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Original Research Article

Role of Clinical Pharmacist in Improving Medication Adherence and Monitoring Medicinal Plant–Drug Interactions in Heart Failure Patients

Muhammad Shafiq Khan[1], Muhammad Zakryya Khan[2], Farhana Amin[3], Sania Begum[3], Naqeeb Ullah Jogezai[4], Zafar Iqbal[5], Hafiz Muhammad Abdullah[6], Awais Ahmed Uttra[*7]

[1]Department of Biotechnology, Mohi UD Din Islamic University (MIUNS), Islamabad, Pakistan
[2]Department of Biotechnology, International Islamic University, Islamabad, Pakistan
[3]National Institute for Genomics and Advanced Biotechnology NIGAB, NARC, Islamabad, Pakistan
[4]Department of Quality Enhancement Cell, University of Loralai, Pakistan
[5]Department of Pharmacy, Hazara University, Mansehra, Pakistan
[6]Department of Pharmacy Practice, University of Biological and Applied Sciences Lahore, Pakistan
[7]Department of Clinical Pharmacy, Faculty of Pharmaceutical Sciences, Prince of Songkla University, 90110, Hat Yai, Thailand
**Corresponding author`s email address:* awaisutra@yahoo.com

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Abstract: *Heart failure (HF) remains a leading cause of morbidity and mortality worldwide. Medication non-adherence and the concurrent use of medicinal plants increase the risk of adverse events and reduce therapeutic efficacy. Clinical pharmacists may play a critical role in optimizing adherence and monitoring herb–drug interactions.* ***Objective:*** *To evaluate the role of clinical pharmacists in improving medication adherence and tracking medicinal plant–drug interactions in HF patients.* ***Methods:*** *A prospective, controlled, interventional study was conducted from January 2023 to June 2024, including 230 adult patients with HF. Participants were randomized into intervention (pharmacist-led counseling and monitoring) and control (usual care) groups. Medication adherence was assessed using MMAS-8, and herb–drug interactions were monitored using standard databases over six months.* ***Results:*** *The intervention group showed significant improvement in adherence (MMAS-8: 6.32±1.12 to 7.85±0.70) compared to controls (6.28±1.15 to 6.50±1.05; p<0.001). Adverse events from interactions were lower (3.48% vs. 10.43%; p=0.03), and interaction resolution was higher in the intervention group (34.78% vs. 13.04%; p<0.001).* ***Conclusion:*** *Clinical pharmacist interventions significantly enhance medication adherence and reduce herb–drug–related risks in HF patients.*

Keywords: Heart Failure, Medication Adherence, Clinical Pharmacist, Medicinal Plants, Herb–Drug Interactions

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Introduction

One of the most difficult chronic cardiovascular diseases in the world, heart failure (HF) has a substantial impact on morbidity, mortality, and medical expenses (1). Even with significant improvements in pharmacological treatment, thorough monitoring of any drug-related hazards and regular medication adherence are crucial for the best possible disease management (2). The use of herbal supplements and medicinal plants has increased significantly in recent years, especially among those seeking complementary treatments for chronic conditions such as heart failure (3). Even while certain medicinal plants may seem to alleviate symptoms, using them in conjunction with prescription heart drugs raises the risk of pharmacokinetic and pharmacodynamic interactions, some of which may reduce therapeutic effectiveness or cause significant side effects (4).

Polypharmacy, financial constraints, a lack of knowledge about the pathophysiology of the illness, and worries about adverse effects are some of the numerous variables that contribute to medication non-adherence in HF patients (5). The potential for uneven dosing, duplicate effects, and negative interactions increases when herbal therapies are included in this regimen (6). Due to a lack of proper counseling or the false belief that herbal products are always safe, many patients do not tell medical professionals that they use medicinal herbs (7). This communication breakdown highlights the need for organized, patient-centered medication management.

