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Evaluation of vinegar as a supportive therapy compared to standard triple therapy for helicobacter pylori infection in Babil, Iraq, 2025

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Abstract

Background: *Helicobacter pylori* infection is a prevalent chronic bacterial infection associated with gastritis, peptic ulcers, and gastric cancer. Standard triple therapy (proton pump inhibitor + two antibiotics) is effective but challenged by antibiotic resistance. Natural remedies like Vinegar, particularly apple cider vinegar, have shown antimicrobial effects.

Aim of the study: To compare Vinegar as a supportive therapy to standard triple therapy regarding eradication, symptom improvement, adherence, and patient willingness to recommend treatment.

Results: No significant differences were observed between *H. pylori* and vinegar groups regarding age, gender, smoking status, treatment adherence, or symptom improvement ($p > 0.05$). Completing the whole course was significantly associated with group allocation ($P = 0.03$). Post-treatment test results showed a higher negative rate in the vinegar group (60% vs 20%, $P = 0.004$). Moreover, more participants in the vinegar group were willing to recommend the treatment to others (60% vs 10%, $P = 0.001$).

Conclusion: Vinegar treatment demonstrated superior effectiveness in *H. pylori* eradication compared to the standard therapy, reflected by higher negative test rates and greater willingness of participants to recommend it. Completion of the full treatment course remains crucial for optimal outcomes.

Keywords: Apple cider vinegar, antibiotic resistance, helicobacter pylori infection

1. Introduction

Helicobacter pylori is considered one of the most common causes of Infection globally. The World Health Organization (WHO) ranked the pathogen as a Class I carcinogen for gastric cancer based on the results of epidemiological studies demonstrating its ability to induce carcinogenesis without the administration of co-carcinogens ^[1].

Currently, the most effective treatment regimens include a combination of antibiotics (β -lactams, macrolides, and quinolones), bactericidal agents (bismuth salts), and antiprotozoal agents (metronidazole) ^[2].

However, the multidrug application is associated with remarkable side effects, and sometimes patients do not complete the treatment course.

Thus, treatment failure is associated with *H. pylori* strains resistant to the commonly used antibiotics ^[3].

Antibiotic resistance poses a considerable challenge in treating *H. pylori*, complicating eradication efforts. Chey *et al.* emphasized that increasing rates of antibiotic resistance may result in treatment failures, with factors such as patient compliance playing a significant role in this phenomenon ^[4]. The gastric environment also influences the success of *H. pylori* treatment. *H. pylori* typically resides within the human stomach, and populations of organisms occupy different environments, each with its own challenges. Most organisms are found within the mucus layer, technically outside the body. Many are attached to surface cells, and a few are found within epithelial cells ^[5].

Helicobacter pylori survives over the pH range 4.8 but is incapable of growing. In contrast, active replication primarily occurs at pH 6 and 7, and, as the organism is only susceptible to killing by antibiotics such as clarithromycin or amoxicillin during growth, it can remain phenotypically resistant and thus survive antibiotic therapy. As the matter includes interference with the energy metabolism and the respiratory chain of *H. pylori*, an immediate paralysis of the organism can be considered. This further explains the dramatic symptomatic relief expressed mainly by all patients taking a vinegar-mixed food.

Acetic acid's fast, immediate influence on *H. pylori* gives the organism no chance to resist the Vinegar treatment and migrate or develop resistant strains. Humans have consumed or used natural products as therapeutic agents for centuries, showing few side effects. So, isolating and defining the active principles in those experimentally active plant extracts is essential. Recently, studies have proven the effects of natural products (like fruits, vegetables, spices, and medicinal plants) on infectious diseases, cancers, and cardiovascular diseases [6, 7]. One study showed the *in vitro* anti-*H. pylori* activity of some carotenoids of the apple peel extracts.

Apple cider vinegar (ACV), which is derived from apples, contains 4% acetic acid, polyphenols, pectin, and carotenoids with antibacterial and prebiotic properties [8].

