JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

https://doi.org/10.61919/k3dg5019

Original Article

Descriptive Study of Non-Pharmacological Strategies Actually Used by Patients with Resistant Hypertension in Daily Life

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ABSTRACT

Background: Resistant hypertension remains a major clinical challenge because many patients continue to have uncontrolled blood pressure despite multidrug therapy, and little is known about how they use non-pharmacological and complementary strategies in routine life. Objective: To document the types, frequency, and self-perceived effectiveness of lifestyle and complementary non-pharmacological strategies used by adults with resistant hypertension in an urban Pakistani setting. Methods: A descriptive cross-sectional study was conducted over four months in the Islamabad–Rawalpindi region among 72 adults aged 30-70 years with resistant hypertension. Participants were recruited from outpatient clinics, community pharmacies, and patient support settings. Data were collected through face-to-face interviews using a structured questionnaire assessing dietary practices, physical activity, sleep hygiene, herbal therapies, and relaxation or meditation practices. Self-perceived effectiveness was rated on a 5-point Likert scale, and recent blood pressure readings were extracted from patient-held records. Continuous and categorical data were summarized descriptively, and correlations and group comparisons were examined using Pearson correlation and independent-samples t-tests. Results: DASH-style dietary modification was the most commonly used strategy (61.1%), while relaxation or meditation had the highest mean perceived effectiveness score (3.9 ± 0.8). The number of strategies used was positively correlated with overall perceived effectiveness ($r = 0.34$, $p = 0.004$), and physical activity was inversely correlated with systolic blood pressure ($r = -0.29$, $p = 0.017$). Physically active participants reported higher effectiveness scores than inactive participants (3.8 ± 0.7 vs 3.2 ± 0.9; $p = 0.012$). Conclusion: Adults with resistant hypertension commonly adopt multiple self-management strategies beyond medication, with relaxation-based approaches and physical activity showing particularly favorable perceived benefit. Integrating patient-reported lifestyle and complementary practices into routine care may support more patient-centered hypertension management. Keywords: resistant hypertension; self-management; lifestyle modification; complementary therapies; physical activity; DASH diet; perceived effectiveness; Pakistan

"Cite this Article" | **Received**: 02 February 2026; **Accepted**: 13 March 2026; **Published**: 15 March 2026

Author Contributions: Concept: AB; Design: CD; Data Collection: EF; Analysis: GH; Drafting: IJ

Ethical Approval: Isra University, Hyderabad, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest; **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: N/A.

INTRODUCTION

Hypertension remains one of the leading modifiable contributors to cardiovascular morbidity and mortality worldwide and continues to impose a substantial burden despite the availability of multiple effective antihypertensive agents (1). Although blood pressure can be controlled in many patients through standard pharmacological regimens, a clinically important subgroup continues to have persistently elevated blood pressure despite multidrug therapy, thereby meeting the operational definition of resistant hypertension (2). This condition is associated with a markedly increased risk of stroke, myocardial infarction, heart failure, chronic kidney disease, and premature death, making it one of the most challenging phenotypes in routine cardiovascular care (3). Resistant hypertension is not solely a pharmacological problem; rather, it reflects a complex interaction between biological

mechanisms, treatment burden, behavioral adherence, psychosocial stressors, sleep patterns, dietary habits, body weight, and broader social determinants that shape how blood pressure is managed outside the clinic (4).

Non-pharmacological strategies have long been recognized as integral to the prevention and management of hypertension and are routinely recommended alongside drug therapy (5). Dietary sodium restriction, adherence to DASH-style eating patterns, regular physical activity, weight reduction, improved sleep hygiene, moderation of tobacco and stimulant exposure, and stress reduction techniques are all known to contribute to blood pressure control through complementary physiological pathways, including improved vascular function, reduced sympathetic activation, enhanced metabolic regulation, and better overall cardiovascular resilience (6). In parallel with these guideline-aligned measures, many patients also adopt complementary practices such as herbal remedies, breathing exercises, meditation, spiritual coping, and traditional self-care approaches. These practices are often shaped by personal beliefs, cultural norms, cost considerations, family influence, and prior experiences with formal healthcare systems, particularly in settings where pluralistic health-seeking behavior is common (7). For patients living with resistant hypertension, such strategies may represent not only attempts to lower blood pressure but also efforts to regain personal control over a condition perceived as difficult to manage through medication alone (8).

