalbuminuria [10]. According to some data, after 10 to 15 years of untreated type 1 diabetes with persistent MA, over 80% of patients will have overt nephropathy, and 50% will eventually progress to end-stage renal disease (ESRD) [11]. 20 – 40% of type 2 diabetes individuals with MA advance to overt nephropathy after 20 years from the time of onset, and about 20% develop ESRD, according to research [12].

Prevalence of microalbuminuria among type 2 diabetic patients in some of the Arab Countries, in Saudi Arabia, the rate of microalbuminuria among type


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2 diabetic patients attending the diabetic clinic of King Abdul-Aziz University Hospital during the period of September 2004 to April 2005 was 45.6%. [13], in another setting of Saudi, Alhasa during 2017, the prevalence of patients who had microalbuminuria among type 2 diabetic patients was 37.4% [14]. In Bahrain, the prevalence of microalbuminuria and macroalbuminuria among Type 2 diabetic patients were 22% and 5.8%,[15] respectively. In Kuwait, a result taken from patients with type 2 DM in El-Fahaheel Primary Healthcare Centre shows that the prevalence of microalbuminuria was 58.2% [16], in another setting of Kuwait, the prevalence rate of proteinuria among type 2 diabetic patients at Al-Sabah Hospital was found to be 43.5%, the prevalence of microalbuminuria and macroalbuminuria was 27.3%, and 16.2%, respectively [17]. During 2003/2004, among people with DM in Al-Ain district, United Arab Emirates, microalbuminuria was present in 61.2% of the sample population [18]. In Oman, the prevalence of patients who had microalbuminuria among type 2 diabetic patients attending an outpatient diabetic clinic at Sultan Qaboos University Hospital between 2002 and 2003 was 27% [19]. In another study in Oman, 42.5% of the studied population was found to have diabetic nephropathy [20]. In 2016, a study was conducted on type 2 diabetic patients attending the diabetic center of Baghdad, the capital city of Iraq, showed that the prevalence of microalbuminuria was 16.1% [21]. In Sudan, in 2012, the prevalence of microalbuminuria among type 2 diabetic patients in Elmusbah Medical Center-Omdurman was 44% [22]. During 2011/2012, among type 2 diabetic patients in Menoufia governorate, Egypt, the overall prevalence of microalbuminuria and macroalbuminuria was 34.2% and 12.8%, respectively [23]. In 2016 in Tunisia, the prevalence of microalbuminuria among Type 2 diabetic patients who were followed up in two primary healthcare centers was 23% [24]. In 2019 in Ramallah, Palestine, the overall prevalence of microalbuminuria and macroalbuminuria was 29.3% and 5.3 % respectively [25]. Therefore, the present study is aimed to investigate the prevalence of microalbuminuria in type 2 diabetes patients attending to AL-Thawra Hospital and Saref Medical Center in Sana'a City.

## MATERIALS AND METHODS

### Study Design and Population

This cross-sectional analytical study was performed in AL-Thawra Hospital and Saref Medical Center which provide health care for diabetic patients in Sana'a City (Yemen). The target population of this study involved 125 participants, they were all adults both males and females with type 2 DM defined according to the American Diabetes Association (ADA) [13] these patients attending to AL-Thawra Hospital and Saref Medical Center during the period (from 1 February to 30 April 2021). **Inclusion criteria**: medically diagnosed type 2 diabetes mellitus patients. **Exclusion criteria**: Type 1 DM, or any one of the participants who suffered from, gestational diabetes, thyroid problems, obstructive liver disease, advanced renal failure, and tuberculosis.

### Data Collection and Tools

Interview (face to face) by using a questionnaire: the patient was provided n=ıted questionnaire a set =384 ɐd into three main sections: 1st –personal data. 2nd – Socio-demographic (age, gender). 3rd - Clinical characteristic (duration of DM). Laboratory investigation (microalbuminuria test). Microalbuminuria was assessed using mispa-i3 microalbuminuria test kits. Urine samples were collected in spot in the early morning. Category spot was defined as follows:

(1) normoalbuminuria was defined as < 30 μg of albumin / mg of creatinine.

