INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

COMPARISON OF LEVOFLOXACIN BASED VERSUS CLARITHROMYCIN BASED TRIPLE REGIMEN THERAPY FOR IN THE ERADICATION OF HELICOBACTER PYLORI

Original Research

Fasih Ur Rehman[1]*, Hira Fatima[2], Muhammad Adil Zaka Khan[1]
[1]NHS, UK.
[2]Niazi Medical and Dental College Sarghoda, Pakistan.
Corresponding Author: Fasih Ur Rehman, NHS, UK, friendlyfasih@gmail.com
Acknowledgement: The authors gratefully acknowledge the support of Sheikh Zayed Medical Complex, Lahore, for facilitating this study.

Conflict of Interest: None
Grant Support & Financial Support: None

ABSTRACT

Background: *Helicobacter pylori* is a globally prevalent gastric pathogen implicated in chronic gastritis, peptic ulcer disease, and gastric malignancies. Rising resistance to commonly used antibiotics, particularly clarithromycin, has led to declining eradication success rates with conventional therapies. Levofloxacin, a fluoroquinolone antibiotic, has emerged as a potential alternative in triple therapy regimens. Evaluating the comparative effectiveness of these treatment options in different populations is essential to guide empirical clinical practice and adapt to regional antibiotic resistance patterns.

Objective: To compare the success of levofloxacin-based versus clarithromycin-based triple regimen therapy in the eradication of *Helicobacter pylori* infection.

Methods: This randomized controlled trial was conducted at the Department of Gastroenterology, Sheikh Zayed Medical Complex, Lahore, from April 2 to October 2, 2020. A total of 120 patients, aged 16 to 75 years and diagnosed with *H. pylori* via ^13C urea breath test, were enrolled and randomly allocated into two equal groups. Group A received omeprazole 40 mg, amoxicillin 1 g, and levofloxacin 250 mg twice daily for 14 days. Group B received omeprazole 40 mg, amoxicillin 1 g, and clarithromycin 500 mg twice daily for the same duration. After 28 days of treatment completion, *H. pylori* status was reassessed using the ^13C urea breath test. Eradication success was defined by a negative result.

Results: The mean age of participants was 44.58 ± 15.16 years, with 88 patients (73.3%) being male. Successful eradication was achieved in 49 patients (81.7%) in the levofloxacin group compared to 39 patients (65.0%) in the clarithromycin group. The difference was statistically significant ($p = 0.039$).

Conclusion: Levofloxacin-based triple therapy demonstrated significantly higher eradication rates than clarithromycin-based therapy, supporting its use as a more effective regimen for the treatment of *Helicobacter pylori* infection in adult populations.

Keywords: Amoxicillin, Clarithromycin, *Helicobacter pylori*, Levofloxacin, Omeprazole, Triple therapy, Urea breath test.

INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

INTRODUCTION

Helicobacter pylori (H. pylori) infection remains one of the most significant contributors to gastrointestinal disease and global mortality. Affecting nearly half of the world's population, its distribution varies widely across and within countries, with higher prevalence rates consistently noted among individuals from lower socioeconomic backgrounds (1). This bacterium is strongly associated with several severe digestive pathologies, including chronic gastritis, peptic ulcer disease, and gastric malignancies, making it a critical target for both diagnostic vigilance and therapeutic intervention (2). Understanding the epidemiological patterns of H. pylori infection is crucial for estimating the disease burden and formulating effective public health strategies tailored to specific populations (3). Demographic disparities in infection rates have also been observed, with Hispanic individuals comprising up to 60% of diagnosed cases compared to 29% among white populations (4). Despite its high prevalence, especially in developing countries, precise data on infection rates remain elusive due to limited access to accurate diagnostic tools and underreporting (4,5). This lack of reliable epidemiological data contributes to the ongoing challenge of formulating optimized, evidence-based treatment protocols, particularly in regions where healthcare resources are constrained. While successful eradication of H. pylori has been shown to significantly reduce the risk of peptic ulcers and gastric cancer, evolving antibiotic resistance patterns pose substantial obstacles to treatment efficacy (6).

