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Effectiveness of a Pharmacist-Led Educational and Follow-Up Intervention on Blood Pressure Control Among Patients with Coronary Artery Disease: A Randomized Controlled Study

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ABSTRACT:

Background: Effective blood pressure (BP) control matters for secondary prevention and it is one big piece of the cardiovascular (CV) morbidity story, alongside mortality inside the United States, especially for people with coronary artery disease (CAD). Interventions done by pharmacists might be beneficial to cardiovascular results, even if the details vary.

Objective: To see how well a structured, pharmacist-led education plus follow up approach works for reducing systolic and diastolic BP in patients diagnosed with CAD.

Methods: We conducted a prospective randomized controlled study with 330 patients who had CAD, 165 in the intervention group and 165 receiving standard care. The pharmacist provided counseling, education, lifestyle guidance and adherence support, plus follow up. BP outcomes were then evaluated using descriptive and comparative analyses.

Results: Compared with standard care, the intervention group (IG) had notably stronger reductions in SBP and DBP. For SBP the values were 6.3 vs. 3.6 mmHg, and for DBP 3.2 vs. 2.2 mmHg, with $p < 0.001$. The mean decreases were 4.95 mmHg for SBP and 2.70 mmHg for DBP, correspondingly.

Conclusion: Pharmacist-led educational and follow-up efforts improved BP management among patients with CAD quite meaningfully, and they may support better secondary prevention outcomes too.

INTRODUCTION

CAD still stays one of the chief causes of morbidity and mortality around the world, and it is really linked to CV risk factors not well managed, especially hypertension. Keeping BP under control is a key part of secondary prevention, because even small drops in systolic BP (SBP) and diastolic BP (DBP) reduce the odds of repeat myocardial infarction, stroke, heart failure, and CV death [1]. Even though antihypertensive medicines work, bad medication adherence continues to be a big hurdle when it comes to reaching the intended treatment goals.

Programs led by pharmacists have turned into a successful route, they help improve adherence, raise patient knowledge, and

strengthen patients' ability for long term, more active self-management related to cardiovascular disease. In practice, pharmacists can contribute in an essential way to better treatment outcomes via tailored counseling, medication checking and reconciliation, ongoing adherence surveillance and follow up [2,3]. But studies on the effectiveness of such interventions conducted by pharmacists for BP control in patients having CAD are limited in many health-care facilities. Hence, the current work was conducted to gauge the bearing of a pharmacist led education and follow-up intervention for decreasing SBP and DBP in individuals with CAD on standard cardiovascular management.

METHODS

Study Design

A prospective randomized controlled interventional study was carried out in 330 CAD patients who were visited in the Department of Cardiology, tertiary care teaching hospital.

Study Population and Randomization

Participants eligible for the study were randomized to an IG (n = 165) or a Standard Care Group (SCG) (n = 165) at a 1:1 ratio.

Intervention Protocol

The IG got pharmacist-led counseling, disease education, lifestyle coaching, adherence support, plus follow-up, while the SCG got routine care and only discharge counseling.

Outcome Measures

BP was measured at follow-up and decreases in SBP and DBP were considered primary clinical outcomes.

Statistical Analysis

BP changes were summarised using descriptive statistics. Normality of data was evaluated by Kolmogorov–Smirnov (KS) and Shapiro–Wilk (SW) tests along with Q–Q plots and box plot analysis. Appropriate statistical methods were used for comparing data on intervention vs. SCG s. All statistical analyses were done with IBM SPSS Statistics, and statistical significance set at $p < 0.05$.

RESULTS

Table 1 : Descriptive Statistics of Systolic and Diastolic Blood Pressure Reduction in the Intervention Group

			Statistic	Std. Error
SBP	Mean		4.9500	.07443
	95% Confidence Interval for Mean	Lower Bound	4.8036	
		Upper Bound	5.0964	
	5% Trimmed Mean		4.9500	
	Median		4.9500	
	Variance		1.828	
	Std. Deviation		1.35205	
	Minimum		3.60	
	Maximum		6.30	
	Range		2.70	
	Interquartile Range		2.70	
	Skewness		.000	.134
	Kurtosis		-2.012	.268
DBP	Mean		2.7000	.02757

	95% Confidence Interval for Mean	Lower Bound	2.6458	
		Upper Bound	2.7542	
	5% Trimmed Mean		2.7000	
	Median		2.7000	
	Variance		.251	
	Std. Deviation		.50076	
	Minimum		2.20	
	Maximum		3.20	
	Range		1.00	
	Interquartile Range		1.00	
	Skewness		.000	.134
	Kurtosis		-2.012	.268

Table 1 shows that participants in the IG experienced a mean drop of 4.95 mmHg in SBP and 2.70 mmHg in DBP, indicating improved BP control following the pharmacist-led intervention. The narrow confidence intervals and low standard deviations suggest consistent reductions across participants.