1.2 Objectives

To compare the efficacy of natural remedies (Vinegar) versus standard antibiotic therapy in eradicating *Helicobacter pylori*.

2. Patients and methods

- **Ethical considerations and official approvals:** The Ethical Committee of the Babylon Health Directorate, centre of Training and Human Development, reviewed and approved the study protocol. Written informed consent was obtained from all participants before inclusion. The study complied with the ethical standards of the Declaration of Helsinki. Verbal permission was obtained from children's parents before collecting data, and the information was anonymous. The names were removed and replaced with the identification codes. All information was kept confidential on a password-secured laptop, and the data were used exclusively for research purposes.
- **Setting Design:** A comparative cross-sectional study was carried out among participants diagnosed with *Helicobacter pylori* infection enrolled in the study. From the first of January 2025 to the end of August 2025, fifty participants diagnosed with *Helicobacter pylori* infection were enrolled in the study. Patients were recruited from multiple public health facilities in Babylon Governorate, including popular outpatient clinics, Al-Musayyib General Hospital, Al-Mahawil General Hospital, and Imam Al-Sadiq Hospital. Public health facilities in Babylon Governorate were selected as a purposeful (non-probability) technique. A simple random sampling technique was employed to select participants diagnosed with *Helicobacter pylori* infection from public clinics and hospitals (Al-Musayyib, Al-Mahawil, and Imam Al-Sadiq Hospitals) affiliated with the Babylon Health Directorate. The calculated sample size was 50 patients by convenience sampling. These 50 patients were randomly allocated into two groups: 30 for the antibiotic treatment group and 20 for the vinegar treatment group.
- **Inclusion criteria:** Males and females aged 18 and older, Symptoms of confirmed *H. pylori* infection via urea breath test.

Exclusion criteria

- Gastric ulcer or duodenal bleeding with a history of haematemesis.
- H. induced gastric lymphoma.
- Primary comorbid conditions (e.g., liver, kidney, heart disease).

- **Intervention:** Participants were randomly divided into two groups: Group A (Vinegar Group): Received a natural treatment with apple cider vinegar, 20 CC taken after dinner as an alternative approach taken daily for 14 days. The regimen was standardized and supervised by a certified nutritionist.
- **Group B (Antibiotic Therapy Group):** Received the standard triple therapy regimen, consisting of a proton pump inhibitor, clarithromycin, and amoxicillin or metronidazole, administered for 14 days following clinical guidelines.
- **Outcome Assessment:** The primary outcome was eradication of *H. pylori*, which was evaluated 14 days after completion of therapy using the same non-invasive diagnostic test (urea breath test).

Secondary outcomes included

- Treatment compliance (based on pill count and self-report)
- Symptomatic improvement (measured via a dyspepsia symptom questionnaire)
- **Data Collection:** Data were gathered through structured interviews and clinical records. Sociodemographic and medical history were recorded at baseline. Follow-up assessments were conducted in person at the initial recruitment sites.
- **Statistical Analysis:** Data were analysed using SPSS software. Chi-square tests compared categorical variables, A p-value of <0.05 was considered statistically significant.

3. Results

The 3D pie chart illustrates the gender distribution among 50 individuals infected with *Helicobacter pylori*. Males represent 57% of the infected group, while females account for 43%. As shown in Figure 2.