Despite the clinical importance of these behaviors, much of the existing literature has focused primarily on efficacy under structured or experimental conditions rather than on real-world patient practice (9). Controlled trials and supervised interventions have demonstrated that specific lifestyle measures can reduce blood pressure, yet such studies often involve selected populations, intensive monitoring, standardized implementation, and levels of support that differ substantially from daily living conditions. Consequently, an important evidence gap remains regarding which non-pharmacological and complementary strategies are actually used by adults with resistant hypertension in routine life, how frequently these strategies are practiced, and how patients themselves judge their usefulness within the constraints of their own environments. This gap is especially relevant because self-perceived effectiveness is closely linked to motivation, adherence, and long-term sustainability. Strategies perceived as beneficial are more likely to be maintained, whereas those seen as ineffective may be discontinued even when physiologically promising, thereby affecting both behavioral persistence and clinical outcomes over time (10).

This question is particularly relevant in urban Pakistani settings, where patients commonly navigate a mixed healthcare environment that includes biomedical treatment, informal health advice, community-based practices, and traditional remedies. Exposure to multiple sources of health information may encourage the simultaneous use of guideline-based lifestyle changes and complementary approaches, yet empirical patient-level data on these practices among individuals with resistant hypertension remain scarce. Without such data, clinicians may underestimate the extent of self-directed self-management, overlook potentially relevant complementary practices, and miss opportunities for culturally responsive counseling. The present study was therefore designed to document the types, frequency, and self-perceived effectiveness of non-pharmacological and complementary strategies used by adults with resistant hypertension in daily life in the Islamabad–Rawalpindi region. The central research question was whether patients with resistant hypertension actively employ multiple lifestyle and complementary strategies as part of routine self-management, and which of these strategies are perceived by patients as most effective in supporting blood pressure control and day-to-day disease management.

MATERIALS AND METHODS

This study was conducted as a descriptive cross-sectional observational investigation over a four-month period in the Islamabad–Rawalpindi region, an urban setting selected because of its dense outpatient care network, wide availability of both conventional and complementary health services, and substantial

burden of chronic cardiometabolic disease in routine practice (11). Data collection was undertaken across outpatient cardiology and internal medicine clinics, selected community pharmacies, and patient support settings in order to capture a real-world sample of adults managing resistant hypertension beyond a single institutional context. The study period extended from the beginning of the recruitment phase through completion of questionnaire administration and extraction of recent blood pressure records, allowing all participants to be assessed within the same operational timeframe.

Eligible participants were adults aged 30 to 70 years with documented resistant hypertension, operationally defined as persistently uncontrolled blood pressure despite the concurrent use of at least three antihypertensive agents of different classes, including a diuretic, or controlled blood pressure requiring four or more antihypertensive medications. Participants were required to have lived with the diagnosis for at least one year and to report current use of at least one non-pharmacological or complementary strategy in addition to prescribed treatment. Individuals with secondary hypertension, pregnancy-related hypertension, advanced chronic kidney disease, or cognitive impairment that could compromise reliable self-reporting were excluded. Participants were recruited through consecutive screening at the selected data collection sites. Potentially eligible individuals were approached in person, the purpose of the study was explained, and written informed consent was obtained prior to participation. This recruitment approach was selected to enhance feasibility while reducing overt selection based on investigator preference and preserving the descriptive intent of the study (12).

Data were collected through face-to-face interviewer-administered interviews using a structured questionnaire developed from established hypertension self-management domains and adapted for the local context. Before formal data collection, the questionnaire underwent content review for clarity, sequence, and contextual relevance, and interviewers were oriented to a standardized administration procedure to reduce variability in prompting, interpretation, and recording. The instrument captured demographic data, clinical history, duration of hypertension, medication burden, body mass index, and recent blood pressure values from patient-held records documented within the preceding three months. It also assessed routine non-pharmacological practices, including dietary modification consistent with DASH-style principles, physical activity behavior, sleep hygiene measures, and use of complementary practices such as herbal remedies, relaxation techniques, breathing exercises, and meditation. For each strategy, participants were asked whether they used it, how often they used it, and how effective they perceived it to be. Self-perceived effectiveness was rated on a five-point Likert scale ranging from no benefit to very effective. To improve reproducibility, all participants were interviewed in the same sequence of questionnaire items, and responses were entered using a predefined coding framework immediately after collection to minimize transcription error (13).