Little studies have explicitly examined medicinal plant–drug interactions in this group, despite several studies examining medication adherence and the role of clinical pharmacists in managing heart failure (8). There is a significant information vacuum about how these interactions impact HF outcomes since the majority of current research is on conventional drugs alone or on herbal interactions in other chronic illnesses (9). In countries with a strong cultural dependence on herbal treatments, where unmonitored interactions may jeopardize the safety and effectiveness of conventional medications, closing this gap is especially crucial.

One essential component of the multidisciplinary HF care team is the clinical pharmacist. Clinical pharmacists are in a unique position to recognize adherence issues, provide individualized instruction, and conduct ongoing medication reviews due to their specialized knowledge of pharmacotherapy, drug safety, and patient counseling (10,11). In contexts where the use of medicinal plants is culturally prevalent, their capacity to evaluate and reduce herbal–drug interactions is especially beneficial. Clinical pharmacists enhance clinical outcomes and lower hospitalization rates by promoting better patient participation, improving treatment regimens, and reinforcing evidence-based procedures (12).

In this regard, assessing clinical pharmacists' contributions to improving medication adherence and monitoring potential interactions between medicinal plants and drugs provides valuable information to bolster HF management plans and encourage the safer, more efficient use of both conventional and complementary therapies.

Thus, this study aimed to evaluate the role of clinical pharmacists in improving medication adherence and monitoring medicinal plant–drug interactions among patients diagnosed with HF.

Methodology

This research was carried out at the Punjab Institute of Cardiology (PIC), Lahore, and used a prospective, controlled interventional design. The purpose of the study was to evaluate how clinical pharmacists might improve medication adherence and monitor medicinal plant-drug interactions in patients with heart failure. Patients were recruited, counseled, and monitored throughout the 18-month research period, which ran from January 2023 to June 2024.

Adult patients (18 years of age and older) with a confirmed Diagnosis of heart failure (HF), whether decreased, slightly reduced, or maintained ejection fraction, who had been on conventional pharmaceutical treatment for at least one month before enrollment, were included in the trial. ACE inhibitors, ARBs, beta-blockers, diuretics, and mineralocorticoid receptor antagonists were among the most frequently recommended HF drugs in standard treatment. Eligibility was limited to those who could complete follow-up assessments and were willing to participate. Individuals with terminal diseases needing palliative treatment, those hesitant to report their use of medicinal plants, pregnant or breastfeeding women, and patients with cognitive impairment or mental problems that may impede adherence evaluation were also excluded.

A total of 230 patients were recruited. Participants were split into two groups: the intervention group, which received organized monitoring and counseling from pharmacists, and the control group, which continued to receive their regular treatment. To preserve sufficient statistical power and account for any loss to follow-up over the research period, the final sample size was determined. To reduce selection bias, participants were randomly assigned to the intervention and control groups.

The data-gathering process included a baseline assessment of clinical history, prescription medications, demographic traits, and medicinal plant use. The validated Morisky Medication Adherence Scale (MMAS-8) was used to measure medication adherence. Medication education, appropriate dosages, potential herbal-drug interactions, and customized adherence techniques were the main topics of the 15–20-minute structured pharmacist-led counseling sessions that comprised the intervention. The clinical pharmacist specifically examined adherence to standard HF medications and evaluated potential interactions between the drugs and any medicinal plants the patients were using during counseling. At each subsequent appointment, follow-up therapy was provided. Clinical pharmacists used well-known drug-interaction resources, such as Micromedex and Lexicomp, to review prescription regimens and identify potential medicinal plant–drug interactions. To track changes in adherence, document adverse events, and find any new herbal–drug interactions, follow-up evaluations were conducted at one, three, and six months. Both planned phone calls and in-person clinic visits were used for follow-up encounters. Pairwise deletion was used to handle missing or partially observed data to preserve statistical validity.

SPSS version 26 was used to analyze all of the data. Clinical features and patient demographics were compiled using descriptive statistics. Whereas categorical data were summarized as frequencies and percentages, continuous variables were reported as means with standard deviations. Independent t-tests for continuous variables and chi-square tests for categorical variables were used to compare the intervention and control groups. Paired t-tests were used to assess within-group changes in adherence over time, and a p-value <0.05 was considered statistically significant.

