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Association of Helicobacter Pylori Infection with Metabolic Syndrome in Egyptians

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ABSTRACT

Background: Helicobacter (H.) pylori infection and metabolic syndrome (MetS) are both significant health concerns with potential interconnections. However, H. pylori infection and MetS association in the Egyptian society remains uncertain due to inconsistent findings in previous studies.

Objective: To evaluate correlations between MetS and H. pylori infection.

Patients and Methods: Totally 50 adult participants diagnosed with metabolic syndrome as MetS group and 52 healthy controls as control group were involved in our study. MetS was diagnosed regarding NECP ATP III criteria, while H. pylori stool antigen test (SAT) was utilized to determine H. pylori infection presence. Participants underwent medical history assessment, general examination, laboratory tests, including H. pylori SAT, and abdominal ultrasound.

Results: H pylori was more positive in MetS group in comparison to control group (67.3% vs. 30%, respectively, P<0.01). Logistic regression model showed that univariate analysis showed that positive H. pylori infection was a risk factor for MetS development with p value <0.001 and odds ratio 4.8 (95% CI 2.08-11.1). Multivariate logistic regression found that positive H. pylori infection is a MetS independent predictive factor with 5 folds increase in a developing MetS risk following age, gender, and body mass index (BMI) adjustment with p value 0.002.

Conclusions: H. pylori infection was significantly related to MetS incidence with 5-fold rise in MetS incidence among individuals with positive H. pylori antigen in stool test after adjusting for other risk factors.

Keywords: Helicobacter Pylori, Infection, Metabolic Syndrome, Egyptians.

INTRODUCTION

MetS is a significant public health concern worldwide, characterized by metabolic abnormalities clustering involving hypertension, insulin resistance, dyslipidaemia and central obesity [1]. MetS prevalence has progressively risen over the past few decades, and it is related to an elevated cardiovascular diseases and type T2DM risk. MetS has a complicated aetiology involving interactions between genetic, environmental, and behavioural variables [2, 3]. The Gram-negative bacteria H. pylori are known to cause chronic gastritis, peptic ulcer disease, and stomach cancer. It colonises the gastric mucosa. Recent data indicates, however, that H. pylori may also has a role in extra-gastrointestinal diseases, like metabolic disorders. Multiple researches have studied the potential relationship among MetS and H. pylori infection, but the outcomes have been variable [4, 5]. Based on the observation that H. pylori-induced chronic gastritis changes stomach acid secretion and ghrelin levels, which may impact appetite and satiety, a connection between H. pylori infection and MetS has been proposed. Infection with H. pylori has also been associated to oxidative stress, insulin resistance, and low-grade systemic inflammation, which are crucial MetS components [6,7]. In Egypt, H. pylori infection and MetS are prevalent, so it provides an ideal setting to explore this potential association. Several researches have examined H. pylori infection and MetS prevalence independently in Egyptian populations. However, limited research has focused on examining H. pylori infection and MetS association in this particular community [8,9]. Therefore, this study purposed to assess H. pylori infection and MetS association in Egyptians.

PATIENTS AND METHODS

Study Design and Participants: A cross sectional study was performed to detect H. Pylori infection and MetS association in Egyptians. Our sample included 50 adult patients who seek GIT outpatient clinic at faculty of medicine in Benha University that were diagnosed with metabolic syndrome (MetS group) along with 52 healthy controls (control group).

Metabolic syndrome was diagnosed according to NECP ATP III criteria:

Component	Clinical Cutoff Values
Waist Circumference	≥102 cm in men ≥88 cm in women
Triglycerides	≥150 mg/dL
HDL Cholesterol	<40 mg/dL in men <50 mg/dL in women
Blood Pressure (BP)	≥130 mmHg Systolic BP or ≥85 mmHg Diastolic BP
Fasting Glucose	≥100 mg/dL

Figure (1): Diagnostic criteria for metabolic syndrome [10].