The primary descriptive variables were the types and frequency of non-pharmacological and complementary strategies used and their self-perceived effectiveness scores. Key clinical contextual variables included age, sex, duration of hypertension, body mass index, number of prescribed antihypertensive medications, and most recent systolic and diastolic blood pressure readings. Physical activity status was categorized according to whether participants reported achieving at least 150 minutes of moderate-intensity activity per week. Dietary adherence was categorized according to responses indicating lower versus higher alignment with DASH-style recommendations. The number of non-pharmacological strategies used by each participant was calculated as a cumulative count to examine whether broader self-management engagement was associated with higher perceived benefit. Because medication adherence, disease duration, and lifestyle patterns may influence both blood pressure control and perceptions of benefit, these variables were captured and considered during interpretation and subgroup comparisons to reduce uncontrolled confounding in the descriptive analysis (14).

A target sample size of 72 participants was considered appropriate for this study on the basis of feasibility, study duration, and the descriptive objective of characterizing variation in patient-reported self-management practices within a defined clinical population. This sample size was sufficient to estimate

the frequency of commonly used strategies and to permit exploratory comparison of mean perceived effectiveness across key behavioral subgroups without overextending recruitment capacity within the study window. Data were entered into statistical software using double-check verification against source forms to enhance data integrity. Continuous variables were assessed for distributional normality using the Shapiro–Wilk test and were summarized as means with standard deviations when approximately normally distributed. Categorical variables were summarized as frequencies and percentages. Pearson correlation analysis was used to examine associations between the number of strategies used and self-perceived effectiveness scores, as well as between activity-related measures and recent systolic blood pressure where assumptions were met. Independent-samples t-tests were used to compare mean effectiveness scores between physically active and inactive participants, and one-way analysis of variance was planned for comparison across categories of complementary therapy use. Records with missing information on a given variable were excluded only from analyses involving that specific variable, while all available data were retained for the remaining analyses. A two-sided p-value of less than 0.05 was considered statistically significant.

The study was conducted in accordance with accepted ethical principles for human participant research. Participation was voluntary, written informed consent was obtained from all participants, and identifiable personal information was not included in the analytical dataset. Interview responses and extracted clinical information were handled confidentially and used solely for research purposes. The overall methodological approach was designed to prioritize patient-reported real-world experience while maintaining procedural consistency, transparent variable definitions, and reproducible data handling suitable for descriptive observational research.

RESULTS

A total of 84 patients were approached across outpatient clinics, community pharmacies, and patient support settings in the Islamabad–Rawalpindi region. Of these, 76 fulfilled the eligibility criteria and 4 declined participation because of time constraints, yielding a final analytical sample of 72 participants and a response rate of 94.7%. Complete interview and questionnaire data were available for all enrolled participants, while recent documented blood pressure records from the preceding three months were retrievable for 68 participants (94.4%). The sample was predominantly male, urban-residing, and had a long-standing history of hypertension despite multidrug treatment, supporting the clinical profile of a resistant hypertension population. The mean age was 56.2 ± 9.8 years, the mean duration of hypertension was 9.1 ± 4.6 years, and participants were taking a mean of 3.4 ± 0.7 antihypertensive agents. Adiposity was common, with a mean body mass index of 29.1 ± 3.8 kg/m², and 45 of 72 participants (62.5%) were overweight or obese. Despite ongoing pharmacotherapy, the mean recorded systolic and diastolic blood pressures remained elevated at 151.6 ± 12.4 mmHg and 94.8 ± 7.9 mmHg, respectively, confirming persistent suboptimal control in routine care (Table 1).

Use of non-pharmacological and complementary strategies was frequent, although the degree of adoption varied across domains. DASH-style dietary modification was the most commonly reported strategy, used by 44 participants (61.1%; 95% CI: 49.9% to 72.4%), followed by sleep hygiene practices in 38 participants (52.8%; 95% CI: 41.3% to 64.3%), herbal therapies in 32 participants (44.4%; 95% CI: 32.9% to 55.9%), regular physical activity in 28 participants (38.9%; 95% CI: 27.6% to 50.1%), and relaxation or meditation practices in 26 participants (36.1%; 95% CI: 24.9% to 47.4%). Among those using each strategy, the highest mean self-perceived effectiveness score was observed for relaxation or meditation at 3.9 ± 0.8, with an estimated 95% CI of 3.59 to 4.21, followed by DASH-style dietary modification at 3.6 ± 0.9 (95% CI: 3.33 to 3.87). Physical activity yielded a mean effectiveness score of 3.4 ± 1.0 (95% CI: 3.03 to 3.77), whereas sleep hygiene and herbal therapies showed lower mean scores of 3.2 ± 0.8 (95% CI: 2.95 to 3.45) and 3.1 ± 1.1 (95% CI: 2.72 to 3.48), respectively. These data indicate that the most widely adopted strategy was not necessarily the one perceived as most beneficial, with relaxation-

based practices showing the strongest subjective benefit despite being less commonly used than dietary modification (Table 2).