The research was carried out at the Punjab Institute of Cardiology (PIC), Lahore, Pakistan, with ethical permission from the Institutional Review Board of the Department of Pharmacy Practice, University of Biological and Applied Sciences, Lahore, Pakistan. All participants provided written informed consent before being included in the study, guaranteeing adherence to ethical guidelines for research involving human subjects.

Results

Table 1 presents the baseline demographic characteristics of 230 HF patients, equally divided between the intervention (n = 115) and control (n = 115) groups. The mean age was 58.72 ± 11.45 years in the intervention group and 59.38 ± 12.02 years in the control group (p = 0.72). Males comprised (n=68) 59.13% and (n=66) 57.39%, and females (n=47) 40.87% and (n=49) 42.61% of the intervention and control groups, respectively (p = 0.74). Educational levels and residence distribution were comparable between groups, with no statistically significant differences observed (p > 0.05).

Table 2 summarizes the clinical profile of participants. The distribution of HF types was similar between groups: HFrEF (43.48% vs. 45.22%), HFmrEF (26.09% vs. 24.35%), and HFpEF (30.43% vs. 30.43%) in the intervention and control groups, respectively (p = 0.91). Comorbidities, including hypertension (60.87% vs. 59.13%), diabetes mellitus (39.13% vs. 40.87%), and chronic kidney disease (17.39% vs. 15.65%), were comparable, as was the prevalence of polypharmacy (47.83% vs. 49.57%; p > 0.05).

Figure 1 shows mean MMAS-8 adherence scores over six months. Baseline adherence was similar between groups (6.32 ± 1.12 vs. 6.28 ± 1.15; p = 0.78). The intervention group demonstrated significant improvement at 1 month (7.10 ± 0.95), 3 months (7.45 ± 0.88), and 6 months (7.85 ± 0.70) compared to the control group (6.35 ± 1.10, 6.40 ± 1.08, and 6.50 ± 1.05; p < 0.001 for all time points).

Table 3 presents categorical adherence levels. High adherence increased from 26.09% at baseline to 73.91% at 6 months in the intervention group, while the control group showed a modest increase from 24.35% to 29.57% (p < 0.001). Medium adherence decreased from 47.83% to 21.74% in the intervention group, with little change in controls. Low adherence fell dramatically in the intervention group, from 26.09% to 4.35%, compared with 26.96% in the control group.

Table 4 details the use of medicinal plants. Approximately 45% of participants in both groups reported using medicinal plants (intervention 45.22%, control 46.96%; p = 0.81). The most commonly used plants were garlic (34.62% vs. 37.04%), hawthorn (28.85% vs. 25.93%), and ginseng (19.23% vs. 22.22%), with no statistically significant differences between groups.

Table 5 illustrates medicinal plant–drug interactions. No interaction was detected in 60.87% of the intervention group and 52.17% of the control group (p = 0.20). Minor interactions were observed in 21.74% vs. 24.35%, moderate in 13.04% vs. 17.39%, and major in 4.35% vs. 6.09% of participants, indicating effective monitoring by the clinical pharmacist in the intervention group.

Table 6 shows follow-up outcomes at six months. Medication adherence improved in 69.57% of the intervention group compared to 31.30% of controls (p < 0.001). Adverse events related to interactions were lower in the intervention group (3.48% vs. 10.43%; p = 0.03), and medicinal plant–drug interactions were successfully resolved in 34.78% of intervention patients versus 13.04% of controls (p < 0.001).