(2) microalbuminuria was defined as 30 - 300 μg of albumin / mg of creatinine.

(3) macroalbuminuria was defined as > 300 μg of albumin / mg of creatinine.

### Ethical Consideration

The study protocol was approved by Dar AL-Slam International University for Science and Technology. Informed consent was obtained from all individuals after explaining the purpose and nature of the study.

### Statistical analysis

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) for Windows version 23. The descriptive results are expressed as mean ± standard deviation and percentages were used to determine correlations be-

tween microalbuminuria and other risk factors.

## RESULTS

This study includes 125 type 2 diabetes outpatients: 58 (46.4 %) males and 67 (53.6%) females, whose ages are ranged from (25 -70) years with mean age of (48.6). The age was divided into three groups (25 - 44), (45 - 65) and (> 65) years, 24(19.2%), 88(70.4 %), 13 (10.4%) respectively as shown in (Table 1).

**Table 1**: **distribution of socio – demographic characteristic of partici–pants** (**n= 125**).

| Characteristic | | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 58 | 46.4 % |
| | Female | 67 | 53.6 % |
| | Total | 125 | 100 % |
| Age (years) | 25 – 44 | 24 | 19.2 % |
| | 45 – 65 | 88 | 70.4 % |
| | > 65 | 13 | 10.4 % |
| | **Total** | **125** | **100 %** |

Among 125 type 2 diabetic patients analyzed, the prevalence of microalbu–minuria and macroalbuminuria was 56 (44.8%) and 15 (12 %), respectively as shown in (Table 2).

**Table 2**: **Prevalence of microalbuminuria among study participants** (**n= 125**).

| Albuminuria | Frequency | Percentage |
|---|---|---|
| Normoalbuminuria | 54 | 43.2 % |
| Microalbuminuria | 56 | 44.8 % |
| Macroalbuminuria | 15 | 12.0 % |
| **Total** | **125** | **100 %** |

We did not find any significant association between gender, BMI and the presence of microalbuminuria (p = 0.419), (p = 0.390) respectively. Analysis involving different age groups versus the presence of microalbuminuria revealed no statistically significant association (P = 0.299). We found that there was a significant difference with regard to the duration of diabetes mellitus with more than 15 years with microalbuminuria group having a prevalence of 73.3% compared to the prevalence of 26.7% in normoalbuminuria group (P = 0.031) (Table 3).


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**Table 3: Bivariate analysis to show the association between categorical variables and albuminuria status (n= 110).**

| Variables | | Normoalbuminuria n = 54 n (%) | Microalbuminuria n = 56 n (%) | P-Value |
|---|---|---|---|---|
| Gender | Male | 24 (47.1 %) | 27 (52.9 %) | 0.419 |
| | Female | 30 (50.8 %) | 29 (49.2 %) | |
| Age (years) | Mean $\pm$ SD | 53.5 $\pm$ 10.5 | 52.8 $\pm$ 11.26 | 0.299 |
| | 25 - 44 | 9 (42.9 %) | 12 (57.1 %) | |
| | 45 – 65 | 38 (48.7 %) | 40 (51.3 %) | |
| | $> 65$ | 7 (63.6 %) | 4 (36.4 %) | |
| Duration of diabetes (years) | Mean $\pm$ SD | 12.64 $\pm$ 7.46 | 17 $\pm$ 7.59 | 0.031 |
| | $< 5$ | 26 (59.1 %) | 18 (40.9 %) | |
| | 5 – 10 | 16 (48.5 %) | 17 (51.5 %) | |
| | 11 – 15 | 8 (44.4 %) | 10 (55.6 %) | |
| | $> 15$ | 4 (26.7 %) | 11 (73.3 %) | |
| BMI (Kg/m$^2$) | Mean $\pm$ SD | 25.5 $\pm$ 5.85 | 24.71 $\pm$ 4.61 | 0.390 |
| | Underweight ($\leq 18.5$) | 5 (71.4 %) | 2 (28.6 %) | |
| | Normal ($18.5 - 25$) | 27 (43.5 %) | 35 (56.5%) | |
| | Overweight ($26 - 30$) | 14 (58.3 %) | 10 (41.7 %) | |
| | Obese ($\geq 30$) | 8 (47.1 %) | 9 (52.9 %) | |

Statically Significant = P. Value 0.05, BMI = body mass index.

