Iraqi Journal of Science

ISSN: 0067-2904

Changes of Serum Electrolytes and Serum Vitamin C Levels in a Sample of Iraqi patients Infected with *Helicobacter pylori* (*H. pylori*)

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Received: 15/2/2023 Accepted: 10/4/2023 Published: 30/8/2023

Abstract

Helicobacter pylori (*H. pylori*) is widespread and involved in the pathogenesis of the majority of stomach and duodenal diseases. Reduced stomach acidity facilitates the initial infection. Electrolytes (sodium, potassium, and chloride) are essential for the production of stomach acid. This study aimed to observe any changes in the levels of serum electrolytes (Na, K, and Cl) and serum vitamin C levels in a sample of Iraqi patients infected with *H. Pylori*. We studied 30 infected patients with *H. Pylori* and 30 matched healthy controls. The results revealed that the serum sodium, potassium, and chloride levels were significantly decreased (p = 0.002, 0.003 and 0.0001, respectively) in the patients infected with the *H. Pylori* group in comparison with those of the healthy controls. Also, vitamin C levels were significantly lower in patients infected with *H. Pylori* than in the control group (p = 0.001). The present results suggest that these changes may be attributed to or contribute to the infection itself through changes in gastric acidity, and this needs further study.

Keywords: *Helicobacter pylori*, Electrolytes, Vitamin C

التغيرات في شوارد المصل ومستويات فيتامين ج في عينة من المرضى العراقيين المصابين بالعدوى الحلزونية البوابية

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الخلاصة

تنتشر البكتيريا الحلزونية البوابية (*H. pylori*)على نطاق واسع وتساهم في التسبب في معظم أمراض المعدة والاثني عشر وإن انخفاض حموضة المعدة يسهل العدوى الأولية بهذه البكتيريا. تعتبر الشوارد (الصوديوم والبوتاسيوم والكلوريد) ضرورية لإنتاج حمض المعدة.تهدفت هذه الدراسة إلى ملاحظة التغيرات في مستويات شوارد الدم (الصوديوم والبوتاسيوم والكلوريد) ومستويات فيتامين ج في دم عينة من المرضى العراقيين المصابين بالبكتيريا الحلزونية البوابية. شملت هذه الدراسة على 30 مريضًا مصابًا بالبكتيريا الحلزونية البوابية و 30 اشخاص اصحاء كمجموعة سيطرة .أظهرت النتائج أن مستويات الشوارد (الصوديوم والبوتاسيوم والكلوريد) في الدم قد انخفضت بشكل معنوي (p=0.002, 0.003 and 0.0001, respectively) في المرضى المصابين بالحلزونية البوابية مقارنة مع مجموعة الاصحاء. كذلك كانت مستويات فيتامين ج أقل بشكل ملحوظ في المرضى المصابين بالحلزونية البوابية مقارنة بمجموعة الاصحاء (P=0.001) ،وكاستنتاج تشير النتائج الحالية إلى

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أن هذه التغييرات قد تُعزى أو تساهم في العدوى نفسها من خلال التغيرات في حموضة المعدة. هذا يحتاج إلى مزيد من الدراسات.

1. Introduction

Helicobacter pylori (*H. pylori*) is a spiral-shaped gram-negative bacterium [1,2]. It is among the most common bacterial stomach infections [3], and it infects more than half of the global population, with an estimated 4.4 billion people worldwide affected [2,4]. *H. pylori* prevalence in developed countries is between 30 and 50%, while it ranges between 85 and 95% in developing countries [5]. In Baghdad/Iraq, the rate of infected populations with *H. pylori* infection is more than 58%, as was recorded in two studies [6,7]. Also, several studies in Iraq have shown a relationship between *H. pylori* infection and several pathological conditions, such as Hashimoto's thyroiditis [8], atrophic gastritis [9], gallbladder [10], dyspeptic [11], type 2 diabetes [12] obesity [13], male infertility [14], and skin disorders [15]. *H. pylori* colonization normally occurs in childhood, but symptoms usually do not appear until adulthood. It is unknown if childhood colonization produces symptoms or changes in gastric acidity [16]. *H. pylori* cannot survive in an overly acidic stomach, and to survive, it requires a pH close to neutral [17,18,19]. Therefore, the initial infection depends on temporal hypoacidity, where *H. pylori* attacks the lining that protects the stomach [20,21,22]. The present study aims to observe any changes in the levels of serum electrolytes (Na, K, and Cl) and serum vitamin C levels in a sample of Iraqi patients infected with *H. Pylori*.