Table 1: Baseline Demographic Characteristics of Study Participants (n = 230)

Characteristic	Variable	Intervention Group (n = 115)	Control Group (n = 115)	p-value	Test Used
Age (years)	Mean ± SD	58.72 ± 11.45	59.38 ± 12.02	0.72	Independent t-test
Gender, n (%)	Male	68 (59.13)	66 (57.39)	0.74	Chi-square
	Female	47 (40.87)	49 (42.61)		
Education Level, n (%)	Illiterate	25 (21.74)	27 (23.48)	0.89	Chi-square
	Primary/Secondary	54 (46.96)	50 (43.48)		
	Higher Education	36 (31.30)	38 (33.04)		

Residence, n (%)	Urban	70 (60.87)	68 (59.13)	0.80	Chi-square
	Rural	45 (39.13)	47 (40.87)		

Table 2: Clinical Characteristics of Participants (n = 230)

Characteristic	Variable	Intervention Group (n = 115)	Control Group (n = 115)	p-value	Test Used
Type of Heart Failure, n (%)	HFrEF	50 (43.48%)	52 (45.22%)	0.91	Chi-square
	HFmrEF	30 (26.09%)	28 (24.35%)		
	HFpEF	35 (30.43%)	35 (30.43%)		
Comorbidities, n (%)	Hypertension	70 (60.87%)	68 (59.13%)	0.76	Chi-square
	Diabetes Mellitus	45 (39.13%)	47 (40.87%)	0.79	
	Chronic Kidney Disease	20 (17.39%)	18 (15.65%)	0.72	
Polypharmacy	(>5 drugs)	55 (47.83%)	57 (49.57%)	0.81	Chi-square

HFrEF: Heart Failure with Reduced Ejection Fraction
HFmrEF: Heart Failure with Mildly Reduced Ejection Fraction
HFpEF: Heart Failure with Preserved Ejection Fraction

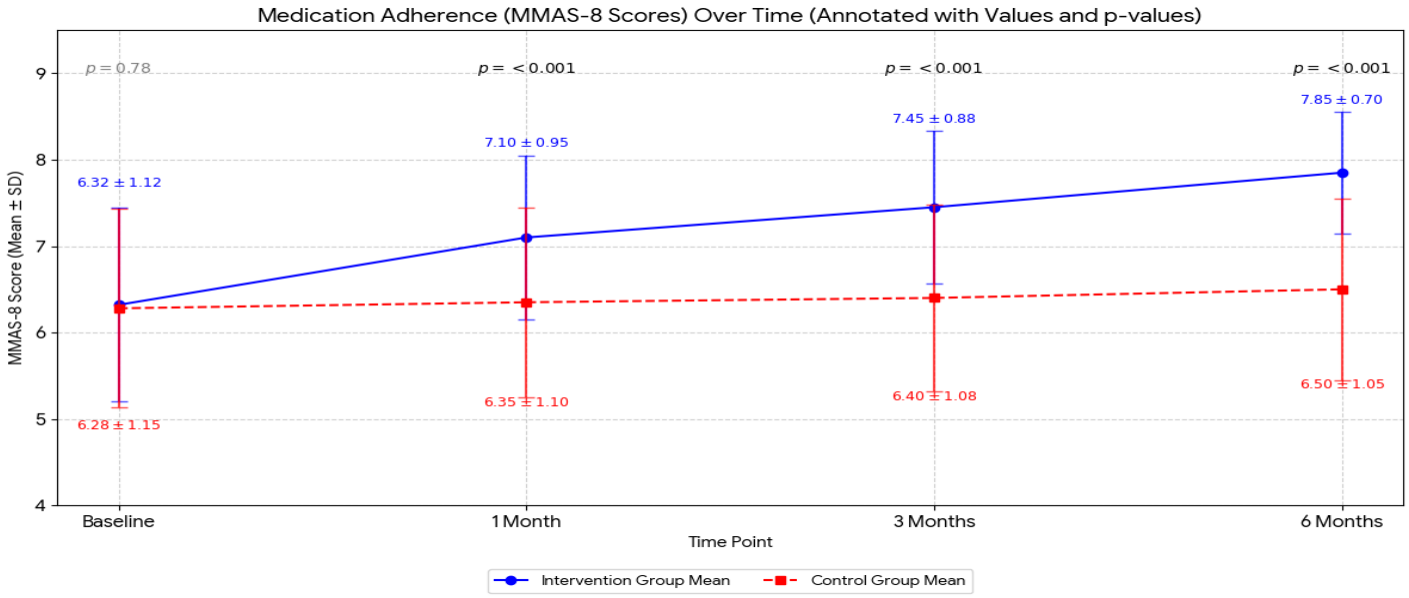

Figure 1: Medication Adherence (MMAS-8 scores) — Numeric Values for Paired t-tests