## DISCUSSION

The overall prevalence of albuminuria among type 2 diabetic patients in our study was 56.8% (44.8% had microalbuminuria and 12% had macroalbuminuria). This was similar and comparable to previous studies done in Pokhara,-Nepal, the overall prevalence of albuminuria was 56.7 % (45.5% microalbuminuria and 11.2% macroalbuminuria) [27], but higher than the studies done in Bahrain, overall prevalence of albuminuria was 27.8 % (22% microalbuminuria and 5.8% macroalbuminuria), Kuwait, overall prevalence of albuminuria was 43.5% (27.3% microalbuminuria and 16.2% macroalbuminuria), Egypt, the overall prevalence of albuminuria was 47% (34.2% microalbuminuria and 12.8% macroalbuminuria), Ramallah, Palestine, the overall prevalence of albuminuria was 34.6% (29.3% microalbuminuria and 5.3 % macroalbuminuria), Saudi Arabia overall prevalence of albuminuria was 10.8% (1.2% microalbuminuria, 8.1% macroalbuminuria, and 1.5% ESRD) [15,17,23,25,28] respectively.

The prevalence of microalbuminuria in our patients with type 2 diabetes mellitus was 44.8%. This was similar to the results done in Saudi Arabia (45.6%), Oman (42.5%), Sudan (44%), Botswana (44.6%), Uganda (45.7%), Pakistan (47.7%) and Ethiopia (48%) [13, 20, 22, 29, 30, 31, 32] (Respectively), but lower than the studies done in Kuwait (58.2%), United Arab Emirates (61%), Tanzania (62.1%) and Nigeria (58%) [16,18,33,34], (respectively) and its higher than the studies done in Saudi, Alhasa (37.4%), Oman (27% ), Baghdad ,Iraq (16.1%), Tunisia (23 %), Nigeria (35%), Nigeria (35.3%), Cameroon (14.2%), and Pakistan (14 %) [14, 19, 21, 24, 35, 36, 37, 38] (Respectively).

The prevalence of macroalbuminuria in our study was 12%. This was similar to the results done in Pokhara -Nepal (11.2%), Egypt (12.8%), and Pakistan (13.94 %), [27, 28, 38], respectively, but it is lower than the studies done in Kuwait (16.2%) [39] and higher than the studies done in Bahrain (5.8%) and Saudi Arabia (8.1 %) [15, 28], respectively. Variations in the prevalence can be explained by genetic susceptibility to nephropathy and prolonged diabetic duration, differences in age groups and population.


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No significant association was found between the prevalence of microalbuminuria and the age of patients in the present study (p = 0.3299. This result was supported by studies done in Baghdad and Uganda which found no association between microalbuminuria and age with (P = 0.14) and (P = 0.316) [21, 30], respectively, however, this result was in contrast with a study done in Botswana which found that there is an association between microalbuminuria and age with (P = 0.09). [29].

In the present study, there was no significant association between BMI of diabetic type 2 patients and microalbuminuria (p = 0.390). This result was supported by the numerous previous findings [13, 27, 29, 32, 33, 34], which is contrary to other studies that provided statistically significant to BMI [14, 18, 30]. Likewise, gender had no significant association with microalbuminuria in this study (p = 0.419). This result is supported by a study done in Uganda [30]. Whereas in Emirates a study showed an association between gender and microalbuminuria [18]. In this study, male patients were more affected by microalbuminuria than females, and the prevalence of microalbuminuria in males was (52.5%) and in females it was (49.2%). This was in accordance with studies done in Uganda and Ethiopia [22, 30], while in another study in Botswana, prevalence of microalbuminuria was (31.8% and 68.2%) in males and females respectively [29].