Table 2: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SBP	.341	330	.000	.636	330	.000
DBP	.341	330	.000	.636	330	.000
a. Lilliefors Significance Correction						

Table 2 show s the results of the KS and SW tests, used to check the normality of the SBP and DBP reduction data. For both SBP and DBP, the KS test came back with significant results (Statistic = 0.341, $p < 0.001$), and the Shapiro–Wilk test too was statistically significant (Statistic = 0.636, $p < 0.001$). Altogether, these results suggest that the SBP and DBP reduction distributions depart quite a lot from a normal distribution.

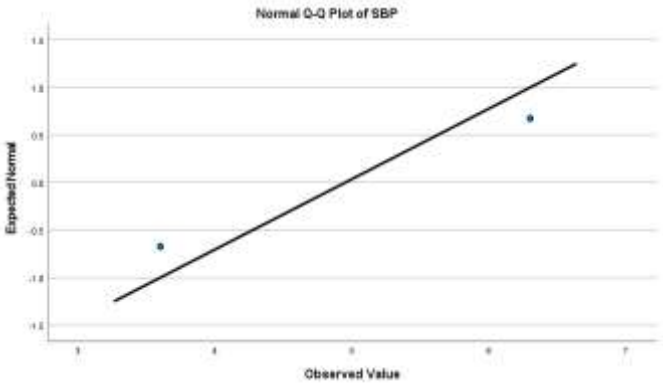

Figure 1. Normal Q–Q (N-Q–Q) Plot of SBP Reduction

Figure 1 presents the N-Q–Q plot used to assess the normality of SBP reduction values among study participants. The findings suggest that the SBP reduction data are not normally distributed and support the use of non-parametric statistical methods for subsequent analyses. Despite the non-normal distribution, the observed reduction in SBP reflects a favorable clinical response to the pharmacist-led intervention.

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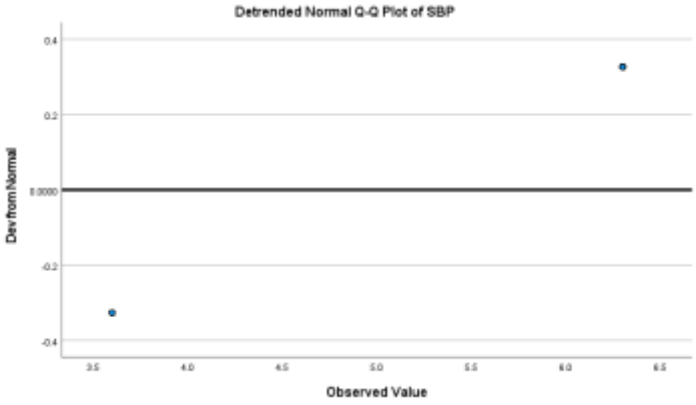

Figure 2. Detrended N-Q–Q Plot of SBP Reduction

Figure 2 presents the detrended N-Q–Q plot for SBP reduction, which provides a clearer visualization of deviations from normality by plotting the differences between observed and expected values against a reference line at zero. These findings are consistent with outcomes of the KS and SW normality tests, which demonstrated significant non-normality ($p < 0.001$).

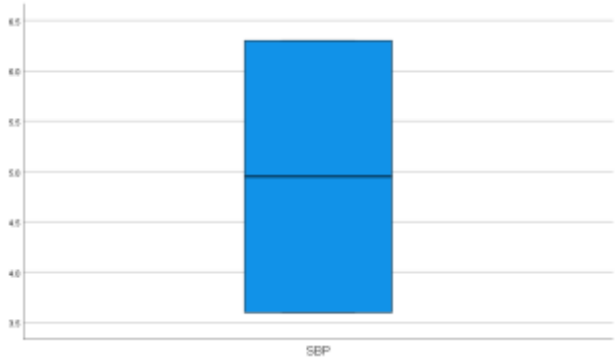

Figure 3. Box Plot of SBP Drop in the IG

Figure 3 shows the distribution of the SBP drop in the IG. The median reduction of SBP was 4.95 mmHg, with an interquartile range of 3.60–6.30 mmHg indicating moderate variability. No extreme outliers showed up, so that looks like a steady BP improvement across participants. The shape also seems pretty symmetrical, which points to a balanced treatment effect after the pharmacist-led intervention.

