# Relationship between *H. pylori* infection and microalbuminuria in type 2 diabetic patients

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**Abstract: Objective:** The aim of this study was to investigate the relationship between helicobacter infection and occurrence of microalbuminuria (a marker of diabetic nephropathy) in type 2 diabetic patients. **Background:** The incidence and prevalence of type 2 diabetes mellitus is one of the most critical problems in the healthcare system. Diabetes is a fast-growing health problem in Egypt with a significant impact on morbidity, mortality, and health care resources. Currently, the prevalence of type 2 diabetes (T2D) in Egypt is around 15.6% of all adults aged 20 to 79. **Patients and Methods:** Cross sectional study was conducted on50 type-2 diabetic patients that invited to Group I: Included 25 patients of type 2 diabetes mellitus with microalbuminuria, and Group II: Included 25 patients of type 2 diabetes mellitus without microalbuminuria attending to Banha Educational Hospital-EGYPT for diabetic care. In addition, Twenty healthy individuals as control group. The study was done during the period from January 2015 to December 2015. Subjects were submitted to the history taking, physical examination as well as routine and special investigations. **Results:** no significant difference between case and control groups regarding age and BMI (p value> 0.05). On contrast, there was high significant difference regarding hypertension, SBP /mmhg and DBP /mmhg and all studied laboratory characteristics except Urea and Creatinine. There was significant relation between group I and group II regarding age, BMI and all studied laboratory except Creatinine (mg/dl). no significant correlation (p value > 0.05) between microalbuminuria with clinical data and all studied laboratory characteristics except 24h urinary ptn (mg/d). Results indicated that non-significant correlation (p value >0.05) was observed between CIMT and studied microalbuminuric patients with positive HPIgG. **Conclusions:** Results of concluded that H.P. infection is significantly prevalent in type 2 diabetes patients with microalbuminuria (64%) compared to non-microalbuminuric diabetic patients (28%). In H.P. IgG positive diabetic patients with microalbuminuria (16/25%), microalbuminuria is not significantly correlated with the studied clinical, CIMT and laboratory data except with 24 hrs urinary patients (r=1, p=0.00). moreover, the validity of microalbuminuria for detection of H.P. IgG in the studied type 2 diabetes patients is weak at cut off level of 95.0 (sensitivity 56.2, specificity, 44.4, p value = 0.699).

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**Key words**: Type 2 diabetes, Cross Sectional, *H. pylori*, Microalbuminuria

## 1. Introduction:

T2DM is a disease that is often accompanied with different complications. Still it is presumed that patients who at the same time are Hp positive have a higher risk for developing several of them **(Covantev, et al., 2016).** Among the complications that can be present in T2DM more often seen in T2DM patients with Hp were muscular (47.2%), gastrointestinal (29.8%), chronic bronchitis (22.4%), nausea (19.9%), anemia (18%), abdominal pain (12.4%), diarrhea (10.6%) and vomiting (7.5%) (***Bener, et al., 2007***). Many of the pathologies associated with T2DM overlap with Hp probably increasing the risk for associated pathologies **(Horikawa, et al., 2014)**. The crude prevalence rate of diabetes among adult population aged 15 – 59 years in Egypt in 2008, was calculated to be 4.07%. Cairo governorate had a prevalence of 4.9%, while the governorates of Alexandria, Suez, the Red Sea, and North Sinai, all had prevalence's of more than 7% **(EDHS, 2008).** *Helicobacter pylori* (HP) infections are very common worldwide, affecting approximately 50% of the world's population, and are more common especially in developing countries (**Pounder and Ng, 2005**). The presence of *H. pylori* and diabetes mellitus (DM) is one of the main causes of gastrointestinal diseases (**Sargin, et al., 2007**). Additionally, the presence of *H. pylori* in DM cases plays an important role in the development of gastrointestinal diseases (**Kayar, et al., 2015).** The worsening of glycemic and metabolic control increases the incidence of *H. pylori* infections and complaints of dyspepsia (**Devrajani, 2010**). Microalbuminuria is defined as increased urinary albumin excretion, between 30 and 300 mg/day or between 30 and 300 mg/g microalbumin/creatinine ratio in a spot urine sample (**Namgoong, 2007**). It is