In the present study, a good significant association was found between the prevalence of microalbuminuria and the duration of diabetes (p = 0.031). Earlier studies reported a significant association between microalbuminuria and the duration of diabetes [13, 14, 25, 27, 29, 32, 33, 34]. Though another study reported no significant association between microalbuminuria and the duration of diabetes [21, 37], we found the microalbuminuria develops after 15 years from diabetes onset, and the percentage of microalbuminuria was (73.3%). This is also supported by the study done in Albania, which found the microalbuminuria develops after 15 years from diabetes onset, of which the percentage of microalbuminuria was (48.2%) [40]. Another study was done in Ethiopia, showing that microalbuminuria develops after 10 years from diabetes onset, and the percentage of microalbuminuria was (73.7%) [32]. Also, other studies

were done in Botswana and Tanzania, finding that the microalbuminuria develops after 5 years from diabetes onset, and the percentage of microalbuminuria was (29.5%) and (21.0%), [29, 33] respectively.

## CONCLUSIONS

The high prevalence of albuminuria 56.8% (44.8% had microalbuminuria and 12% had macroalbuminuria) was observed in this study of patients diagnosed with type 2 diabetes mellitus. Patients at longer duration of diabetes were associated with an increased level of microalbuminuria. The detection of microalbuminuria in patients can be useful for the screening of diabetes mellitus during annual health check-ups. Moreover, microalbuminuria may be adopted as a marker among patients with type 2 diabetic patients.

## REFERENCES

1.Naicker, S., & Ashuntantang, G. (2017). End stage renal disease in sub-Saharan Africa. In Chronic Kidney Disease in Disadvantaged Populations (pp. 125-137). Academic Press.

2.Story, M., & Stang, J. (2005). Nutrition needs of adolescents. Guidelines for adolescent nutrition services, 3(1), 21-34.

3.Obineche, E. N., & Adem, A. (2005). Update in diabetic nephropathy. International Journal of Diabetes and Metabolism, 13(1), 1-9.

4.John, S. (2016). Complication in diabetic nephropathy. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 10(4), 247-249.

5.Yadav, B., Shashidhar, K. N., Raveesha, A., & Muninarayana, C. (2021). Assessment of Cystatin C and Microalbumin as Biomarkers for Nephropathy in Patients with Type 2 Diabetes Mellitus. Journal of Evolution of Medical and Dental Sciences, 10(25), 1866-1871.

6.American Diabetes Association. (2011). Standards of medical care in diabetes—2011. Diabetes care, 34(Supplement_1), S11-S61.

7.Warram, J. H., Scott, L. J., Hanna, L. S., Wantman, M., Cohen, S. E., Laffel, L. M., ... & Krolewski, A. S. (2000). Progression of microalbuminuria to proteinuria in type 1 diabetes: nonlinear relationship with hyperglycemia. Diabetes, 49(1), 94-100.