Conventional first-line therapies, primarily the triple regimen involving a proton pump inhibitor (PPI), clarithromycin, and amoxicillin or metronidazole, are witnessing declining success rates in many regions due to rising clarithromycin resistance (7). Consequently, alternative therapeutic strategies such as bismuth- and non-bismuth-containing quadruple regimens, and in some cases dual therapies, are being actively explored for improved outcomes (8). Emerging evidence has suggested that levofloxacin-based triple therapy may offer better eradication rates compared to clarithromycin-based regimens, particularly in areas where clarithromycin resistance is prevalent (9). Nevertheless, these findings have yet to be thoroughly validated through region-specific studies, and the absence of localized data continues to hinder the implementation of the most effective therapeutic approach. In clinical practice, the selection of the optimal eradication regimen is ideally guided by antibiotic susceptibility testing. However, in many healthcare settings, especially those with limited laboratory infrastructure, resistance profiling remains impractical (10,11). As a result, clinicians often rely on empirical treatments without region-specific evidence to support their choice. In Pakistan, both clarithromycin- and levofloxacin-based regimens are prescribed interchangeably, despite the lack of localized comparative data to support one over the other. Given these gaps, this study was designed to determine whether a levofloxacin-based regimen offers superior efficacy in the eradication of H. pylori infection compared to the standard clarithromycin-based protocol within a local population. The findings aim to inform future clinical practice by establishing evidence-based treatment guidelines tailored to regional resistance patterns and healthcare realities.

METHODS

This randomized controlled trial was conducted in the Department of Gastroenterology at Sheikh Zayed Medical Complex, Lahore, over a six-month period from April 2, 2020, to October 2, 2020. Ethical approval was obtained from the hospital's Ethical Review Committee. A total sample size of 120 patients, with 60 patients allocated to each treatment group, was calculated using a 5% level of significance and 80% power of the test, based on previously reported eradication success rates of 87.6% with levofloxacin-based therapy and 68.4% with clarithromycin-based therapy (7). Patients were enrolled using a non-probability consecutive sampling technique from the medical outpatient department. Participants included patients aged 16 to 75 years of either gender who tested positive for *Helicobacter pylori* infection, confirmed using the ^13C urea breath test. Exclusion criteria were: prior *H. pylori* treatment, known allergies to study medications, current antibiotic use for other infections, history of gastrectomy or gastrointestinal malignancy (adenocarcinoma or lymphoma), use of proton pump inhibitors, and pregnancy or lactation at the time of enrollment. Written informed consent was obtained from all participants, and baseline demographic data including age, gender, BMI, symptom duration, and contact details were recorded.

Patients were randomized into two groups using a simple lottery method. Group A received oral omeprazole 40 mg, amoxicillin 1 g, and levofloxacin 250 mg, each administered twice daily for 14 days. Group B received oral omeprazole 40 mg, amoxicillin 1 g, and clarithromycin 500 mg, also administered twice daily for the same duration. Patients were monitored throughout the 14-day treatment period, and then followed for an additional 28 days post-treatment to assess sustained eradication. At the end of the 28-day follow-up,

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

the ^13C urea breath test was repeated. A negative test result was taken as evidence of successful *H. pylori* eradication. All relevant data were recorded on a structured proforma. Statistical analysis was performed using SPSS version 20.0. The primary outcome—eradication success—was compared between the two groups using the chi-square (χ^2) test, with a p-value ≤0.05 considered statistically significant.