Table 3: Medication Adherence Levels (Categorical, MMAS-8)

Adherence Level	Intervention Group Baseline n (%)	Intervention Group 6 Months n (%)	Control Group Baseline n (%)	Control Group 6 Months n (%)	p-value (between groups)	Test Used
High Adherence	30 (26.09%)	85 (73.91%)	28 (24.35%)	34 (29.57%)	<0.001	Chi-square
Medium Adherence	55 (47.83%)	25 (21.74%)	57 (49.57%)	50 (43.48%)		
Low Adherence	30 (26.09%)	5 (4.35%)	30 (26.09%)	31 (26.96%)		

Table 4: Use of Medicinal Plants (n = 230)

Parameter	Variable	Intervention Group (n = 115)	Control Group (n = 115)	p-value	Test Used
Patients using medicinal plants	n (%)	52 (45.22%)	54 (46.96%)	0.81	Chi-square
Most Common Plants Used, n (%)	Garlic	18 (34.62%)	20 (37.04%)	0.78	
	Ginseng	10 (19.23%)	12 (22.22%)	0.72	
	Hawthorn	15 (28.85%)	14 (25.93%)	0.81	
	Others	9 (17.31%)	8 (14.81%)	0.78	

Table 5: Identified Medicinal Plant–Drug Interactions

Interaction Type	Intervention Group (n = 115)	Control Group (n = 115)	p-value	Test Used

No interaction detected, n (%)	70 (60.87%)	60 (52.17%)	0.20	Chi-square
Minor interaction, n (%)	25 (21.74%)	28 (24.35%)		
Moderate interaction, n (%)	15 (13.04%)	20 (17.39%)		
Major interaction, n (%)	5 (4.35%)	7 (6.09%)		

Table 6: Follow-Up Outcomes

Outcome	Intervention Group (n = 115)	Control Group (n = 115)	p-value	Test Used
Adherence Improved	80 (69.57%)	36 (31.30%)	<0.001	Chi-square
Adverse Events Due to Interactions	4 (3.48%)	12 (10.43%)	0.03	Chi-square
Medicinal Plant–Drug Interactions Resolved	40 (34.78%)	15 (13.04%)	<0.001	Chi-square

Discussion

The current research shows that organized clinical-pharmacist-led interventions considerably enhanced medication adherence among HF patients. The mean MMAS-8 scores of the intervention group increased significantly from 6.32 ± 1.12 at baseline to 7.85 ± 0.70 after six months, whereas those of the control group increased very little. These results are consistent with prior research demonstrating that medication reconciliation, follow-up, and pharmacist-led counseling greatly improve adherence and therapeutic optimization in patients with heart failure (13,14).

In addition to improving adherence, the clinical-pharmacist intervention significantly decreased clinically significant side effects associated with herb-drug interactions. Compared with 10.43% in the control group, only 3.48% of intervention patients experienced adverse events that might be attributable to interactions. Previous findings that pharmacists reduce medication-related issues, inappropriate polypharmacy, and adverse drug reactions through structured monitoring and the use of evidence-based tools like Micromedex and Lexicomp are strongly supported by the pharmacist-led identification and resolution of interactions in 34.78% of intervention patients (15).

The prevalence of herbal medicine use in this study (≈45%) is consistent with global research indicating that cardiovascular patients rely heavily on medicinal plants. It is generally known that common herbs such as ginseng, garlic, and hawthorn interact pharmacodynamically and pharmacokinetically with cardiovascular drugs. Hawthorn may intensify digoxin-like effects or induce hypotension, ginseng may disrupt glycemic regulation and anticoagulation, and garlic has been shown to increase antiplatelet and anticoagulant activities (16). The importance of including pharmacists in HF care teams to conduct thorough screening and provide patient education on herbal products is demonstrated by the lower prevalence of moderate and significant interactions in the intervention group.