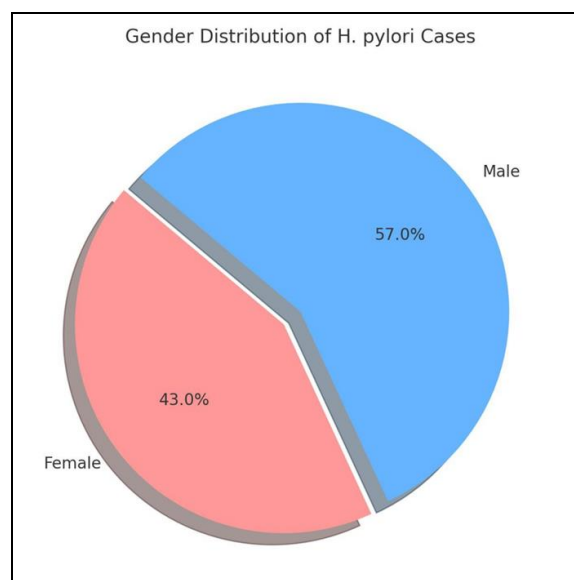


Fig 1: Gender distribution of *H. pylori* cases

The data present the demographic and treatment-related characteristics of the study population. The distribution of participants across age categories revealed that the most significant proportions were in the 51-60 (32%) and 40-50 (30%) age groups, whereas younger participants aged 18-28 constituted the most minuscule fraction at 6%. Regarding treatment, 40% of participants received Vinegar, with a significant majority adhering to the regimen; 74% took the

treatment regularly and completed the whole course. Clinical outcomes were positive, with 80% of participants reporting symptom improvement and 50% demonstrating favorable test results following treatment. Furthermore, 72% indicated a willingness to recommend the treatment to

others, implying overall satisfaction and perceived effectiveness. The findings demonstrate significant adherence and a marked therapeutic effect, underscoring Vinegar's potential acceptability and advantages as an intervention in this cohort.

Table 1: Age categories of the study subjects

Age categories	Frequency	Percentage (%)
18-28	3	6
29-39	7	14
40-50	15	30
51-60	16	32
61-70	9	18
Type of treatment received (Vinegar)	20	40
Did you take the treatment regularly?	37	74
Did you complete the full course?	37	74
Have your symptoms improved?	40	80
Test result after treatment (Positive)	25	50
Would you recommend this treatment to others?	36	72

The Table 2 provides a comparative analysis of participant characteristics and treatment outcomes for the *H. pylori* group and the vinegar treatment group. No statistically significant differences were observed in distribution across age groups ($\chi^2 = 0.44-0.61$, $p > 0.05$). Similarly, gender ($\chi^2 = 2.15$, $P = 0.14$) and smoking status ($\chi^2 = 0.83$, $P = 0.36$) did not demonstrate significant associations with the treatment group. Treatment adherence, encompassing regular intake ($\chi^2 = 1.7$, $P = 0.18$) and symptom improvement ($\chi^2 = 2.6$, $P = 0.10$), was greater in the *H. pylori* group; however, the differences lacked statistical significance. There was a

significant association between completing the whole course and group allocation ($\chi^2 = 4.3$, $P = 0.03$). Post-treatment test results indicated an important difference, with the vinegar group exhibiting a higher proportion of positive results ($\chi^2 = 12.3$, $P = 0.004$), implying lower efficacy relative to the *H. pylori* group. The willingness to recommend the treatment was significantly lower in the *H. pylori* group ($\chi^2 = 17.6$, $P = 0.001$), indicating differences in perceived satisfaction and acceptability. The findings underscore the differences in efficacy and adherence associated with vinegar treatment compared to standard *H. pylori* interventions.

Table 2: Association between treatment groups and characteristics of participants

Characteristics	<i>H. pylori</i> groups			
N,(%)	χ^2	P-Value		
Age groups			0.44	0.9
18-28	3,(100)	0,(0)		
29-39	4,(57.1)	3,(42.9)		
40-50	9,(60)	6,(40)		
51-60				
61-70	6,(60)	4,(40)		
Gender				
Male				
Female	13,(72.2)	5,(27.7)		
Smoking status				
Yes				
No	8,(80)	2,(20)		
Did you take the treatment regularly?				
Yes				
No	6,(46.1)	7,(53.8)		
Did you complete the full course?				
Yes				
No	10,(76.9)	3,(23.0)		
Have your symptoms improved?				
Yes				
No	8,(80)	2,(20)		
Test result after treatment (Positive / Negative)				
Positive				
Negative	20,(80)	5,(20)		
Would you recommend this treatment to others?				