RESULTS

The study enrolled 120 patients diagnosed with *Helicobacter pylori* infection, evenly divided into two groups receiving either levofloxacin-based or clarithromycin-based triple therapy. The mean age of patients in the levofloxacin group was 45.82 ± 16.04 years, while in the clarithromycin group it was 43.33 ± 14.25 years. In terms of gender distribution, 81.7% of patients in the levofloxacin group were male, compared to 65% in the clarithromycin group. Female representation was 18.3% and 35% in the respective groups. The average BMI recorded was 24.15 ± 3.45 kg/m² in the levofloxacin group and 25.31 ± 3.43 kg/m² in the clarithromycin group. The mean duration of infection was 4.57 ± 1.76 weeks for patients receiving levofloxacin and 4.32 ± 1.74 weeks for those receiving clarithromycin. Overall, successful eradication of *H. pylori* was achieved in 88 out of 120 patients, resulting in a cumulative success rate of 73.3%. When stratified by treatment arm, 49 patients (81.7%) in the levofloxacin group achieved eradication, compared to 39 patients (65%) in the clarithromycin group. This difference was statistically significant (p = 0.039), indicating superior efficacy of the levofloxacin-based regimen.

Subgroup analyses further evaluated eradication success across demographic and clinical variables. Among patients aged ≤50 years, the levofloxacin group demonstrated a higher success rate (83.3%) compared to the clarithromycin group (65%), though this did not reach statistical significance (p = 0.070). In patients older than 50 years, eradication success was 79.2% in the levofloxacin group and 65% in the clarithromycin group (p = 0.293). In male patients, a significantly higher eradication rate was observed with levofloxacin (85.7%) versus clarithromycin (66.7%) (p = 0.034). Among females, the success rate was 63.6% in the levofloxacin group and 61.9% in the clarithromycin group, with no significant difference (p = 0.923). Stratification by BMI revealed that patients with a BMI ≤25 kg/m² responded better to levofloxacin, with a success rate of 85.3%, compared to 61.5% in the clarithromycin group (p = 0.035). In contrast, among patients with BMI >25 kg/m², the difference in success rates was less pronounced (76.9% vs. 67.6%; p = 0.429). Analysis based on duration of infection showed that patients treated within 4 weeks of diagnosis had a success rate of 75.9% with levofloxacin and 61.8% with clarithromycin (p = 0.231). For those with infection duration exceeding 4 weeks, eradication rates were 87.1% and 69.2%, respectively (p = 0.098).

Table 1: Baseline demographics of enrolled patients (n = 120)

	Study Groups	
	Levofloxacin	Clarithromycin
n	60	60
Age (years)	45.82 ± 16.04	43.33 ± 14.25
Gender		
Males	49 (81.7%)	39 (65%)
Females	11 (18.3%)	21 (35%)
BMI (kg/m2)	24.15 ± 3.45	25.31 ± 3.43
Duration of diagnosis (months)	**4.57 ± 1.76**	**4.32 ± 1.74**

Table 2: Comparison of success in both groups

		Study Groups		
		Levofloxacin (n = 60)	Clarithromycin (n = 60)	**p-value**
Success	Yes	49 (81.7%)	39 (65%)	0.039
	No	**11 (18.3%)**	**21 (35%)**	

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Table 3: Comparison of success in both groups when stratified for age, gender, BMI and duration of disease

	Study Groups		p-value
	Levofloxacin	Clarithromycin	
Age ≤ 50 years	30 (83.3%)	26 (65%)	0.070
Age >50 years	19 (79.2%)	13 (65%)	0.293
Male	42 (85.7%)	26 (66.7%)	0.034
Female	7 (63.6%)	13 (61.9%)	0.923
Normal BMI	29 (85.3%)	16 (61.5%)	0.035
Obese BMI	20 (76.9%)	23 (67.6%)	0.429
Duration of infection ≤4 months	22 (75.9%)	21 (61.8%)	0.231
Duration of infection >4 months	**27 (87.1%)**	**18 (69.2%)**	**0.098**