known as a predictor of clinical nephropathy in patients with diabetes mellitus, and a risk factor of cardiomyopathy and nephropathy in the general adult population (**Viberti, 2009)**. Several epidemiological and clinical studies have demonstrated that the presence of microalbuminuria is an independent and strong predictor of cardiovascular mortality and morbidity in patients with diabetes mellitus (DM) (**Schmiedel, et al., 2007**). It has been shown that microalbuminuria is a marker of vascular damage and atherosclerosis (**Holm, et al., 2006).**

The aim of this study was to investigate the relationship between helicobacter infection and occurrence of microalbuminuria (a marker of diabetic nephropathy) in type 2 diabetic patients.

## 2. Patients and Methods

The cross-sectional study was conducted on 50 type-2 diabetic patients attending to Banha Educational Hospital-EGYPT for diabetic care. Twenty healthy individuals were also included as a control group. The study was done during the period from January 2015 to December 2015.

**Inclusion criteria:** Adults patients with type 2 diabetes mellitus

**Exclusion criteria:** Type 1 diabetes mellitus, Recent history of bleeding, Infectious diseases, Liver diseases, Treatment with steroids or immunosuppressive drugs, Multiple organ dysfunctions and Inability to give informed consent.

**Subjects were classified into 3 groups: Group I:** Included 25 patients (16 males & 9 females) of type 2 diabetes mellitus with microalbuminuria. **Group II:** Included 25 patients (9 males & 16 females) of type 2 diabetes mellitus without microalbuminuria. **Group III:** Included 20 healthy subjects (13 male, 7 female) who were clinically free and volunteered to participate in the study.

**Subjects were submitted to the following:**

**A- History taking:** Include personal history, present history specifically stressing (for patients) on duration of diabetes, family history, organ dysfunctions and drug history with special emphasis on antihypertensive drugs.

**B- Physical examination:** Complete general and local examination with special emphasis on: Arterial blood pressure: Brachial arterial BP was measured with mercuric sphygmomanometer in seated position**,** Weight, height and BMI.

**C- Investigations: Routine investigations (**Complete urine analysis, 24 hours' urine protein, Complete blood count, Blood sugar, HbA1c %, Blood urea and serum creatinine).

**Special investigations:** Albumin/ Creatinine ratio in a random urine sample and Detection of helicobacter pylori IgG antibody in serum).

**Ethical consideration**: All participants were volunteers. Oral consent was taken from each participant in the study with explaining the purpose of this study to each participant. The consent form was developed according to the standard in Quality Improvement System in Ministry of Health and Population in Egypt, which was introduced in Banha Educational Hospital-EGYPT for diabetic care. Also, it was modified according to international ethical guidelines for Biochemical Research involving human subjects as prepared by the Council for Faculty of Medicine, Menoufia University.

**Statistical Analysis:** Results were tabulated and statistically analyzed by using personal computer using MICROSOFT EXCEL 2016 and SPSS v.20 (SPSS Inc., Chicago, IL, USA). Two types of statistics were done: Descriptive: e.g. percentage (%), mean and standard deviation. Analytical: that includes: Chi-Squared ($\chi^2$), student t test, f test (ANOVA- analysis of variance), Mann-Whitney test and correlation coefficient test.

## 3. Results

**Table 1:** illustrated that a total of 50 patients were studied. Only 34% of the study population had prior hypertension. The mean age of subjects group was 46.10 years for cases group and 43.75 years for control group. The mean SBP /mmhg was 126.7 and 113 mmhg for cases and control groups respectively. Mean of DBP /mmhg was 81.6 and 69.0 mmhg in cases and control groups respectively. Results of the current study revealed that no significant difference between case and control groups regarding age and BMI (p value> 0.05). On contrast, there was high significant difference between case and control groups regarding hypertension, SBP /mmhg and DBP /mmhg (p value=0.000). Regarding laboratory characteristics, results indicated that highly significant difference was observed between case and control groups regarding all studied laboratory characteristics except Urea and Creatinine (mg/dl). the highest mean was of 2h PP (284.32 mg/dl), HbA1c (6.35%), 24h urinary ptn (84.86 mg/dl), Ur Albumin/cr (82.88 mg/g), RT CIMT (0.83 mm) and LT CIMT (0.837 mm) was recorded in cases group as compared with control group that recorded the lowest mean for the previous characters.