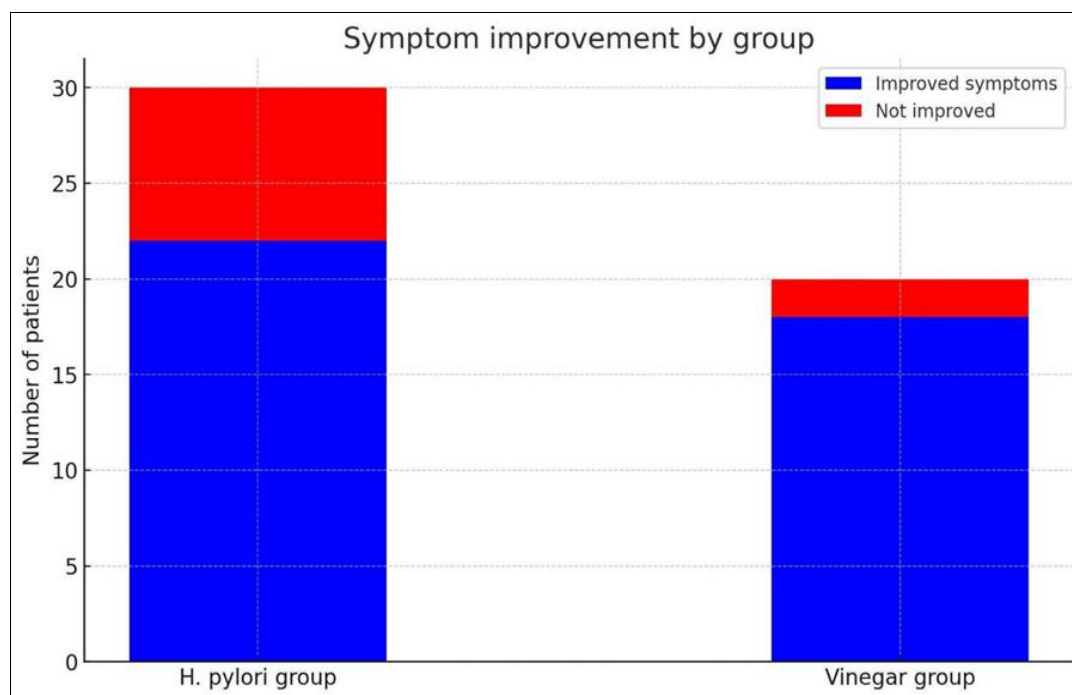


Fig 2: Symptoms improvement by group

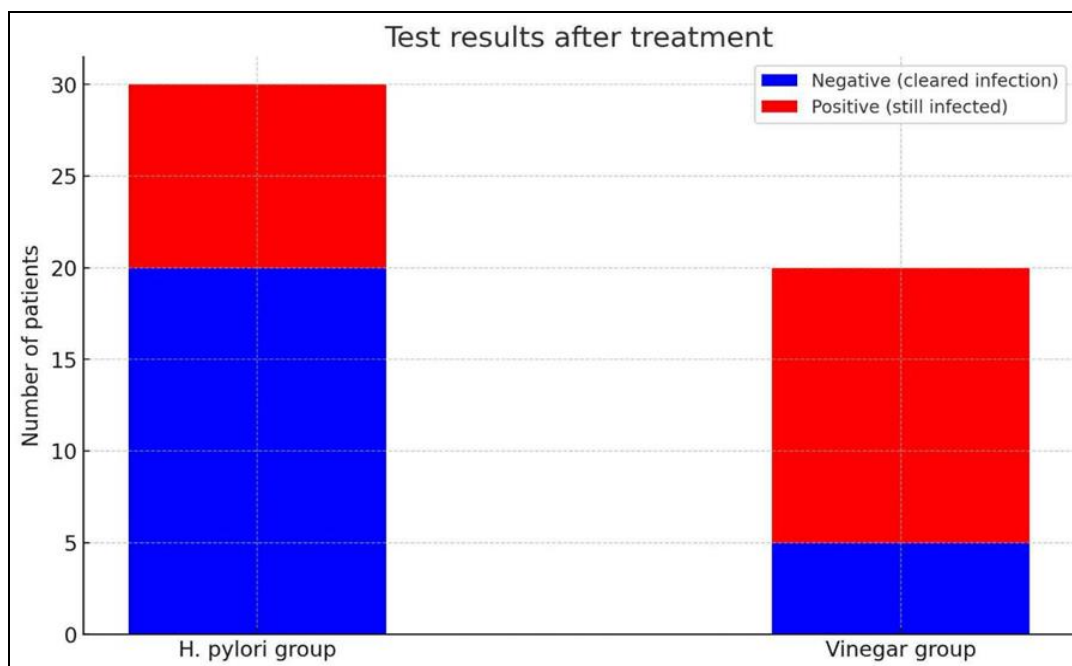


Fig 3: Test results after treatment

4. Discussion

This study compared the therapeutic effects of standard triple therapy and vinegar administration in patients with *Helicobacter pylori* infection. Triple therapy has traditionally been regarded as the gold standard for *H. pylori* eradication. However, rising antibiotic resistance, treatment-related adverse effects, and financial burdens have prompted concerns about its long-term efficacy and patient adherence [9]. Successful treatment of *H. pylori* infections presents numerous challenges. The reasons encompass the organism's characteristics, intra-gastric environment, and the treatment regimens employed for its eradication, and the host's behavior and responses [10].

The relationship between vinegar consumption and the effectiveness of antibiotics in eliminating *Helicobacter pylori* (*H. pylori*) is a significant focus in medical research.

The impact of Vinegar, specifically acetic acid, on *H. pylori* is substantial. Ibrahim's study reported that various dilutions of dietary Vinegar can exhibit a lethal effect on *H. pylori* when added to culture media, suggesting a potential role for Vinegar as a supplementary treatment alongside antibiotics [11].

This is supported by Enck, who investigated the combined effect of apple cider vinegar with standard proton pump inhibitor [12] based triple therapy on *H. pylori* eradication. Their study demonstrated improved eradication rates when Vinegar was included, suggesting that acetic acid may enhance the efficacy of conventional antibiotic therapies [13]. Our study found that a greater percentage of participants in the vinegar group experienced symptom relief and expressed a higher likelihood of recommending this treatment to others than those in the standard therapy group.