2. Material and methods

2.1. Studied groups

A case-control study was performed on 30 patients who were attending the endoscopic unit at the Baghdad Medical City teaching hospital for gastroenterology and hepatology in Baghdad with clinical manifestations of gastritis, nausea, and bloating, and who were confirmed to be infected with *H. pylori* infection by diagnostic tests. From August to October 2021, the serum samples from these patients were collected. Patients who had non-steroidal anti-inflammatory medicines in addition to *H. Pylori* eradication therapy was excluded from the study. Patients with other comorbidities were also excluded from the study. The diagnosis was made under the supervision of the specialists. For comparison purposes, 30 healthy volunteers were used as a control. They had no previous history of any complaints of gastrointestinal tract disease and negative diagnostic tests. The study protocol conforms to the ethical guidelines, which have been endorsed by the College of Science, University of Baghdad Ethics Committee, and all participants provided written consent.

2.2. Diagnostic tests for *H. pylori* infection

Two kits were used to diagnose the presence of H. pylori infection. The first was the Heliforce breath test kit manufactured by Beijing Richen-Force Science and Technology Co. Ltd. The second was the OnSite H. pylori Ag Rapid Test (in the human feces), manufactured by CTK Biotech.

2.3. Blood sample collection

From each participant, five milliliters of venous blood samples were collected in serum-separating tubes (SST) at room temperature. Serum was obtained by centrifuging the clotted blood at 3000 rpm for ten minutes. The obtained clear serum was stored frozen at -20 ◦C until laboratory determination of the level of electrolytes and vitamin C.

2.4. Assay of electrolytes (Na^+, K^+ and Cl^-) Levels

Serum levels of electrolytes were determined *via* the colorimetric method using a commercial kit manufactured by Human Company in Germany.

2.5. Vitamin C (Ascorbic acid) level

The serum level of vitamin C was determined by the method of Nino and Shah [23] using a DTCS reagent [a mixture of 2,4-dinitrophenylhydrazine (2%) + thiourea (5%) + copper sulfate (0.6%)] at $\lambda = 520$ nm. Trichloroacetic acid (6%) (TCA) was used instead of metaphosphoric acid (6%) as a protein-precipitating agent. The concentrations of vitamin C in samples were obtained from the standard curve using ascorbic acid as a standard and expressed in g/L.

2.6. Statistical analysis

Data were statistically analyzed using the package IBM SPSS Statistics for Windows, version 22. Data normality was assessed using the Shapiro-Wilk normality test. The student t-test was used to test the differences between the studied groups, and the *P*-value was considered significant if it was < 0.05.

3. Results

3.1. Baseline characteristics

The baseline characteristics of patients infected with *H. Pylori* and controls are illustrated in Table 1.

Table 1: Baseline characteristics of the studied groups

Characteristic		Patients infected with H. Pylori group (n=30)	Control group (n=30)	*P*-value
Age (years) mean ± SD		54.77±5.004	51.4±4.15	0.011
Gender	Female	12 (40%)	12 (40%)	-
	Male	18 (60%)	18(60%)	-

3.2. Electrolytes (Na^+, K^+ and Cl^-) and vitamin C levels

From the results presented in Table 2, the levels of serum sodium, potassium, and chloride were significantly decreased in the patients infected with *H. Pylori* compared to the control (p = 0.002, 0.003, and 0.0001, respectively). Also, levels of vitamin C were significantly decreased in patients infected with *H. Pylori* compared with the control group (p = 0.001).

