

EVALUATION OF MICROALBUMINURIA IN TYPE 2 DIABETIC AND HYPERTENSIVE PATIENT AND ITS CORRELATION WITH DIABETIC NEPHROPATHY

Alfagieh Esam¹⁻⁴, Abukhattala Emhemed¹⁻³, Bennasr bayio Faiza¹,
Khadoura Siham¹, Belgayed Hawa¹, Abu Shiba Esra¹.

Department of Medical Laboratory, Faculty of Medical Technology-Misurata, Libya¹.

Department of Medical Laboratory, Misurata Diabetic Center-Misurata, Libya².

Department of Medical Science, Libyan Academy of Graduate studies-Misurata, Libya³.

Department of Medical Laboratory, Assafwa International Hospital-Misurata, Libya⁴.

Abstract

Background: This represents an important topic to study because Microalbuminuria is only one earliest sensitive predictor for poor renal outcomes in Type 2 diabetes mellitus and essential hypertension. **Objective:** Specifically, we aim to investigate the Microalbuminuria and its association with hypertension, diabetic nephropathy, and other diabetic complications. **Methods:** Eighty-six patients with type 2 diabetes mellitus (41 male and 45 female) were enrolled with twenty-five healthy donors (10 male and 15 female). Microalbumin in a random morning urine sample was used and the patients were categorized as micro-albuminuria group, macro-albuminuria group, and control group. Microalbuminuria, glycosylated hemoglobin, serum urea, and creatinine were measured by (COBASIntegra400plus). **Results:** This approach allows a more detailed analysis of some aspects of the Microalbuminuria data that it was significantly higher in male and female type 2 Diabetes Mellitus compared with the control group ($P \leq 0.022$) ($P \leq 0.005$) respectively. The most significant observation of this study is that systolic blood pressure was increased among the Microalbuminuria group in females ($P \leq 0.0012$), also in the Macro-albuminuria group in males ($P \leq 0.0001$), and female ($P \leq 0.0012$) and diastolic Blood pressure in male ($P \leq 0.0076$). By carefully examining the data, it is found that HbA1c was increased in Microalbuminuria and macro-albuminuria patients with Type 2 Diabetes Mellitus ($P < 0.0001$) in male and female compared to the control group. The result of this study showed significant increase in urea in macro-albuminuria group in female ($P \leq 0.0115$) and male ($P \leq 0.0143$), and creatinine in male and female ($P \leq 0.0001$) however urea and creatinine increased in Microalbuminuria group in male-only ($P \leq 0.009$) ($P \leq 0.0003$) respectively. On statistical analyses, a strong correlation was found between Microalbuminuria and poor glycemic control in females (R 0.426) also urea in females ($r = 0.470$) and creatinine in males ($r = 0.370$) and female ($r = 0.716$). **Conclusion:** We have provided further evidence the severity and progression of Diabetes Miletus play an important role in increasing the possibility of diabetic nephropathy and other diabetic complications, regular measurement of Microalbuminuria should delay or prevent the development of end-stage renal disease.

Key Words: Microalbuminuria, Hypertension, Diabetic nephropathy.

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INTRODUCTION

Type 2 diabetes mellitus (T2DM) and its complications have been a major health problem worldwide, particularly in developing countries.⁽¹⁾ diabetic nephropathy (DN) is one of the long term complication of diabetes mellitus (DM) and it is the major cause of end-stage renal disease worldwide and the main cause of morbidity and mortality in patient with DM and it is more frequent in T2DM.^(2,3) Among diabetic patients, 20-40% is the victims of DN and 10–20% of them die due to kidney failure in T2DM.^(4,5) furthermore, DM and hypertension can be increased complications in patients with DM than DM only.⁽⁶⁾ Some studies showed that Microalbuminuria (MA) is the first detectable sign of DN and is considered as an independent predictor of DN. (7, 8) MA is associated with high blood pressure (BP).⁽⁹⁾ The prevalence of MA in Type2 diabetic patients showed marked variation, ranging from less 10% in the United Kingdom (10), 36.3% in Southern India,⁽¹¹⁾ 40.8 % in Albania,⁽¹²⁾ and to more than 41% in China.⁽¹³⁾ Some authors have convincingly argued that MA is likely a marker than a predictor of renal structural change. Numerous studies have confirmed a positive correlation between early detection and of kidney disease can slow, that or even reverse its progression.⁽¹⁴⁾ The objective of the present

investigation is to evaluate of MA in T2DM and hypertension and its correlation with DN.

Materials and methods

Study cases

In this cross-sectional study, A total number of 111 subjects: 86 Type 2 diabetes mellitus (N = 41 males and N = 45 females) who attending the Diabetic Center in Misurata, Libya from December 2018 to February 2019 and 25 healthy donors (N = 10 males and N = 15 females) were included. The Ethics Committee at Misurata Diabetic Center approved the study rules.