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H. pylori infection diagnosis was conducted as following: H. pylori stool antigen test, which is a laboratory test detected antigenic proteins that is related to it in stool. SAT is a technique used for H. pylori antigen detection in faeces. It utilises an enzyme sandwich immunoassay with antigen detection.

Inclusion criteria: Patients diagnosed with MetS aged > 18 years old.

Exclusion criteria: Gastric surgery or anti-H. pylori treatment history, antibiotics, H2 blockers, proton pump inhibitors or bismuth usage within last 4 weeks, severe neurological or mental problems and cancer history.

Every patient was subjected to the following:

1. Medical history and general examination including (age, weight, height, vital signs, waist circumference, and hip circumference). BMI was assessed by formula of:
   BMI= Weight (Kg) / Height $(m)^2$
2. Laboratory tests involving (complete blood count, kidney function test, fasting lipid profile, liver function tests, fasting and 2 hours post prandial blood glucose level, HBA1c, H. pylori stool antigen test).
3. Radiological investigations including abdominal ultrasound.

Ethical consideration: Benha University's Faculty of Medicine Institutional Review Board authorised this study. Each participant signed a written informed consent form. The study adhered to the ethical guidelines established by the World Medical Association in the Declaration of Helsinki for human research.

Statistical analysis

The acquired data were revised, coded, tabulated, and analyzed, among other processes. 2017-released SPSS v25.0 (IBM Corp., Armonk, NY) was utilized for the analysis. Categorical variables provided as counts and percentages were compared utilizing Chi-square test. The mean, standard deviation, and range were given for quantitative variables. Comparison of quantitative variables was conducted by Mann Whitney U test. Logistic regression model was implemented to assess MetS risk factors. Any p value <0.05 was regarded considerable.

RESULTS

A number of 50 MetS were eligible for inclusion in our study, along with 52 healthy control subjects.

Comparison between groups showed that MetS group were substantially older than control group. BMI was substantially greater among MetS group. Regarding comorbidities all MetS group were diabetic and hypertensive, however, MetS group harboured significantly more cardiac patients, pulmonary diseases, and patients with CKD (Table 1).

Table (1): Comparison of demographics and medical history among study groups

		MetS (N=50)		Control (N=52)		p value
		N/ mean± SD	%/ min-max	N/ mean± SD	%/ min-max	
Age		62.1±12.1	37-75	55.2± 10	37-69	**0.002***
Gender	Male	26	50.0%	30	60%	0.310
	Female	26	50.0%	20	40%	
BMI		34.8±7	27.7-52.3	27.8±6.6	23.9-35.1	**<0.001***
SBP		137.1±9.1	120-150	133.9±8.8	120-150	0.080
DBP		89.6±5.2	80-100	87.8±4.2	80-90	0.081
DM	No	0	0.0%	52	100%	**<0.001***
	Yes	50	100.0%	0	0%	
HTN	No	0	0.0%	52	100%	**<0.001***
	Yes	50	100.0%	0	0%	
Cardiac	No	12	24.0%	52	100%	**<0.001***
	Yes	38	76.0%	0	0%	
Neuro	No	50	100.0%	52	100%	**<0.001***
	Yes	0	0.0%	0	0%	
Chest	No	35	70.0%	52	100%	**<0.001***
	Yes	15	30.0%	0	0%	
GERD	No	41	82.0%	52	100%	**<0.001***
	Yes	9	18.0%	0	0%	
CKD	No	47	94.0%	52	100%	**<0.001***
	Yes	3	6.0%	0	0%	

MetS: Metabolic syndrome, *: Significant

Comparison of laboratory findings between study groups showed that creatinine, urea, AST, glycemic profile including glycated hemoglobin and random blood glucose levels, and total leukocytic count. Lipid profile showed that MetS patients had significantly higher total cholesterol, total triglycerides, lower HDL, higher LDL and VLDL (Table 2).