**Table 2:** Regarding clinical characteristics, there was significant relation between group I and group II regarding age, and BMI (P value < 0.05). Mean value of age and BMI were 49.8±9.1 years, and 29.84±2.43 $kg/m^2$ in group I and 42.4±7.82 years, 32.16±4.26 $kg/m^2$ respectively in microalbuminuria, results added that highly significant differences were recorded between microalbuminuria and without microalbuminuria groups regarding all studied laboratory characteristics except Creatinine (mg/dl).

Microalbuminuria group scored the highest mean of HbA1c (6.8±1.19%), 24h urinary ptn (151.68±96.74mg/d), Ur Albumin/cr (149.07±96.84 mg/g), RT CIMT (0.974±0.16mm), LT CIMT (0.966±0.14 mm) and Mean CIMT (0.968±0.14 mm) compared with non-microalbuminuria group which recorded lowest mean for that previous characters.

**Table 1: Clinical and Laboratory characteristics of the studied group (n=70).**

| Clinical characteristics | Case group (50) | Control group (20) | test | P value |
|---|---|---|---|---|
| Age /y, Range<br>Mean ±SD | 30-60<br>46.1±9.19 | 29-67<br>43.75±8.41 | #0.989 | 0.326 |
| BMI (kg/m$^2$), Range<br>Mean ±SD | 24.77-36.79<br>31.0±3.63 | 25.95-44.46<br>30.1±3.3 | #0.965 | 0.338 |
| Hypertension n (%) | 17(34.0) | 0(0.0) | ^7.23 | 0.007** |
| SBP /mmhg, Range<br>Mean ±SD | 90-140<br>126.7±17.46 | 100-160<br>113.0±13.42 | #3.15 | 0.002** |
| DBP /mmhg, Range<br>Mean ±SD | 50-90<br>81.6±12.1 | 50-110<br>69.0±9.68 | #4.15 | 0.001** |
| Laboratory characteristics | | | | |
| 2h PP (mg/dl) | 284.32±76.22 | 138.85±12.96 | #8.45 | 0.001** |
| HbA1c % | 6.35±1.17 | 5.72±0.59 | #2.31 | 0.024* |
| Urea (mg/dl) | 26.66±9.0 | 26.2±6.11 | #0.21 | 0.835 |
| Creatinine (mg/dl) | 0.975±0.24 | 0.983±0.17 | #0.124 | 0.902 |
| 24h urinary ptn (mg/d) | 84.86±95.7 | 19.65±5.81 | #3.03 | 0.003** |
| Ur Albumin/cr (mg/g) | 82.88±95.29 | 17.75±5.04 | #3.04 | 0.003** |
| CIMT characteristics | | | | |
| RT CIMT (mm) | 0.83±0.21 | 0.52±0.06 | 6.47 | 0.001** |
| LT CIMT (mm) | 0.837±0.21 | 0.53±0.06 | 6.51 | 0.001** |
| Mean CIMT (mm) | 0.83±0.21 | 0.52±0.05 | 6.59 | 0.001** |

#=student t test $=chi square test ^=fisher exact test *=sig **=highly sig, BMI: body mass index, RT CIMT: Right carotid Intimal medial thickness, LT CIMT: Left carotid Intimal medial thickness, SBP=systolic blood pressure, DBP=diastolic blood pressure, n=number, %=percentage

**Table 2:** Clinical and Laboratory characteristics of the studied groups of patients (n=50) with and without microalbuminuria.