Exploratory correlational analysis showed that broader engagement in self-management behaviors was associated with higher perceived benefit. The cumulative number of non-pharmacological strategies used was positively correlated with the overall self-perceived effectiveness score ($r = 0.34$, 95% CI: 0.12 to 0.53; $p = 0.004$), indicating a modest but statistically significant association. Higher physical activity level was inversely correlated with systolic blood pressure ($r = -0.29$, 95% CI: -0.49 to -0.06; $p = 0.017$), suggesting that participants reporting greater activity tended to have lower recent systolic values. In addition, better DASH adherence was positively associated with higher effectiveness ratings ($r = 0.26$, 95% CI: 0.03 to 0.47; $p = 0.031$). Although these correlations were modest in magnitude, all three findings were statistically significant and clinically directionally coherent with established self-management principles (Table 3).

Between-group comparison further demonstrated that participants meeting the threshold for regular physical activity reported significantly greater perceived benefit from their non-pharmacological strategies than physically inactive participants. The mean effectiveness score was 3.8 ± 0.7 in the physically active group and 3.2 ± 0.9 in the inactive group, giving a mean difference of 0.60 points (95% CI: 0.15 to 1.05; $p = 0.012$). The standardized effect size for this comparison was moderate (Cohen's $d = 0.73$), indicating that the difference was not only statistically significant but also clinically meaningful in magnitude. No statistically significant differences in overall effectiveness scores were observed by sex or by duration of hypertension in the available comparisons, although these secondary contrasts were smaller and should be interpreted cautiously given the modest sample size (Table 4).

Taken together, the findings show that adults with resistant hypertension in this urban Pakistani sample were actively engaged in multiple self-directed non-pharmacological and complementary practices, with perceived benefit differing meaningfully by strategy type and behavioral intensity. The overall pattern suggests that patients who adopted more comprehensive self-management approaches, especially those incorporating physical activity and relaxation-based practices, reported greater subjective benefit alongside persistent but variably controlled blood pressure in routine living conditions.

Table 1. Baseline Demographic and Clinical Characteristics of Participants (N = 72)

Variable	Category / Statistic	Value
Age (years)	Mean ± SD	56.2 ± 9.8
Sex	Male, n (%)	42 (58.3)
Sex	Female, n (%)	30 (41.7)
Marital status	Married, n (%)	59 (81.9)
Residence	Urban, n (%)	55 (76.4)
Duration of hypertension (years)	Mean ± SD	9.1 ± 4.6
Antihypertensive drugs	Mean ± SD	3.4 ± 0.7
BMI (kg/m²)	Mean ± SD	29.1 ± 3.8
Overweight/obese	n (%)	45 (62.5)
Systolic BP (mmHg)	Mean ± SD	151.6 ± 12.4
Diastolic BP (mmHg)	Mean ± SD	94.8 ± 7.9

Table 2. Use of Lifestyle and Complementary Strategies with Perceived Effectiveness

Strategy	Users, n (%)	95% CI for proportion	Effectiveness score (Mean ± SD)	95% CI for mean effectiveness
DASH-style diet	44 (61.1)	49.9 to 72.4	3.6 ± 0.9	3.33 to 3.87
Regular physical activity	28 (38.9)	27.6 to 50.1	3.4 ± 1.0	3.03 to 3.77
Sleep hygiene practices	38 (52.8)	41.3 to 64.3	3.2 ± 0.8	2.95 to 3.45
Herbal therapies	32 (44.4)	32.9 to 55.9	3.1 ± 1.1	2.72 to 3.48
Relaxation / meditation	26 (36.1)	24.9 to 47.4	3.9 ± 0.8	3.59 to 4.21