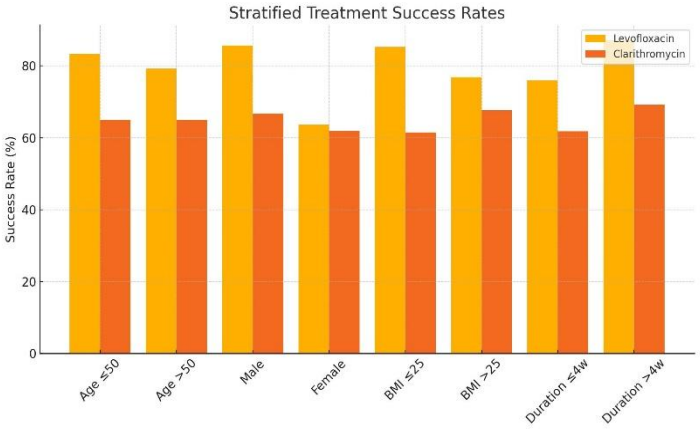

Figure 1 Stratified Treatment Success Rates

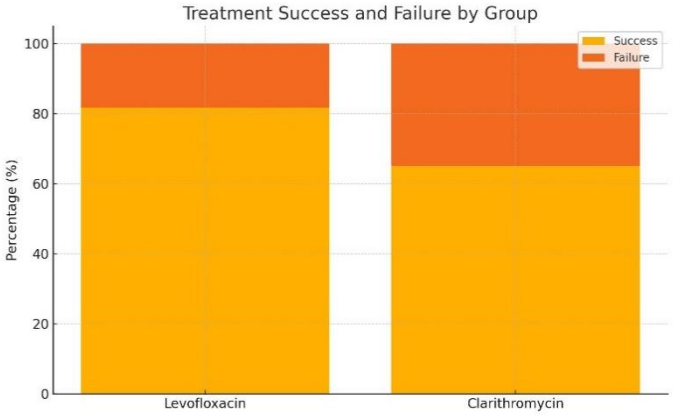

Figure 2 Treatment Success and Failure by Group

DISCUSSION

The present study demonstrated that levofloxacin-based triple therapy was significantly more effective than clarithromycin-based therapy in the eradication of *Helicobacter pylori*, with a success rate of 81.7% compared to 65% (p = 0.039). This finding aligns with several prior studies that have consistently reported higher eradication rates with levofloxacin-containing regimens, particularly in populations where clarithromycin resistance has been rising over the years. The observed eradication rate of 73.3% across both groups also reflects an encouraging outcome for a localized trial, though variation remains depending on population demographics, antibiotic resistance patterns, and regimen duration. Reported eradication rates for levofloxacin-based therapies in the literature range from 51.6% to 94.3%, suggesting considerable heterogeneity in outcomes across studies and populations (12,14). In some trials, eradication rates with levofloxacin triple therapy reached as high as 94.8%, far exceeding those with clarithromycin, which ranged from approximately 66% to 76% in similar cohorts (15,16). However, not all evidence conclusively supports the superiority of levofloxacin. A large-scale comparative study reported similar eradication rates between levofloxacin (79.05%) and clarithromycin (81.4%) regimens, with no statistically significant difference (17). This variability is likely attributable to differences in regional antibiotic use, particularly the prior use of fluoroquinolones, which has been identified as a key contributor to levofloxacin resistance (18-20).

Importantly, eradication success in this study remained higher in the levofloxacin group across most subgroups, including males, patients aged ≤50 years, those with BMI ≤25 kg/m², and those with infection duration greater than four weeks. Although some subgroup differences did not achieve statistical significance, the trend favored levofloxacin in almost all strata. The only exception was among females, where both regimens performed similarly. These findings support the hypothesis that levofloxacin-based regimens may offer more robust and consistent efficacy across patient profiles (21,22). Despite these promising results, the study has some limitations that

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

may influence generalizability. Being a single-center trial with a relatively small sample size, the findings are subject to population and sampling biases. Regional antibiotic resistance profiling was not conducted, which is a crucial factor when evaluating eradication protocols, particularly in areas with evolving resistance patterns. The dosage of levofloxacin (250 mg twice daily) used in this study was also lower than that employed in many international protocols, which typically use 500 mg once or twice daily, potentially affecting eradication outcomes and comparability with other studies. Moreover, the study did not assess adverse events, compliance rates, or long-term recurrence—factors essential for evaluating treatment tolerability and sustained efficacy.