The eradication rate significantly improved in the vinegar group, consistent with prior *in vitro* studies that highlight Vinegar's strong antibacterial properties and capacity to modify the gastric microenvironment, which may inhibit *H. pylori* growth^[14]. In addition, Vinegar contains galacturonic acid, which diminishes gastrointestinal tract inflammation in animal models^[15]. This may reduce the side effects of standard *H. pylori* treatments. Vinegar has a significant amount of phenolics. Free radicals are essential in the pathogenesis of gastroduodenal mucosal inflammation, peptic ulcer disease, and probab^[16]. ACV is also a good source of prebiotics. In the large intestine and colon, microorganisms degrade pectin and liberate oligofructose and short-chain fatty acids that have prebiotic effects. Prebiotics stimulate the growth and/or the activity of bifidobacteria and lactic acid bacteria in the digestive system. It has been shown that probiotics, which are live nonpathogenic bifidobacteria and lactic acid bacteria that benefit a host through altering gut microflora composition, may reduce the side effects of standard *H. pylori* treatments, especially diarrhea. Prebiotics stimulate the growth and/or the activity of bifidobacteria and lactic acid bacteria in the digestive system. It has been shown that probiotics, which are live nonpathogenic bifidobacteria and lactic acid bacteria that benefit a host through altering gut microflora composition, may reduce the side effects of standard *H. pylori* treatments, especially diarrhea. As a result, they may be helpful adjuncts to improve the tolerability and compliance with more traditional antibiotic regimens^[17].