Table 3. Correlation Analysis of Key Behavioral and Clinical Variables

Variable Pair	Correlation coefficient (r)	95% CI for r	p-value
Number of strategies used vs. overall effectiveness score	0.34	0.12 to 0.53	0.004
Physical activity level vs. systolic BP	-0.29	-0.49 to -0.06	0.017
DASH adherence vs. effectiveness score	0.26	0.03 to 0.47	0.031

Table 4. Comparative Analysis of Overall Perceived Effectiveness by Physical Activity Status

Group	n	Mean ± SD	Mean difference	95% CI of difference	Effect size (Cohen's d)	p-value
Physically active	28	3.8 ± 0.7	0.60	0.15 to 1.05	0.73	0.012
Physically inactive	44	3.2 ± 0.9	Reference	Reference	Reference	Reference

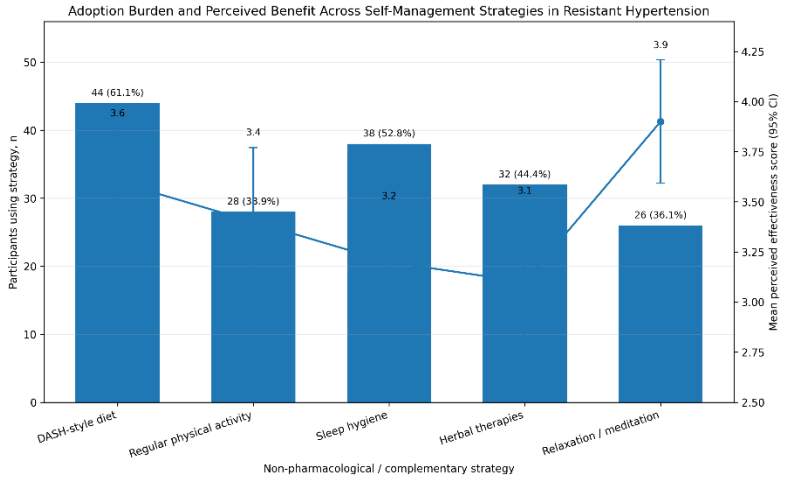

Figure 1 Adoption Burden and Perceived Benefit Across Self-Management Strategies in Resistant Hypertension

The figure demonstrates a clinically relevant divergence between strategy uptake and perceived benefit across self-management practices in resistant hypertension. DASH-style dietary modification had the highest adoption burden at 44 users (61.1%), yet its mean effectiveness score was 3.6, lower than relaxation or meditation, which was used by only 26 participants (36.1%) but achieved the highest perceived effectiveness at 3.9 with a relatively narrow 95% confidence interval of 3.59 to 4.21. Sleep hygiene and herbal therapies occupied an intermediate-to-lower position, with uptake rates of 52.8% and 44.4% and corresponding mean effectiveness scores of 3.2 and 3.1, respectively, while regular physical activity showed moderate adoption at 38.9% and a mean effectiveness of 3.4. This pattern suggests that relaxation-based strategies may be underutilized relative to their perceived benefit, whereas dietary strategies appear highly accepted but somewhat less strongly valued on a per-user basis, supporting the interpretation that self-management burden and subjective return are not linearly aligned across behavioral domains.

DISCUSSION

The present study showed that adults with resistant hypertension in an urban Pakistani setting were not passive recipients of pharmacological treatment, but were actively engaged in a broad range of self-management practices alongside prescribed medication. Dietary modification consistent with DASH principles was the most frequently reported strategy, whereas relaxation and meditation practices achieved the highest mean self-perceived effectiveness score. In addition, participants using a greater number of non-pharmacological strategies reported significantly higher overall effectiveness scores, and those meeting recommended physical activity levels demonstrated both higher perceived benefit and lower systolic blood pressure. Collectively, these findings suggest that real-world management of resistant hypertension extends well beyond formal drug regimens and includes a substantial behavioral and complementary component that deserves greater clinical attention (15).

These observations are consistent with the broader hypertension literature, which has repeatedly shown that lifestyle-based interventions remain central to blood pressure control even in the era of multidrug pharmacotherapy. International recommendations continue to emphasize sodium restriction, DASH-style dietary patterns, regular aerobic activity, weight reduction, moderation of alcohol intake, and sleep optimization as core elements of long-term hypertension management because of their cumulative vascular and metabolic effects (16,17). However, most evidence supporting these strategies has been derived from controlled trials or structured intervention programs rather than from patient-reported real-world practice. The present study contributes to this gap by demonstrating that such strategies are indeed being used outside research settings, although uptake and perceived utility vary considerably across domains. The high frequency of dietary modification in the current sample likely reflects the strong visibility of food-based advice in both clinical counseling and public health messaging, whereas the lower uptake of physical activity may indicate practical barriers such as time limitation, comorbidity burden, fear of exertional symptoms, and limited access to safe or convenient exercise environments (18).