Nevertheless, the study's strength lies in its randomized controlled design and objective outcome assessment using the ^13C urea breath test, a reliable noninvasive diagnostic method. The follow-up period of 28 days post-treatment was adequate to detect early recurrence or failure, though longer-term surveillance would provide better insight into sustained eradication. Moving forward, there is a compelling need for multicenter trials with larger sample sizes to validate these findings and reflect broader population dynamics. Such studies should incorporate antibiotic resistance profiling, adverse event reporting, and cost-effectiveness analysis to better inform therapeutic decisions in clinical practice (23). Future regimens should also consider concurrent and sequential quadruple therapies, which have shown promise in regions with high clarithromycin resistance, offering better eradication outcomes and easier administration schedules. Tailoring eradication protocols based on local resistance patterns and prior antibiotic exposure remains the cornerstone for optimizing *H. pylori* management in clinical settings.

CONCLUSION

This study concludes that levofloxacin-based triple therapy offers a more effective approach for the eradication of *Helicobacter pylori* infection in the adult population compared to the conventional clarithromycin-based regimen. The findings underscore the practical value of revising empirical treatment protocols in favor of regimens that demonstrate greater efficacy, particularly in settings where antibiotic resistance may compromise standard therapies. By providing local evidence to support a more successful therapeutic option, this research contributes meaningfully to clinical decision-making and highlights the need for personalized, resistance-informed treatment strategies in gastrointestinal practice.

AUTHOR CONTRIBUTION

Author	Contribution
Fasih Ur Rehman*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Hira Fatima	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Adil Zaka Khan	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published

REFERENCES

1. Schubert JP, Gehlert J, Rayner CK, Roberts-Thomson IC, Costello S, Mangoni AA, et al. Antibiotic resistance of Helicobacter pylori in Australia and New Zealand: A systematic review and meta-analysis. J Gastroenterol Hepatol. 2021;36(6):1450-6.
2. Zeng S, Kong Q, Wu X, Duan M, Nan X, Yang X, et al. Antibiotic resistance of Helicobacter pylori in Mainland China: A focus on geographic differences through systematic review and meta-analysis. Int J Antimicrob Agents. 2024;64(5):107325.
3. Ayaş M, Gürol Y. Antibiotic Resistance of Helicobacter pylori in Turkey: A Systematic Review and Meta-Analysis. Microb Drug Resist. 2023;29(3):96-103.
4. Kotilea K, Iliadis E, Nguyen J, Salame A, Mahler T, Miendje Deyi VY, et al. Antibiotic resistance, heteroresistance, and eradication success of Helicobacter pylori infection in children. Helicobacter. 2023;28(5):e13006.
5. Ashkar Daw M, Azrad M, Peretz A. Associations between biofilm formation and virulence factors among clinical Helicobacter pylori isolates. Microb Pathog. 2024;196:106977.