https://doi.org/10.54582/TSJ.2.2.84

8.Hovind, P., Tarnow, L., Rossing, P., Graae, M., Torp, I., Binder, C., & Parving, H. H. (2004). Predictors for the development of microalbuminuria and macroalbuminuria in patients with type 1 diabetes: inception cohort study. Bmj, 328(7448), 1105.
9.Dadhania, B. P., Aravat, A. H., & Dhruva, G. A. (2012). Study of microalbuminuria in diabetes type 2 patients as a marker of morbidity (a study of 100 cases in Rajkot city). Int J Biomed Adv Res, 3(10), 763-766.
10.Bakris, G. L., & Molitch, M. (2014). Microalbuminuria as a risk predictor in diabetes: the continuing saga. Diabetes care, 37(3), 867-875.
11.Orchard, T. J., Dorman, J. S., Maser, R. E., Becker, D. J., Drash, A. L., Ellis, D., ... & Kuller, L. H. (1990). Prevalence of complications in IDDM by sex and duration: Pittsburgh Epidemiology of Diabetes Complications Study II. Diabetes, 39(9), 1116-1124.
12.Zelmanovitz, T., Gerchman, F., Balthazar, A. P. S., Thomazelli, F. C. S., Matos, J. D., & Canani, L. H. (2009). Diabetic nephropathy. Diabetol Metab Syndr 1 (1): 10.
13.Al-Shaikh, A. (2007). Prevalence of microalbuminuria in type 2 diabetes mellitus at a diabetic clinic in King Abdulaziz university hospital. Pakistan Journal of Medical Sciences, 23(2).
14.AlFehaid, A. A. (2017). Prevalence of microalbuminuria and its correlates among diabetic patients attending diabetic clinic at National Guard Hospital in Alhasa. Journal of Family and Community Medicine, 24(1), 1-5.
15.Al-Salman, R. A., Al-Basri, H. A., Al-Sayyad, A. S., & Hearnshaw, H. M. (2009). Prevalence and risk factors of albuminuria in Type 2 diabetes in Bahrain. Journal of endocrinological investigation, 32, 746-751.
16.Al-Adsani, A. (2012). Risk factors associated with albuminuria in Kuwaiti adults with type 2 diabetes. Saudi Journal of Kidney Diseases and Transplantation, 23(4), 860-865.
17.Shebl, M., & Atteia, M. (2008). High prevalence of microalbuminuria (MA) in type 2 diabetic patients. Health care, 21, 221-232.
18.Al-Maskari, F., El-Sadig, M., & Obineche, E. (2008). Prevalence and determinants of microalbuminuria among diabetic patients in the United Arab

Emirates. BMC nephrology, 9, 1-8.
19.Al-Futaisi, A., Al-Zakwani, I., Almahrezi, A., Al-Hajri, R., Al-Hashmi, L., Al-Muniri, A., & Farooqui, M. (2006). Prevalence and predictors of microalbuminuria in patients with type 2 diabetes mellitus: a cross-sectional observational study in Oman. Diabetes research and clinical practice, 72(2), 212-215.
20.Alrawahi, A. H., Rizvi, S. G. A., Al-Riyami, D., & Al-Anqoodi, Z. (2012). Prevalence and risk factors of diabetic nephropathy in omani type 2 diabetics in Al-dakhiliyah region. Oman medical journal, 27(3), 212.
21.Ali, A. A., & Al Lami, F. H. (2016). Prevalence and determinants of microalbuminurea among type 2 diabetes mellitus patients, Baghdad, Iraq, 2013. Saudi Journal of Kidney Diseases and Transplantation, 27(2), 348-355.
22.Rahamtalla, F. A., Elagib, A. A., Mahdi, A., & Ahmed, S. M. (2012). Prevalence of microalbuminuria among sudanese type 2 diabetic patients at elmusbah center at ombadda—omdurman. IOSR J Pharm, 2(5), 51-55.
23.Farahat, T. M., Elsaeed, G. K., Gazareen, S. S., & Elsayed, T. I. (2014). Prevalence of proteinuria among type 2 diabetic patients in Menoufia governorate, Egypt. Menoufia Medical Journal, 27(2), 363.
24.Afifa, K., Belguith Asma, S., Nabil, H., Ahlem, B., Mounira, S., Kawthar, Y., ... & Mohamed, S. (2016). Screening for nephropathy in diabetes mellitus: is micral-test valid among all diabetics?. International journal of chronic diseases, 2016.
25.Shahwan, M. J., Gacem, S. A., & Zaidi, S. K. (2019). Prevalence of diabetic nephropathy and associated risk factors among type 2 diabetes mellitus patients in Ramallah, Palestine. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 13(2), 1491-1496.
26.American Diabetes Association. (2011). Standards of medical care in diabetes—2011. Diabetes care, 34(Supplement_1), S11-S61.
27.Sigdel, M., Rajbhandari, N., Basnet, S., Nagila, A., Basnet, P., & Tamrakar, B. K. (2008). Microalbuminuria among type-2 diabetes mellitus patients in Pokhara, Nepal. Nepal Med Coll J, 10(4), 242-245.
28.Al-Rubeaan, K., Youssef, A. M., Subhani, S. N., Ahmad, N. A., Al-Shar-