Table (2): Comparison of laboratory findings between study groups

	Groups		P value
	Control	MetS	
	Mean ±SD	Mean ±SD	
Creatinine (mg/dL)	1.0±0.24	1.3± 0.31	**0.008***
Urea (mg/dL)	37.8±5.6	46.0± 11.3	**0.011***
AST (IU/dL)	20.3±4.8	30.6± 7.4	**<0.001***
ALT (IU/dL)	21.1±5.4	24.5± 5.7	0.197
Albumin (gm/dL)	3.3±0.3	3.1± 0.4	0.250
HBA1c (%)	5.6±0.5	7.6± 1.8	**0.035***
RBS (mg/dL)	146.7±35.8	271.9± 49.5	**0.023***
FBG (mg/dL)	90±18.4	152.9± 25.9	0.252
HB (gm/dL)	11.4±1.6	12.3± 2.1	0.115
TLC (10/cc)	8.8±2.1	11.1± 2.61	**0.003***
PLT (10/cc)	211.8±51.41	215.6± 52.31	0.678
TC (mg/dL)	180.7±44.6	209.7± 7.61	**<0.001***
TG (mg/dL)	179.9±25.5	199.7± 19.3	**<0.001***
HDL (mg/dL)	57.0±10.4	39.8± 9.4	**<0.001***
LDL (mg/dL)	141.2 ±27.1	155.6± 20.8	**<0.001***
VLDL (mg/dL)	23.2±5.4	27.5± 4.3	**<0.001***

MetS: Metabolic syndrome, *: Significant

Comparison of H. pylori results between studied groups showed that H pylori was more positive in MetS than control group. However, ultrasound findings showed no substantially considerable changes among groups of study (Table 3).

Table (3): Comparison of H. pylori test and ultrasound findings among study groups

		Groups ACT				P value
		Control		MetS		
		N	%	N	%	
H. pylori test	**Negative**	35	70%	17	32.7%	**0.0001 ***
	Positive	15	30%	35	67.3%	
Ultrasound findings	**Chronic cholecystitis**	0	0.0%	3	6%	0.130
	Fatty liver	16	30.8%	23	46%	
	Liver fibrosis	3	5.8%	7	14%	
	Free	23	44.20%	17	34%	

MetS: Metabolic syndrome, *: Significant

Univariate analysis revealed that positive H. pylori test was a MetS risk factor (Table 4).

Table (4): Univariate logistic regression model for positive H pylori and metabolic syndrome

	P value		Odds ratio	95% C.I. OR	
				Lower	Upper
Positive H. pylori test	**<0.001 ***		4.804	2.079	11.101
MetS dependent, H. pylori test as independent variable					

OR: Odds ratio, CI: Confidence interval, MetS: Metabolic syndrome, *: Significant

Multivariate logistic regression revealed that positive H. pylori testing is a MetS independent predictive factor with 5 folds increase in the developing MetS risk following age, gender and BMI adjustment (Table 5).

Table (5): Multivariate logistic regression model for positive H pylori and metabolic syndrome

	P value	Odds ratio	95% C.I. OR	
Age	**0.033 ***	0.954	0.914	0.996
Gender	**0.005 ***	0.142	0.036	0.557
BMI	**0.004 ***	1.153	1.047	1.269
Positive H. pylori test	**0.002 ***	5.178	1.873	14.318
MetS dependent variable. Age, gender, BMI, and H. pylori test as independent variable				

OR: Odds ratio, CI: Confidence interval, MetS: Metabolic syndrome, *: Significant.

DISCUSSION

MetS is one such entity, its presence indicates an elevated risk for future progression of T2D and CVD, and which may be countered by controlling the components of the MetS through suitable ways [11].

Our study revealed that comparison of H. pylori results between studied groups revealed that H. pylori was more positive in MetS group compared to control group (67.3% versus 30%) with p value 0.0001. In the current study logistic regression model showed that univariate analysis revealed that positive H. pylroi test was a MetS risk factor with p value <0.001 and odds ratio 4.8 (95% CI 2.08-11.1). Multivariate logistic regression regarded positive H. pylori testing as a MetS independent predictive factor with 5 folds increase in the developing MetS risk following age, gender, and BMI adjustment with p value 0.002.