Methods

Microalbuminuria in a random morning urine sample was used and the patients were categorized as Microalbuminuria group when Microalbuminuria $\geq 20 < 300$ mg/l, macro-albuminuria group when ≥ 300 mg/l, and a control group when < 20 mg/l. Urine Microalbumin, glycosylated hemoglobin, serum urea, and creatinine were measured by (COBAS Integra 400 plus). Hypertension was diagnosed if Blood Pressure $> 140/90$ mmHg or already on antihypertensive medications.

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Statistical analysis

The statistical analysis program Graph pad 8 prism was used to determine the mean and standard deviation of the study cases, as well as to identify the value of the significant differences of the samples ($P \leq 0.05$), the T. Test, Two-way ANOVA and the chi-square test were used to determine the significant differences between the study groups, and the study of the relationship between variables using the Pearson coefficient test.

Results

Eighty-six Type 2 diabetes mellitus patient (41 males and 45 females) and 25 healthy donors (10 males and 15 females) were involved in this study. Figure (1) showed the Microalbuminuria significantly increased in male ($P \leq 0.022$) and female ($P \leq 0.005$) of Type 2 diabetes mellitus compared with the control group.

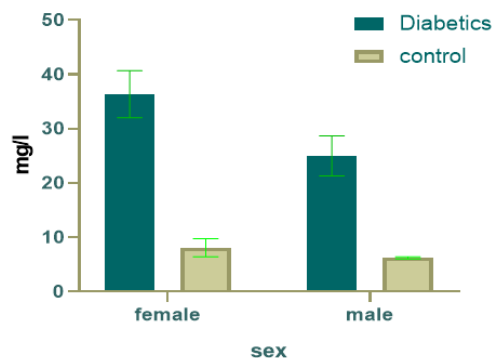


Figure (1) Mean microalbuminuria in type 2 diabetes and control group in male and female.

The most significant observation of this study is that systolic blood pressure (BP) Microalbuminuria was increased among Microalbuminuria group in female ($P \leq 0.0012$), also in Macro-albuminuria group in male ($P \leq 0.0001$), and female ($P \leq 0.0012$) as showed in figure (2), and diastolic BP in male ($P \leq 0.0076$) as showed in figure (3).

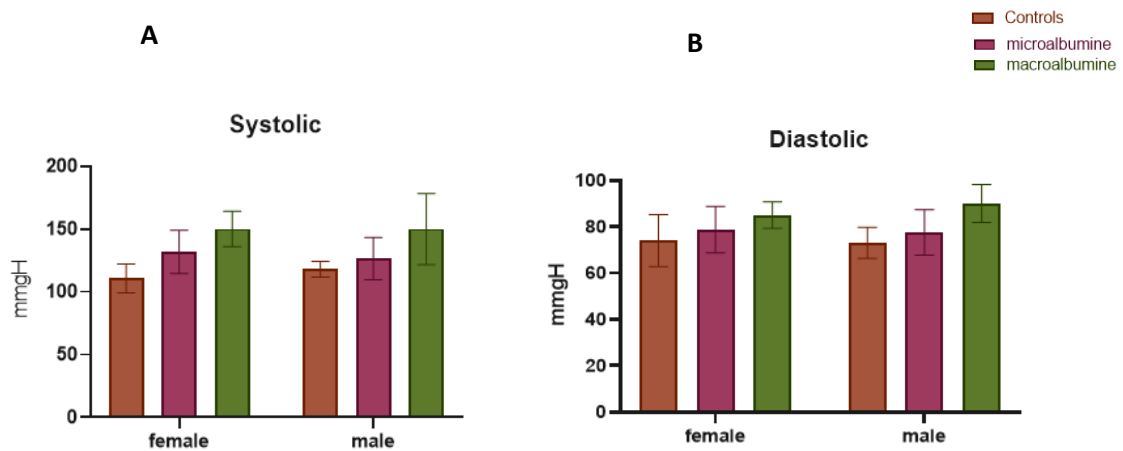


Figure (2) Mean systolic BP (A) and diastolic BP (B) in patients with type 2 diabetes as microalbuminuria, macroalbuminuria, and control groups in female and male.

By carefully examining the data, it is found that HbA1c was increased in Microalbuminuria and macro-albuminuria patients with Type 2 diabetes mellitus ($P < 0.0001$) comparing to control group in male and female as mention to Figure (4).