| Clinical characteristics | Group I (25)<br>(with microalbuminuria) | Group II (25)<br>(without microalbuminuria) | test | P value |
|---|---|---|---|---|
| Age /y, Range<br>Mean ±SD | 33-67<br>49.8±9.1 | 29-60<br>42.4±7.82 | #3.08 | 0.003** |
| BMI (kg/m$^2$), Range<br>Mean ±SD | 26.35-35.43<br>29.84±2.43 | 25.95-44.46<br>32.16±4.26 | #2.37 | 0.022* |
| Hypertension n (%) | 10(40.0) | 7(28.0) | ^0.802 | 0.37 |
| SBP /mmhg, Range<br>Mean ±SD | 110-150<br>131.2±14.53 | 100-160<br>122.2±19.21 | #1.87 | 0.068 |
| DBP /mmhg, Range<br>Mean ±SD | 70-100<br>84.4±9.28 | 50-110<br>78.8±14.01 | #1.67 | 0.102 |
| Laboratory characteristics | | | | |
| 2h PP (mg/dl) | 281.2±92.4 | 287.44±57.46 | #0.287 | 0.776 |
| HbA1c % | 6.8±1.19 | 5.9±0.97 | #2.93 | 0.005** |
| Urea (mg/dl) | 23.68±8.73 | 29.64±8.42 | #2.46 | 0.018* |
| Creatinine (mg/dl) | 0.967±0.29 | 0.984±0.17 | #0.247 | 0.806 |
| 24h urinary ptn (mg/d) | 151.68±96.74 | 18.04±6.19 | #6.89 | 0.001** |
| Ur Albumin/cr (mg/g) | 149.07±96.84 | 16.68±5.82 | #6.82 | 0.001** |
| Serum HP IgG n (%), +ve<br>-ve | 16(64.0)<br>9(36.0) | 7(28.0)<br>18(72.0) | $6.52 | 0.011* |
| CIMT characteristics | | | | |
| RT CIMT (mm) | 0.974±0.16 | 0.69±0.15 | 6.47 | 0.001** |
| LT CIMT (mm) | 0.966±0.14 | 0.707±0.19 | 5.57 | 0.001** |
| Mean CIMT (mm) | 0.968±0.14 | 0.696±0.17 | 6.25 | 0.001** |

#=student t test $=chi square test ^=fisher exact test *=sig **=highly sig, RT CIMT: Right carotid Intimal medial thickness, LT CIMT: Left carotid Intimal medial thickness, SBP=systolic blood pressure, DBP=diastolic blood pressure, n=number, %=percentage

**Table (3)**: no significant correlation (p value > 0.05) between microalbuminuria and clinical data including age, BMI, SBP (mmHg) and DBP (mmHg) in group I of patients (with microalbuminuria). Regarding, Laboratory characteristics, results revealed non-significant correlation (p value >0.05) was observed between microalbuminuria and all studied laboratory characteristics except 24h urinary ptn (mg/d) that was significant positive or related with microalbuminuria (p value = 0.000). Concerning, CIMT characteristics results indicated non-significant correlation (p value >0.05) was observed between CIMT and studied microalbuminuric patients with positive HPIgG (Figure 1).

**Table 3:** Correlation coefficient (r) between microalbuminuria with clinical, laboratory and CIMT characteristics in group (I) (n=25).

| Clinical characteristics | Group I (with microalbuminuria) | |
|---|---|---|
| | r | P value |
| Age /y | 0.353 | 0.179 |
| BMI (kg/m2) | -0.189 | 0.484 |
| SBP (mmHg) | 0.144 | 0.594 |
| DBP (mmHg) | -0.002 | 0.994 |
| Laboratory characteristics | | |
| 2h PP (mg/dl) | 0.286 | 0.283 |
| HbA1c % | 0.124 | 0.647 |
| Urea (mg/dl) | 0.139 | 0.607 |
| Creatinine (mg/dl) | 0.053 | 0.847 |
| 24h urinary ptn (mg/d) | 1.000 | 0.000** |
| HP IgG | 0.351 | 0.182 |
| CIMT characteristics | | |
| RT CIMT (mm) | -0.016 | 0.952 |
| LT CIMT (mm) | 0.196 | 0.467 |
| Mean CIMT (mm) | 0.083 | 0.761 |