A particularly notable finding was the comparatively high perceived effectiveness of relaxation and meditation practices despite their lower prevalence relative to diet and sleep hygiene. This pattern suggests that stress-modulating interventions may have a disproportionately meaningful role in the subjective experience of resistant hypertension. Such an interpretation is biologically plausible because chronic psychological stress, hyperarousal, autonomic imbalance, and poor sleep quality may all contribute to sympathetic overactivity and sustained blood pressure elevation. Mind-body interventions, including breathing exercises and meditation, have shown modest but clinically relevant antihypertensive effects in some populations, particularly when stress reactivity is prominent (19). Although the present study was not designed to establish causal efficacy, the high user-rated benefit of relaxation-based strategies indicates that these practices may be particularly valued by patients and may represent an under-discussed avenue for enhancing adherence and perceived control in difficult-to-treat hypertension.

The inverse association between physical activity and systolic blood pressure in this sample also aligns with established physiological evidence that habitual movement improves endothelial function, vascular compliance, insulin sensitivity, and autonomic regulation. Moreover, the moderate effect size observed in the comparison of effectiveness scores between physically active and inactive participants suggests that activity is associated not only with better clinical readings but also with more favorable patient appraisal of self-management benefit. This dual relevance is important because perception and behavior often reinforce one another in chronic disease management. Patients who experience even modest symptomatic or emotional improvement from activity may be more likely to sustain engagement, while those with better overall self-regulation may be more inclined to adopt several strategies simultaneously. The positive correlation between the cumulative number of strategies used and perceived overall effectiveness may therefore reflect both behavioral intensification and a broader sense of self-efficacy, which has been linked to adherence and improved chronic illness coping across diverse cardiovascular populations (20).

The study has several strengths. First, it focused specifically on resistant hypertension, a clinically important but comparatively understudied subgroup in behavioral research. Second, it captured patient-reported experience across multiple real-world settings rather than relying solely on a single institutional sample, thereby improving contextual relevance. Third, the inclusion of both guideline-based lifestyle measures and complementary therapies allowed a more comprehensive assessment of actual self-management behavior than studies restricted to conventional interventions alone. The high response rate and complete interview dataset further strengthen the descriptive value of the findings. At the same time, the study has important limitations that should temper interpretation. Its cross-sectional design precludes causal inference, and self-reported behavioral measures are vulnerable to recall bias and social desirability bias. The sample size, while adequate for descriptive and exploratory analysis,

remained modest and geographically restricted to an urban twin-city region, which may limit external validity. Blood pressure values were obtained from recent documented records rather than standardized study-specific measurement sessions, introducing possible variation in technique and timing. In addition, residual confounding from medication adherence, socioeconomic position, health literacy, and comorbid disease burden cannot be fully excluded (21).

These limitations also point to clear directions for future research. Longitudinal studies are needed to determine whether the self-management patterns identified here translate into sustained blood pressure improvement over time and whether certain combinations of strategies are more effective than others. Prospective interventional studies could examine whether structured counseling that explicitly integrates patient-preferred behavioral and complementary practices improves both adherence and blood pressure outcomes in resistant hypertension. Qualitative inquiry would also be valuable to clarify why specific strategies are adopted, how benefit is judged by patients, and what cultural, financial, or family-level influences shape continued use. Such work would help distinguish between transient experimentation and stable, meaningful behavioral integration. Broader multicenter studies involving rural and socioeconomically diverse populations would further strengthen generalizability and help identify context-specific barriers and facilitators relevant to hypertension care in South Asia and similar pluralistic health systems (22).

Overall, the findings indicate that non-pharmacological and complementary self-management practices are common among adults living with resistant hypertension and that perceived benefit differs meaningfully across intervention types. In particular, relaxation-based strategies appear to yield high subjective value despite lower uptake, while physical activity shows clinically coherent associations with both perceived effectiveness and systolic blood pressure. These observations underscore the importance of discussing lifestyle and complementary practices openly in routine care rather than assuming that pharmacological escalation alone defines the patient experience of resistant hypertension. A more patient-centered management model that recognizes lived behavior, perceived utility, and cultural context may strengthen therapeutic alliance and support more realistic, sustainable blood pressure control strategies in this high-risk population (23).