qawi, A. H., Al-Mutlaq, H. M., ... & AlNaqeb, D. (2014). Diabetic nephropathy and its risk factors in a society with a type 2 diabetes epidemic: a Saudi National Diabetes Registry-based study. PloS one, 9(2), e88956.
29.Molefe-Baikai, O. J., Molefi, M., Cainelli, F., & Rwegerera, G. M. (2018). The prevalence of microalbuminuria and associated factors among patients with type 2 diabetes mellitus in Botswana. Nigerian journal of clinical practice, 21(11), 1430-1437.
30.Martin, M., Edrisa, M., SSinabulya, I., Samuel, K., Frank, M., & Kiiza, M. C. (2018). Microalbuminuria among newly diagnosed diabetic patients at mulago national referral hospital in Uganda: a cross sectional study. Journal of obesity and weight-loss medication, 4(1).
31.Younas, M. T., Mukhtar, S., Yousaf, S., Niazi, H., & Younas, S. (2023). Microalbuminuria In Newly Diabetes Mellitus Patients: Diagnosis, Screening and Increasing Public Awareness. BMC Journal of Medical Sciences, 4(1), 92-95.
32.Muse, A. I., Osman, M. O., Wedajo, G. T., Abate, K. H., Ibrahim, A. M., Yusuf, R. B., ... & Daud, F. I. (2021). Prevalence of Microalbuminuria and Associated Factors among Type 2 Diabetes Mellitus Patients in Jigjiga Town Public Hospitals, Somali Regional State, Ethiopia, 2020.
33.Kantarama, E., Uwizeye, D., & Mselle, T. (2021). Prevalence and correlates of microalbuminuria among type 2 diabetes patients at Muhimbili National Hospital, Dar es Salaam, Tanzania. Rwanda Journal of Medicine and Health Sciences, 4(1), 84-97.
34.Ufuoma, C., Ngozi, J. C., Kester, A. D., & Godwin, Y. D. (2016). Prevalence and risk factors of microalbuminuria among type 2 diabetes mellitus: A hospital-based study from, Warri, Nigeria. Sahel Medical Journal, 19(1), 16.
35.Ogiator, M., Ojobi, J., Ijachi, O., & Asor, P. (2020). Association between microalbuminuria and hypertension among type 2 diabetes mellitus patients attending Benue State University Teaching Hospital, Makurdi, North Central, Nigeria. Int J Med Rev Case Rep, 4(5), 24.
36.Fetni, S., Goudjil, T., Zekri, S., & Lemdaoui, M. C. (2021). The diagnosis

of diabetic kidney disease; frequencies of urinary microalbumin and creatinine ratios, and the establishment of causal relationships between lipid and glycemic levels and obesity in an Algerian population. Acta Medica, 37, 2433.
37.Efundem, N. T., Assob, J. C. N., Feteh, V. F., & Choukem, S. P. (2017). Prevalence and associations of microalbuminuria in proteinuria-negative patients with type 2 diabetes in two regional hospitals in Cameroon: a cross-sectional study. BMC research notes, 10, 1-5.
38.Iqbal, A., Salman, J., Habib, J., Ali, M., Naveed, S., & Ali, A. (2023). Frequency of microalbuminuria and its relation to HbA1C in type 2 Diabetes mellitus patients. The Professional Medical Journal, 30(02), 199-203.
39.Bruno, G., Cavallo-Perin, P., Bargero, G., Borra, M., Calvi, V., D'Errico, N., ... & Pagano, G. (1996). Prevalence and risk factors for micro-and macroalbuminuria in an Italian population-based cohort of NIDDM subjects. Diabetes Care, 19(1), 43-47.
40.Pasko, N., Toti, F., Strakosha, A., Thengjilli, E., Shehu, A., Dedej, T., ... & Thereska, N. (2013). Prevalence of microalbuminuria and risk factor analysis in type 2 diabetes patients in Albania: the need for accurate and early diagnosis of diabetic nephropathy. Hippokratia, 17(4), 337.