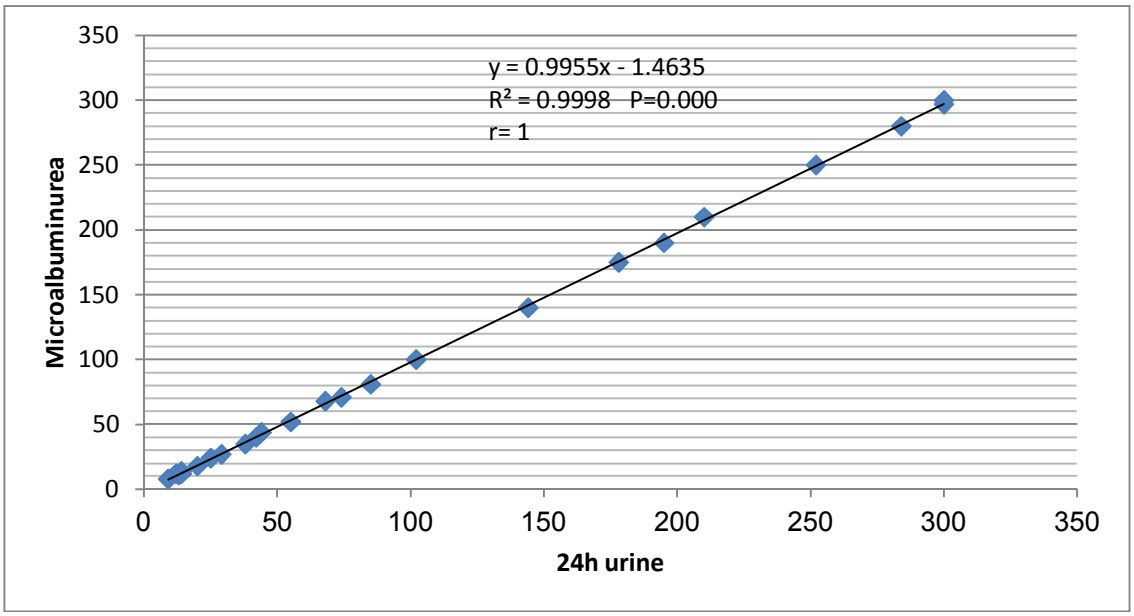


**Figure 1:** Correlation between microalbuminuria and 24hrs urine protein in group I patients.

**4. Discussion**

Microalbuminuria (Malb) is a confirmed marker of diabetic nephropathy. The appearance of albumin in urine is thought to be the consequence of generalized endothelial damage along the vascular area including the glomerulus (**Caramori et al., 2000).** Various infectious diseases may be listed among the etiologic factors related with this vascular endothelial damage and consequently developing atherosclerosis. *H. pylori,* particularly notable in developing countries, and affecting approximately50% of the world population, is a gram-negative, spiral and microaerophilic bacterium. Its inflammatory response models have not been elucidated yet (**Oshima et al., 2005)**. Therefore, we performed a cross-sectional case control study to investigate a possible association between Malb and infection by H. pylori in a population of type 2 diabetic patients.

Results of the current study revealed that no significant difference between case and control groups regarding age and BMI (p value> 0.05). On contrast, there was highly significant difference between case and control groups regarding hypertension, SBP /mmhg and DBP /mmhg (p value< 0.001).

**Chowta, et al., (2010)** found that persson correlation of microalbuminuria with age showed non-statistically significant linear relationship. correlation of microalbuminuria with BMI was also non-significant (r=0.063, p> 0.05). **Midha and Khurana et al., (2009)** found that the change in the pattern of microalbuminuria did not correlate with the age, sex. **Chen *et al.*, (2016)** found that age, duration of DM, systolic blood pressure (SBP), fasting blood glucose (FBG), in T2DM patients with albuminuria had a significant increase than in health subjects. Contrast of the current study, **Saini et al., (2003)** noticed that microalbuminuria was more common in patients with longer duration of diabetes, and poor glycemic control.