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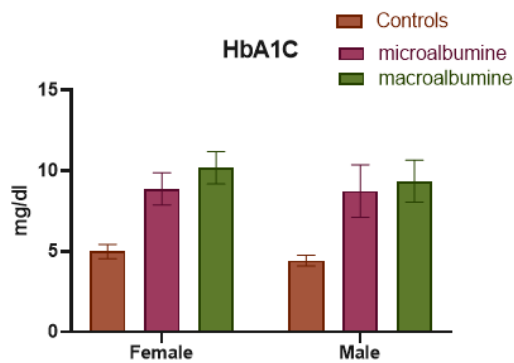


Figure (4) Mean HbA1c; microalbuminuria, macroalbuminuria, and control group in patients with type 2 diabetes in females and males.

As seen in Figure (5) and (6), Urea was increased in macro-albuminuria group in female ($P \leq 0.0115$) and male ($P \leq 0.0145$) and creatinin male and female ($P \leq 0.0001$) however urea and creatinine increased in Microalbuminuria group in male only ($P \leq 0.009$) ($P \leq 0.0003$) respectively.

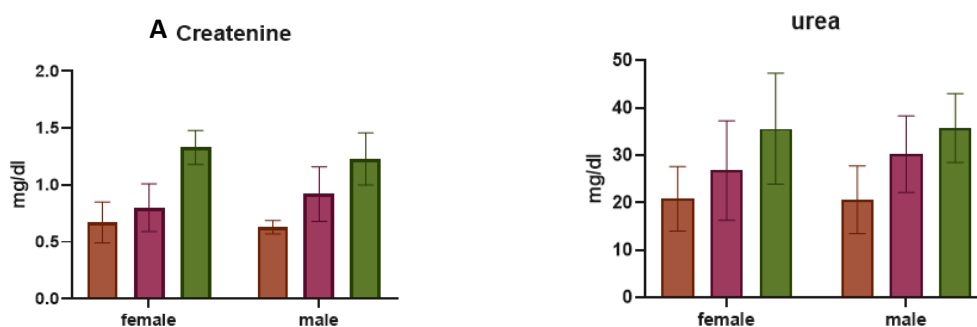


Figure (5) Mean urea (A) and creatanine (B) in patients with type 2 diabetes as microalbuminuria, macroalbuminuria, and control groups in female and male.

It is notable that Microalbuminuria was correlated with creatinine in male and female. Also Microalbuminuria correlated with urea and HbA1c in female as in table (1).

Table (1) the coloration between Micro-albuminuria in males and females with type 2 diabetes and other parameters.

PARAMETER	MALE		FEMALE	
	<i>Pearson Correlation</i>	<i>Sig. (2-tailed)</i>	<i>Pearson Correlation</i>	<i>Sig. (2-tailed)</i>
MICALBUMINE	1.00		1	
SYSTOLIC	0.24	0.09	.165	.207
DIASTOLIC	0.86	0.007	.087	.509
HBA1C	0.15	0.30	.426**	.001
CREATANINE	.370**	0.01	.716**	.000
UREA	0.16	0.31	.470**	.001

DISCUSSION

Microalbuminuria is one of the most popular measurements used for the early detection of Diabetic Nephropathy. ⁽⁸⁾ This study showed a significant increase in the levels of MA patients with Type 2 Diabetes Miletus for both sexes compared to the control group, where these results are consistent with several studies in different countries. ^(10, 12, 13)

It also showed that the rate of excretion of Microalbuminuria in women is higher than that of men. These results were consistent with the study ⁽¹⁵⁾ and may be due to the unhealthy lifestyle of women, which is a major cause of high blood sugar levels and this indicates that Diabetes Miletus

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affects blood supply to the kidneys leading to albumin leakage of urine and thus the occurrence of damage and atrophy of the kidneys, which affects their functions. Also, this study showed a significant increase in systolic blood pressure among the Microalbuminuria group in females as well as in the macro-albuminuria group in both males and females and diastolic blood pressure in males only. These results are matched with other studies^(15, 16, 17) besides a very recent study suggests that an increase in systolic blood pressure during sleep precedes the development of Microalbuminuria.^(9, 17) This study showed significant increases in HbA1c among the Microalbuminuria group of Type 2 diabetes mellitus in males and females as well as in the macro-albuminuria group in males and females. This finding recognized by other studies^(16, 17) and this may be because the irregularity of diabetes over time increased levels of Microalbuminuria excretion in the urine of Type 2 diabetes mellitus. This study showed a significant increase in urea and creatinine in males among the Microalbuminuria group of Type 2 diabetes mellitus, as well as in the macro-albuminuria group in males and females. The results of this study are consistent with several studies,^(18,19) which indicates that in the case of the emergence of a high percentage of protein Macro-albuminuria, it occurs impaired renal

function, which increases the rate of access to advanced stages of diabetic nephropathy, which may lead to kidney failure and death.