CONCLUSION

In this urban Pakistani sample, adults with resistant hypertension commonly used multiple non-pharmacological and complementary strategies alongside multidrug therapy, with dietary modification being the most prevalent and relaxation-based practices showing the highest perceived benefit. Greater use of combined self-management approaches was associated with higher overall effectiveness ratings, and regular physical activity was linked to both better perceived benefit and lower systolic blood pressure. These findings support the need for routine hypertension care to move beyond medication-focused management and incorporate patient-centered counseling that acknowledges actual self-care behavior, perceived utility, and culturally embedded complementary practices.

REFERENCES

1. Nnadi PN. Impact of non-pharmacological management of adult hypertension in home health [dissertation]. Grand Canyon University; 2025.

2. Zeba SA, Islam MS. Health practices among rural adults regarding prevention of hypertension [thesis]. Brac University; 2024.

3. Kabir MT. A pharmacist-led intervention to support type 2 diabetes self-management in community pharmacy settings of Pakistan [thesis]. University of Wollongong; 2024.

4. Tarimo NS. The development of a health promotion programme for clients with hypertension in Malawi [thesis]. University of the Western Cape; 2023.

5. Itua MO. Impact of culturally appropriate hypertension education with remote patient monitoring on adherence to antihypertensive medication among US African immigrants [dissertation]. D'Youville College; 2024.

6. Dahal P. Health economic assessment of a health behaviour intervention for type 2 diabetes mellitus management and care [thesis]. CQUniversity; 2025.

7. González-Rivas JP, Seyedi SA, Mechanick JI. Artificial intelligence enabled lifestyle medicine in diabetes care: a narrative review. Am J Lifestyle Med. 2025:15598276251359185.

8. Shan J, Cao Z, Yu S. Advances in understanding diabetic kidney disease progression and the mechanisms of acupuncture intervention. Int J Gen Med. 2024;17:5593-609.

9. Badi S, Suliman SZ, Almahdi R, Aldomah MA, Elkheir HK, Ibrahim MIM, et al. Impact of clinical pharmacist video-based education on self-care and glycemic control in Sudanese adults with type 2 diabetes: a pre-post interventional study. 2025;19:100617.

10. Monteiro S. Small voices, lasting changes: leveraging children's agency in family-centered hypertension care. Ethics International Press; 2025.

11. Lee JL. Impacting blood pressure in outpatient adults using the DASH diet [dissertation]. Grand Canyon University; 2025.

12. McCaskill TK. Controlling hypertension in the African American population through DASH diet education [dissertation]. 2025.

13. Hoppe KK. Improving outcome for young adults and birthing persons with hypertension [dissertation]. The University of Wisconsin-Madison; 2024.

14. Alnooh G, Alessa T, Noorwali E, Albar S, Williams E, de Witte LP, et al. Identification of the most suitable mobile apps to support dietary approaches to stop hypertension (DASH) diet self-management: systematic search of app stores and content analysis. J Med Internet Res. 2023;15(15):3476.

15. Kuo FC, Lin YT, Chueh TY, Chang YK, Hung TM, Chen YC. Breaking prolonged sitting increases 24-h physical activity and self-perceived energy levels but does not acutely affect cognition in healthy adults. Eur J Appl Physiol. 2024;124(2):445-55.

16. Darwish F. Knowledge, perception and adherence to lifestyle medicine pillars: a cross-sectional study among Lebanese adults [thesis]. 2023.

17. Macri R, Mollace R, Serra M, Scarano F, Ritorto G, Ussia S, et al. Nutritional and nutraceutical support to the failing myocardium: a possible way of potentiating the current treatment of heart failure. Nutrients. 2024;25(22):12232.

18. Jaswal H, Sohi I, Rehm J, Levesque C, Sangers N, Edalatis H, et al. [Incomplete citation provided]. 2024:104.

19. Kuzuya M, Kanno Y, Arai H, Nishiguchi S, Iijima K, Umegaki H, et al. Nutritional management guidelines for sarcopenia and frailty 2025. 2025;25:5-53.

20. Rizzato A. Exercise protocols with unstable devices to enhance the efficiency of neuromuscular mechanisms in postural control [thesis]. 2023.