These results are consistent with recommendations from cardiology and clinical-pharmacy organizations that support pharmacist participation in the management of chronic cardiovascular disease to enhance adherence, reduce drug-related risks, and facilitate shared decision-making (17). This study's repeated follow-ups and planned 15–20-minute pharmacist consultations were effective and practical for everyday cardiology practice.

The need for ongoing pharmacist integration in long-term HF therapy is highlighted by prior research, which has shown that adherence benefits may diminish once active intervention ends (18). Larger multicenter studies, extended follow-up, and assessment of hard clinical outcomes, including mortality, HF decompensation, and rehospitalizations, should all be part of future studies. Furthermore, further research is required to create standardized instruments and protocols for tracking medicinal plant–drug interactions, particularly in HF patients, given the high incidence of using herbal medicines.

The prospective controlled interventional design of this research, which improves the validity of causal conclusions about the effects of clinical pharmacist-led interventions on medication adherence and medicinal plant–drug interaction monitoring, is one of its main advantages. Robust and consistent data collection was assured by the use of a validated adherence instrument (MMAS-8), planned counseling sessions, and repeated follow-ups at various time points. At the same time, the appropriate sample size (n=230) provided sufficient statistical power to detect significant differences between groups, and random allocation reduced selection bias. The study's therapeutic significance was further reinforced by a thorough evaluation of herb-drug interactions and medicinal plant usage utilizing standardized drug-interaction databases. Furthermore, the inclusion of actual heart failure patients from a large tertiary care facility improves the results' applicability to comparable groups who heavily rely on herbal treatments.

Despite its advantages, this research has several shortcomings. The results may not be entirely applicable to primary-care settings, rural populations, or areas with distinct herbal medicine use trends since the study was limited to a single tertiary care facility. Recall or social-desirability bias may be introduced by relying too heavily on self-reported adherence measures, such as MMAS-8. Even though follow-ups were conducted regularly, the comparatively short period (six months) makes it difficult to assess the long-term durability of interaction avoidance and adherence gains. Clinical outcomes that may have shed more light on the clinical effects of pharmacist-led therapies, such as hospitalization, HF aggravation, or death, were not measured in this research. Furthermore, the dosage, frequency, and source of medicinal plants were not quantified, limiting the ability to evaluate dose-response correlations or variations in product quality.

Conclusion

This research shows that interventions guided by clinical pharmacists are essential for increasing medication adherence and promoting the safe use of medicinal plants in patients with heart failure. When compared to standard therapy, structured counseling, frequent follow-up, and thorough screening for herb-drug interactions produced noticeably greater adherence levels, fewer adverse events, and more successful resolution of observed interactions. The inclusion of a clinical pharmacist in the HF care team was crucial in addressing the hidden hazards associated with complementary treatments, since over half of the patients reported using medicinal plants. These results demonstrate the need for pharmacist participation as a workable, empirically supported approach to enhance multidisciplinary HF treatment, improve patient education, and optimize pharmacological therapy. To further verify and broaden the efficacy of pharmacist-driven treatments across various clinical settings, longer follow-up and more comprehensive clinical outcomes are necessary.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC--24)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared no conflict of interest.

Author Contribution

MSK, MZK, FA
Contributed to study design, data collection, and initial manuscript drafting
Assisted in data acquisition, literature review, and manuscript editing
Performed statistical analysis and contributed to the interpretation of results
SB, NUJ, ZI
Helped in methodology development, data organization, and manuscript formatting
Contributed to patient recruitment, data entry, and results compilation
Assisted in referencing, proofreading, and final revisions of the manuscript
HMA, AAU
Guided study execution and critically reviewed the manuscript
Supervised the research, coordinated among authors, finalized the manuscript, and approved the final version

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the study's integrity.

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