Regarding laboratory characteristics, results indicated highly significant difference was observed between case and control groups regarding all studied laboratory characteristics except Urea and Creatinine (mg/dl). Cases group recorded the highest mean of all studied laboratory characteristics including 2h PP, HbA1c, 24h urinary ptn, Ur Albumin/cr, RT CIMT and LT CIMT as compared with control group (P value < 0.05). Results added that highly significant differences were recorded between microalbuminuria and without microalbuminuria groups regarding age, and BMI and all studied laboratory characteristics except Creatinine (mg/dl). Microalbuminuria group scored the highest mean of HbA1c, 24h urinary ptn, Ur Albumin/cr, RT CIMT, LT CIMT and Mean CIMT.

Similar observation has been marked by **Chowta, et al., (2010)** who found that creatinine clearance negatively correlated with microalbuminuria but this was statistical insignificant. **Chen *et al.*, (2016)** revealed that age, fasting blood glucose (FBG), albumin to creatinine ratio (ACR), hemoglobin A1c (HbA1c), high-sensitivity C-reactive protein (hs-CRP), triglycerides, and ACR in T2DM patients with microalbuminuria had a significant increase than in health subjects. **Chung et al. (2013)** demonstrated that subjects with microalbuminuria had a significantly higher H. pylori seropositivity rate than subjects without microalbuminuria (60.7% vs 52.8%, P = 0.024). Multivariate analysis after adjustment for age, body mass index (BMI), waist circumference, and glucose and triglyceride levels showed that H. pylori seropositivity was significantly associated with microalbuminuria. **Gentile et al., (1998)** found that the prevalence of *H. pylori* was significantly higher in the DM group compared to the control group (**Marrollo, et al., 2001)**. However, some studies did not find any significant difference in the DM group and the control group regarding *H. pylori* infections (**Gen, et al., 2010)**. There are studies which report that microalbuminuria is significantly higher in HP-positive patients, regardless of the development of diabetes (**Park, et al., 2011)**. Diabetic patients infected by Helicobacter pylori (Group 1; 186.7±24.2 mg/24 h) showed significantly higher microalbuminuria than non-infected patients (Group 2; 131.2±11.6 mg/24 h) (p=0.012) (**Tanriverd, 2011)**.

The finding of the current study showedno significant correlation (p value > 0.05) between microalbuminuria and clinical data and all studied laboratory characteristics except 24h urinary ptn (mg/d) which showed significant positive correlated with microalbuminuria (p value = 0.000). Also, non-significant correlation (p value >0.05) was observed between CIMT and studied microalbuminuric patients with positive HPIgG.

These results are in agreement with several studies. **Gayathri, et al., (2012)** found that no correlation was observed between age and intima media thickness in microalbuminuric patients. **Doruk et al., (2004)** noticed that there was no significant correlation between age and carotid artery IMT. On the other hand, **Robin et al., (2007)** reported that IMT was independently and positively related to age. It was also observed that the IMT increased with the duration of diabetes with a significant (P 0.0218). **Tanriverd et al., (2011)** found that diabetic patients infected by Helicobacter pylori showed significantly higher microalbuminuria than non-infected patients (p=0.012). Diabetics infected with Helicobacter pylorihad significantly higher inflammation marker

levels than non-infected patients ($p<0.05$). It has been concluded that the relation between microalbuminuria level and Helicobacter pylori infection in diabetics is independent from other study variables. other studies did not detect an association between H. pylori infection and diabetes (**Bures, et al., 2004)**.

These contradictory results among studies might have resulted from differing methods used by the studies and from the uneven epidemiological distribution of H. pylori infection (**Demir, et al., 2008).**

## 5. Conclusion

Results of concluded that H.P. infection is significantly prevalent in type 2 diabetes patients with microalbuminuria (64%) compared to non-microalbuminuric diabetic patients (28%). In H.P. IgG positive diabetic patients with microalbuminuria (16/25%), microalbuminuria is not significantly correlated with the studied clinical, CIMT and laboratory data except with 24 hrs urinary patients (r=1, p=0.00). moreover, the validity of microalbuminuria for detection of H.P. IgG in the studied type 2 diabetes patients is weak at cut off level of 95.0 (sensitivity 56.2, specificity, 44.4, p value = 0.699).

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