CONCLUSION

Microalbuminuria was high in male and female patients with Type 2 diabetes. Therefore, the annual screening program for Microalbuminuria should be performed for these patients. Microalbuminuria is mainly attributed to high systolic blood pressure, poor glycemic control, and renal function in patients with Type 2 diabetes mellitus. It seems that lowering blood pressure, even in the absence of hypertension-prehypertension and controlling blood glucose should be considered for patients with Microalbuminuria.

REFERENCES

1. Wild S, RoglicG, Green A, SicreeR, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes care*. 2004 May 1;27(5):1047-53.
2. American Diabetes Association. Standards of medical care in diabetes--2012. *Diabetes care*. 2012 Jan;35:S11.

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3. Borch-Johnsen K, Kreiner S. Proteinuria: value as predictor of cardiovascular mortality in insulin dependent diabetes mellitus. *Br Med J (Clin Res Ed)*. 1987 Jun 27;294(6588):1651-4.
4. Gu K, Cowie CC, Harris MI. Mortality in adults with and without diabetes in a national cohort of the US population, 1971–1993. *Diabetes care*. 1998 Jul 1;21(7):1138-45.
5. Sharma SK, Ghimire A, Radhakrishnan J, Thapa L, Shrestha NR, Paudel N, Gurung K, Budathoki A, Baral N, Brodie D. Prevalence of hypertension, obesity, diabetes, and metabolic syndrome in Nepal. *International journal of hypertension*. 2011 Apr 19;2011.
6. Epstein M, Sowers JR. Diabetes mellitus and hypertension. *Hypertension*. 1992 May;19(5):403-18.
7. Alzaid AA. Microalbuminuria in patients with NIDDM: an overview. *Diabetes care*. 1996 Jan 1;19(1):79-89.
8. Lutale JJ, Thordarson H, Abbas ZG, Vetvik K. Microalbuminuria among type 1 and type 2 diabetic patients of African origin in Dar Es Salaam, Tanzania. *BMC nephrology*. 2007 Dec;8(1):2.
9. Lurbe E, Redon J, Kesani A, Pascual JM, Tacons J, Alvarez V, Battlle D. Increase in nocturnal blood pressure and progression to

- microalbuminuria in type 1 diabetes. *New England Journal of Medicine*. 2002 Sep 12;347(11):797-805.
10. Gatling W, Knight C, Mulee MA, Hill RD. Microalbuminuria in diabetes: a population study of the prevalence and an assessment of three screening tests. *Diabetic medicine*. 1988 May 6;5(4):343-7.
11. Varghese A, Deepa R, Rema M, Mohan V. Prevalence of microalbuminuria in type 2 diabetes mellitus at a diabetes centre in southern India. *Postgraduate medical journal*. 2001 Jun 1;77(908):399-402.
12. Pasko N, Toti F, Strakosha A, Thengjilli E, Shehu A, Dedej T, Ylli A, Thereska N. 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*. 2013 Oct;17(4):337.
13. Lu B, Wen J, Song XY, Dong XH, Yang YH, Zhang ZY, Zhao NQ, Ye HY, Mou B, Chen FL, Liu Y. High prevalence of albuminuria in population-based patients diagnosed with type 2 diabetes in the Shanghai downtown. *Diabetes research and clinical practice*. 2007 Feb 1;75(2):184-92.

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14. Charlton MR, Wall WJ, OjoAO, GinèsP, TextorS, ShihabFS, MarottaP, CantarovichM, Eason JD, WiesnerRH, Ramsay MA. Report of the first international liver transplantation society expert panel consensus conference on renal insufficiency in liver transplantation. Liver Transplantation. 2009 Nov;15(11):S1-34.
15. AlFehaidAA. Prevalence of microalbuminuria and its correlates among diabetic patients attending diabetic clinic at National Guard Hospital in Alhasa. Journal of family & community medicine. 2017 Jan;24(1):1.
16. Ahmad T, Ulhaqi, MawaniM, Islam N. Microalbuminuria in Type-2 Diabetes Mellitus; the tip of iceberg of diabetic complications. Pakistan journal of medical sciences. 2017 May;33(3):519.
17. PalaniappanL, CarnethonM, FortmannSP. Association between microalbuminuria and the metabolic syndrome: NHANES III. American journal of hypertension. 2003 Nov 1;16(11):952-8.
18. AnsarMM, ShahrokhiRadR, LebodyMK. Risk factors of microalbuminuria and macroalbuminuria in type 2 diabetic patients in north of Iran-Rasht. Nephro-Urology Monthly. 2017 Jan 1;9(1).
19. FarahatTM, ElsaheedGK, GazareenSS, ElsayedTI. Prevalence of proteinuria among type 2 diabetic patients in Menoufiagovernorate, Egypt. Menoufia Medical Journal. 2014 Apr 1; 27(2):363.