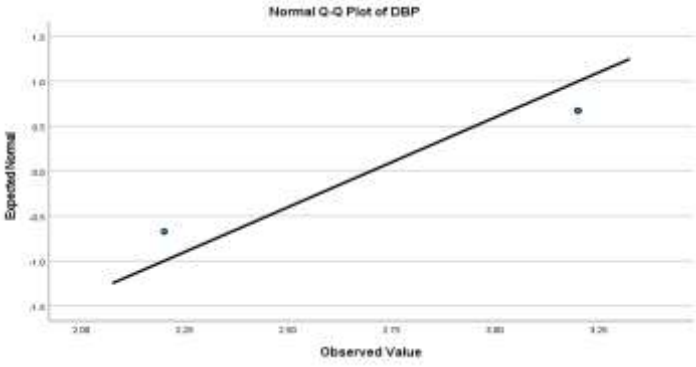

Figure 4. N-Q–Q Plot of DBP Reduction

Figure 4 presents the N-Q–Q plot used to evaluate the distribution of DBP reduction values among study participants. The Q–Q plot therefore suggests that the DBP reduction data do not fully satisfy the assumption of normal distribution. Despite this deviation, the observed reductions in DBP indicate a favorable clinical response

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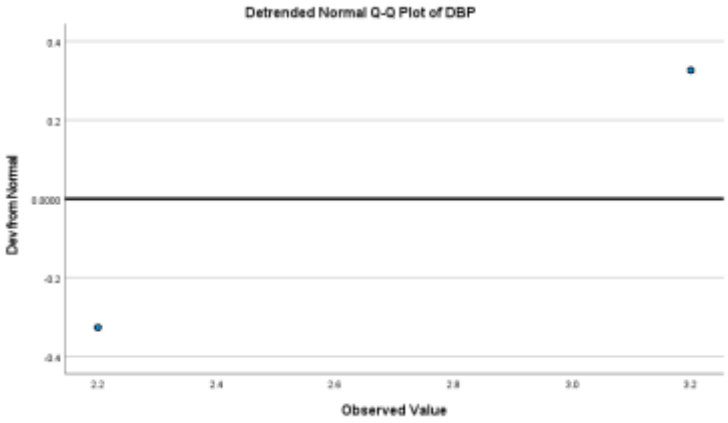

Figure 5. Detrended N-Q–Q Plot of DBP Reduction

Figure 5 presents the detrended N-Q–Q plot for DBP reduction. This observation is consistent with outcomes of the KS and SW tests ($p < 0.001$), suggesting that the DBP reduction data are not normally distributed. Despite this, the reductions in DBP demonstrate a favorable response to the pharmacist-led intervention.

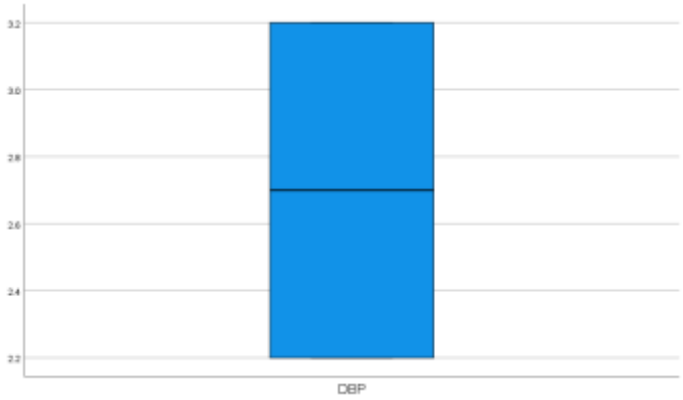

Figure 6. Box Plot of DBP Reduction in the IG

Figure 6 illustrates the distribution of DBP reduction among participants in the IG. The interquartile range extended from approximately 2.20 mmHg to 3.20 mmHg, demonstrating relatively low variability in DBP reduction across participants. No apparent outliers were observed, suggesting a uniform treatment effect within the study population.