6. Wang L, Zhang J, Hu M, Pang X. Comparison of Drug Resistance of Helicobacter pylori Between Children and Adults in Jilin, China. Turk J Gastroenterol. 2021;32(12):1012-8.
7. Min BJ, Seo ME, Bae JH, Kim JW, Kim JH. Development and validation of next-generation sequencing panel for personalized Helicobacter pylori eradication treatment targeting multiple species. Front Cell Infect Microbiol. 2024;14:1379790.
8. Han Z, Li Y, Kong Q, Liu J, Wang J, Wan M, et al. Efficacy of bismuth for antibiotic-resistant Helicobacter pylori strains eradication: A systematic review and meta-analysis. Helicobacter. 2022;27(6):e12930.
9. Islam JM, Yano Y, Okamoto A, Matsuda R, Shiraishi M, Hashimoto Y, et al. Evidence of Helicobacter pylori heterogeneity in human stomachs by susceptibility testing and characterization of mutations in drug-resistant isolates. Sci Rep. 2024;14(1):12066.
10. Ho JJC, Navarro M, Sawyer K, Elfanagely Y, Moss SF. Helicobacter pylori Antibiotic Resistance in the United States Between 2011 and 2021: A Systematic Review and Meta-Analysis. Am J Gastroenterol. 2022;117(8):1221-30.
11. Kamal A, Ghazy RM, Sherief D, Ismail A, Ellakany WI. Helicobacter pylori eradication rates using clarithromycin and levofloxacin-based regimens in patients with previous COVID-19 treatment: a randomized clinical trial. BMC Infect Dis. 2023;23(1):36.
12. Nestegard O, Moayeri B, Halvorsen FA, Tønnesen T, Sørbye SW, Paulssen E, et al. Helicobacter pylori resistance to antibiotics before and after treatment: Incidence of eradication failure. PLoS One. 2022;17(4):e0265322.
13. Ang TL, Ang D. Helicobacter pylori Treatment Strategies in Singapore. Gut Liver. 2021;15(1):13-8.
14. Guevara B, Cogdill AG. Helicobacter pylori: A Review of Current Diagnostic and Management Strategies. Dig Dis Sci. 2020;65(7):1917-31.
15. Zeng J, Xie C, Zhang L, Liu X, Chan MTV, Wu WKK, et al. Host Cell Antimicrobial Responses against Helicobacter pylori Infection: From Biological Aspects to Therapeutic Strategies. Int J Mol Sci. 2022;23(18).
16. Örsten S, Yılmaz E, Akyön Y. Molecular Characterization of Clarithromycin Resistance in Helicobacter pylori Strains. Turk J Gastroenterol. 2023;34(4):427-32.
17. Hong TC, El-Omar EM, Kuo YT, Wu JY, Chen MJ, Chen CC, et al. Primary antibiotic resistance of Helicobacter pylori in the Asia-Pacific region between 1990 and 2022: an updated systematic review and meta-analysis. Lancet Gastroenterol Hepatol. 2024;9(1):56-67.
18. Han X, Yu X, Gao X, Wang X, Tay CY, Wei X, et al. Quantitative PCR of string-test collected gastric material: A feasible approach to detect Helicobacter pylori and its resistance against clarithromycin and levofloxacin for susceptibility-guided therapy. Helicobacter. 2023;28(4):e12985.
19. Yu J, Lv YM, Yang P, Jiang YZ, Qin XR, Wang XY. Safety and effectiveness of vonoprazan-based rescue therapy for Helicobacter pylori infection. World J Gastroenterol. 2023;29(20):3133-44.
20. Losurdo G, D'Abramo FS, Piazzolla M, Rima R, Continisio A, Pricci M, et al. Second-line Therapy for Helicobacter Pylori Eradication: State of the Art. Mini Rev Med Chem. 2022;22(19):2430-7.
21. Zhou Y, Zhong Z, Hu S, Wang J, Deng Y, Li X, et al. A Survey of Helicobacter pylori Antibiotic-Resistant Genotypes and Strain Lineages by Whole-Genome Sequencing in China. Antimicrob Agents Chemother. 2022;66(6):e0218821.
22. Waqar F, Noor M, Haider E, Farhat K, Ali S, Fatime Gilani SF. Therapeutic efficacy and drug safety comparison of one-week Vonoprazan triple therapy with two-weeks Esomeprazole triple therapy in Helicobacter pylori infection: Findings from a single-centre randomized clinical trial in population of Pakistan. J Pak Med Assoc. 2024;74(3):432-5.
23. Tong Y, Dang R, Yin Y, Men C, Xi R. A whole genome sequencing-based assay to investigate antibiotic susceptibility and strain lineage of Helicobacter pylori. Microb Pathog. 2024;197:107069.