As some probiotics have antimicrobial effects, they have been proposed to treat *H. pylori* infection, but they should not be considered a substitute for standard antibiotic treatments^[18].

Hassen *et al.* proposed that enhancing eradication regimens by including potent acid secretion inhibitors may improve outcomes, potentially incorporating dietary acids such as Vinegar^[19].

In our study, Standard triple therapy (STT) exhibits variable eradication rates, with research indicating rates ranging from 67.8% to 84.7%, influenced by treatment duration and regimen. Various studies have suggested that apple vinegar can inhibit the growth of pathogenic bacterial species in food products and that acetic acid has a high inhibitory effect on *Escherichia coli* O157: H7. Likewise, lactic, malic, and citric acids inhibit *E. coli* and *Salmonella typhimurium*^[20].

Apple cider vinegar acts on the bacteria by penetrating their cell wall, destroying their DNA, and turning off their reproduction. Apple vinegar also positively affects the gastrointestinal tract because it reduces the pH, which limits the propagation of pathogenic bacteria in foods already consumed^[21].

The inhibitory, or antibacterial, effect of apple vinegar varies for each bacterial species. The results of this work have confirmed that apple vinegar traditionally has good antibacterial potential. The results are consistent with those of other researchers, who show that apple vinegar has multiple antibacterial potentials with clinical therapeutic implications^[21].

The apple vinegar exhibited a bactericidal activity of 100.00% against *E. coli* and *S. aureus* and a bacteriostatic activity of 100.00% against *E. coli*. Apple cider vinegar demonstrates significant potential for application in both human and veterinary medicine, attributed to its beneficial effects on enhancing food flavor, aiding digestion, and boosting the immune response. This is additionally supported by its antimicrobial activity, regarded as a natural

and acceptable alternative to antimicrobial drugs^[22].

In our study, 45% of participants exhibited symptom improvement. In contrast, a pilot study by Hlebowicz *et al* demonstrated that adding apple cider vinegar to rice pudding in patients with type 1 diabetes and diabetic gastroparesis resulted in a further delay in gastric emptying compared to a placebo. Vinegar is occasionally linked to beneficial effects on blood glucose; however, in this context, the additional delay in gastric emptying is viewed as a potential drawback for glycaemic control in patients with pre-existing delayed gastric emptying.

A notable finding from our study was patient compliance. Participants who received Vinegar demonstrated a higher likelihood of completing the treatment course, potentially attributable to the lack of antibiotic-related adverse events, including diarrhea, nausea, or taste disturbance, frequently associated with triple therapy^[1].

Enhanced compliance may partially explain the superior eradication rates observed in the vinegar group. The findings indicate an increasing interest in functional foods and nutraceuticals as adjunct strategies for managing infectious diseases. Further randomized controlled trials are necessary to confirm these findings and to investigate the ideal dosing and duration of vinegar therapy. Our study offers initial evidence that Vinegar may be a safe, cost-effective, and patient-friendly alternative for *H. pylori* eradication.

As the duration of anti *H. Pylori* therapy is prolonged, the compliance of the patients is weak, and they discontinue their treatment. Thus, the treatment failure is associated with the *H. pylori* strains that are resistant to the commonly used antibiotics. Since an initial attempt at eradicating *H. pylori* fails in approximately 20 percent of the patients

Conclusion

While standard triple therapy is the primary method for *H. pylori* eradication, our findings suggest that Vinegar provides significant patient-centered benefits, such as enhanced symptom relief, improved tolerability, and increased patient satisfaction. While insufficient as a standalone treatment due to lower eradication rates, Vinegar demonstrates potential as a safe, cost-effective, and well-tolerated adjunct therapy. So, recommended Future randomized controlled trials with larger sample sizes are necessary to validate these findings and investigate the potential synergistic effects of Vinegar in conjunction with standard treatment protocols.

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Conflict of Interest

Not available

Financial Support

Not available

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