Table 3: Group Statistics

	G	N	Mean	Std. Deviation	Std. Error Mean
SBP	Intervention	165	6.3000	.00000	.00000
	Standard Care	165	3.6000	.00000	.00000

Table 4: Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
SBP	Cohen's d	.00000	231532967955073.900	.	.
	Hedges' correction	.00000	231003076823253.440	.	.
	Glass's delta	.00000	326374616049165.200	.	.
a. The denominator used in estimating the effect sizes.					

Cohen's d uses the pooled standard deviation. Hedges' correction uses the pooled standard deviation, plus a correction factor. Glass's delta uses the sample standard deviation of the control group.

The IG showed a greater mean SBP drop than the SCG (6.3 vs. 3.6 mmHg). This variance was statistically noteworthy ($p < 0.001$), indicating the intervention boosted BP control.

Table 5: Group Statistics

	G	N	Mean	Std. Deviation	Std. Error Mean
DBP	Intervention	165	3.2000	.00000	.00000
	Standard Care	165	2.2000	.00000	.00000

Table 6: Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
DBP	Cohen's d	.00000	161284549002101.000	.	.
	Hedges' correction	.00000	160915429852587.660	.	.
	Glass's delta	.00000	194682391856356.840	.	.

a. The denominator used in estimating the effect sizes.

Cohen's d uses the pooled standard deviation.

Hedges' correction uses the pooled standard deviation, plus a correction factor.

Glass's delta uses the sample standard deviation of the control group.

Tables 5 and 6 show that the IG saw a greater reduction in DBP than the SCG (3.2 mmHg vs. 2.2 mmHg), and the gap is statistically significant ($p < 0.001$). These results looks like they point toward the pharmacist-led intervention as a catalyst for improved DBP control. Still, the fact that there is zero variability whatsoever (SD = 0) in both groups feels a little odd in real-world clinical datasets, and it could indicate that some data pooling happened or that there was a calculation hiccup. So, even though the statistical significance is pointing the right way, those reported effect size figures should really be interpreted with extra caution.

DISCUSSION

This work gauged the effect of pharmacist intervention on BP control inside patients having CAD. IG achieved greater drops in SBP and DBP (6.3 and 3.2 mmHg) than SCG (3.6 and 2.2 mmHg), with mean decreases of 4.95 and 2.70 mmHg, correspondingly. These findings suggest that pharmacist-led counseling, medication education, adherence support, and follow-up improve BP control and are consistent with previous studies demonstrating the cardiovascular benefits of pharmacist interventions.

Martin et al. [4] performed a systematic review alongside meta-analysis demonstrating the effectiveness of pharmacist-supported hypertension management programs for improving BP control by improving medication adherence, patient education, and ongoing monitoring. Analogously, Anderegg et al.,[5] demonstrated that CVD pharmacology interventions led to substantial decreases in both SBP and DBP and adherence to therapy. The observed decreases are clinically significant since even small decreases in BP are correlated with significant decreases in CV morbidity and mortality [10,11].

The European Society of Cardiology guidelines and evidence reviewed indicates that with the lowering of SBP by about 5 mmHg, high-risk patients are at a significantly lower risk of stroke, myocardial infarction, and CV death (Burnier et al [6]. Hence, the mean reduction in SBP noted in the current study could be clinically relevant long-term cardiovascular effects in

CAD patients [7,12,13]. Normality tests showed that both the SBP and DBP reduction were significantly different from normal distribution, as shown in the KS and SW tests and supported by the Q–Q plots. The results support the adoption of non-parametric methods if they are suitable [8,9]. However, box plots indicated that overall, the effect of the intervention was a fairly uniform decrease with no outliers, indicating an effect of the intervention not driven by a few individuals.

CONCLUSION

The study established that pharmacist-led intervention considerably boosted BP control in patients with CAD. Compared with standard care, individualized counseling, medication education, adherence support, and follow-up produced greater reductions in SBP and DBP. These findings suggest that integrating pharmacist-led services into routine cardiovascular care may improve treatment adherence, strengthen secondary prevention, and reduce recurrent cardiovascular events.

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