Table 2: Electrolytes (Na^+, K^+, and Cl^-) and vitamin C levels in the serum of the studied groups

Parameters (Mean ± SD)	Control group (n = 30)	Patients with *H. pylori* infection group (n = 30)	*P*-value
Serum Sodium (mmol/l)	141.84+2.90	136.1+6.35	0.002*
Serum Potassium (mmol/l)	4.22+0.29	3.89+0.42	0.003*
Serum Chloride (mmol/l)	105.5+4.16	93.33+5.6	0.0001*
Vitamin C (mg/dl)	0.157+0.03	0. 095+0.02	0.001*

∗ Denotes significant *P* values < 0.05

4. Discussion

This study was conducted on Iraqi patients infected with *H. pylori* and during the study, it was noticed that most patients infected with *H. pylori* were males, which may give a clue that

gender may play a role in *H. pylori*-related infection, and this observation agrees with many other studies [24,25,26] that confirmed the male predominance of *H. pylori*. The results showed that there were more electrolyte disturbances in patients infected with *H. pylori* in comparison with healthy controls. There was a decrease in the level of serum sodium and potassium, although they were within the lower limits of the normal range, and a decrease in the level of serum chloride, which was lower than the lower limit of the normal range. Our results are contradictory to the results of Eden *et al.* [27] and Aratani *et al.* [28], as they found a strong relationship between *H. pylori* infection and hypernatremia rather than low serum sodium. The most common electrolyte imbalance encountered in clinical practice is hyponatremia, and several medications are associated with it, such as proton pump inhibitors, which cause hyponatremia [28,29,30]. It is important to be aware of medication-induced hyponatremia, especially that caused by proton pump inhibitors. Thus, it is preferable not to administer any other drug from the same class when the syndrome of inappropriate antidiuretic hormone secretion caused by a proton pump inhibitor is detected [31]. Although the interactions between *H. pylori* and the stomach are quite complicated, low gastric acidity makes it easier for *H. pylori* to proliferate and infect the stomach [17]. Electrolytes (sodium, potassium, and chloride) are essential for the production of very extreme acid (HCl; pH is about 0.8) in the stomach. A hydrogen-potassium pump is the primary driving force for parietal cell hydrochloric acid secretion. Therefore, any inhibition of the pH proton pump by proton pump inhibitors will decrease the pH of the stomach and enhance the growth of *H. pylori* bacteria and then the invasion of the gastric mucosa [28,32]. Additionally, intragastric pH is the most important factor influencing the observed drop in the level of vitamin C in gastric juice when there is hypochlorhydria; pH rises intragastrically, which leads to vitamin C being converted into the less active form, resulting in irreversible inactivation of ingested vitamin C [33,34]. As shown in some studies, *H. pylori* infection reduced the level of vitamin C in gastric juice, such as in a study by Woodward, Pedoe, and McColl in the UK, which included randomly selected men and women aged 25 to 74 [33]. Also, in a study by Waring *et al.* suggested that the eradication of *H. pylori* may increase the level of vitamin C in gastric juice [35].

5. Conclusion

H. pylori is associated with many extragastric abnormalities. One of these is the change in the levels of serum electrolytes (Na, K, and Cl) and serum vitamin C levels in infected patients. These changes may be attributed to or contribute to the infection itself through changes in gastric acidity, and this needs further study.

Ethical Clearance

The Research Ethical Committee at scientific research by ethical approval of both environmental, health, higher education, and scientific research ministries in Iraq.

Conflict Of interest

The authors declare that they have no conflict of interest.

Acknowledgments

The authors acknowledge the great assistance offered by the staff of the endoscopy Unit of the Gastroenterology and Hepatology Centre at Medical City in Baghdad for their assistance with sample collection.

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