Iranian study conducted a multivariate logistic regression model in a cross-section study and discovered that H. pylori infection was related to substantially higher MetS risk among females with OR 1.45 (95% CI 1.09–1.94) and p value 0.01 [12].

The vast majority of the studies that included individuals with MetS to assess the correlation between it and H. pylori was conducted in East Asia, their findings were mainly supportive to our study results [13].

Refaeli *et al.* [13] showed that MetS patients had substantially greater H. pylori infection prevalence, especially those with high bacterial activity who had gastric or duodenal ulcers by OR 1.5 and 1.4 respectively. **Chen *et al.*** [14] have discovered that MetS prevalence was substantially greater in H. pylori - infected than uninfected groups while the relation between MetS H. pylori infection was considerable in females with OR 1.91, 95% CI:1.03–3.53 and OR 1.38, 95% CI: 0.97–1.95 among males. A Japanese study showed that patients with seropositive H. pylori IgG was substantially greater in MetS than control group (P < 0.001). Multivariate logistic regression model detected that H. pylori seropositivity was a MetS independent indicator with OR 1.39, 95% CI 1.18-1.62, P < 0.001 [15]. **Shin *et al.*** [16], performed a cross section research involving 5889 subjects and proved that histologically confirmed H. pylori infection was a MetS independent indicator with OR 1.26 and OR 1.12 for seropositive H. pylori after adjustment for other risk factors. **Chen *et al.*** [17], discovered that a substantially greater H. pylori antibodies prevalence was seen among patients with and without MetS (76.7% vs. 53.7%), they also reported that H. pylori antibody presence is MetS and insulin resistance predictor with OR 3.717 CI: 1.086-12.719.

Our findings were consistent with a Chinese study that evaluated the relation between H. pylori and MetS among elders, they discovered that H. pylori infection was substantially associated to MetS risk by binary logistic regression analysis with OR 5.4 [18].

On contrary, a Lebanese study showed that 52% of the included participants were infected by H. pylori, however it showed no associated with insulin resistance or MetS [19]. This was not consistent with the findings of our study.

These findings agree with **Refaeli *et al.*** [13], who accessed medical records of 147,936 individuals aged between 25–95 years, they all performed the urea breath test during 2002–2012. Regarding international diabetes federation modified definition, the prevalence of MetS was 11.4% and H. pylori infection prevalence was 52.0%. Patients with H. pylori infection were more likely to progress MetS, with an OR of 1.15 (95% CI, 1.10-1.19).

Our data showed larger risk for MetS among H. pylori infected patients than other studies and this is mainly because the current study's small sample size compared to large retrospective and population-based studies.

The exact underlying pathophysiology underlying H. pylori and MetS association, in addition to abnormal lipid profile and insulin resistance was not yet fully explored. Studies has correlated the gastric mucosal irritation or inflammation with metabolic homeostasis [20].

Other studies have emphasized H. pylori infection role in increasing the risk of developing diabetes with OR 1.54 [21], and significant data suggests that HP infection induces diabetes pathogenic pathways, such as inflammation and insulin resistance [21].

While a significant relationship was recently confirmed between dyslipidemia and H. pylori, prospective studies, highlighted that elimination of H. pylori ameliorates dyslipidemia and insulin resistance and reduces inflammatory markers [22].

Additionally, despite contradictory results from numerous research, it has been demonstrated that a substantial link among microvascular problems (neuropathy, retinopathy and nephropathy) and H. pylori infection is present [22, 23].

Finally, this study had some limitations, we believe that due to the cross-section type of the study we can confirm that the observed relationships may be causal, we only studied a relatively small sample size of participants. All our patients were hypertensive and diabetic, which can be a possible confounding factor among the assessed individuals.

CONCLUSION

H. pylori infection was substantially related to MetS incidence with 5-fold rise in MetS occurrence.

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- **Conflict of Interest:** Nil.

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