

RESEARCH ARTICLE

Effectiveness of Leaflet-Based Health Education on Health Behaviour Change in Patients with Hypertension

Asyhariah B^{1*}, Stang², Ridwan Amiruddin³, A. Ummu Salmah⁴, Shanti Riskiyani⁴

¹Master's Program in Public Health, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

²Department of Biostatistics, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

³Department of Epidemiology, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

⁴Department of Health Promotion and Behavioral Sciences, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

Correspondence: Asyhariah B. Email: ash.asyhariah@gmail.com

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ABSTRACT

Introduction: Hypertension is among the leading chronic non-communicable diseases and requires sustained lifestyle modification to achieve long-term blood pressure control. Within primary healthcare settings, printed leaflets are commonly incorporated into patient education because they are affordable, simple to distribute, and practical for routine health promotion. However, previous research has produced inconsistent evidence regarding the effectiveness of leaflets in improving various health-related behaviours. Therefore, this study investigated whether leaflet-assisted health education influenced multiple lifestyle behaviours among patients with hypertension receiving care at UPTD Puskesmas Tampapadang.

Methods: A quasi-experimental pretest–posttest approach was undertaken among 174 adults with hypertension who were assigned to either an intervention or a control group. Participants in the intervention group ($n = 87$) received leaflet-assisted health education, whereas those in the control group ($n = 87$) received routine counselling without printed leaflets. Outcomes comprised physical activity, dietary behaviour, medication adherence, sleep quality, perceived stress, and nicotine dependence. Within-group changes were analysed using the Wilcoxon signed-rank test, whereas between-group differences in change scores were evaluated using the Mann–Whitney U test.

Results: Comparative analyses demonstrated statistically significant between-group differences in change-score distributions for medication adherence ($p = 0.010$), sleep quality ($p = 0.001$), and nicotine dependence ($p < 0.001$). No statistically significant between-group differences were identified for physical activity, dietary behaviour, or perceived stress. Between-group effect sizes were small.

Conclusion: The impact of leaflet-assisted health education differed according to the behavioural outcome evaluated. Between-group differences were detected for medication adherence, sleep quality, and nicotine dependence, but the small effect sizes and change-score directions did not support a uniform conclusion of greater improvement in the leaflet group. Printed leaflets may therefore serve as supportive educational resources in primary health care, particularly when integrated with complementary educational strategies.

Keywords: Hypertension; Leaflet; Medication Adherence; Primary Health Care; Diet; Nicotine Dependence

INTRODUCTION

Hypertension remains a major global public health challenge owing to its considerable contribution to cardiovascular morbidity and mortality. The World Health Organization estimated that 1.28 billion adults aged 30–79 years were living with hypertension in 2019, with almost two-thirds living in low- and middle-income countries (1,2). Although effective preventive strategies and treatments are available, blood pressure control remains inadequate in many settings. Indonesia continues to face substantial gaps in the early detection, treatment, and long-term control of hypertension.

In Indonesia, hypertension remains a priority non-communicable disease and continues to place a considerable burden on primary health care services. Evidence from three nationally representative health surveys indicates that hypertension prevalence rose from 27.9% in 2013 to 31.6% in 2023 (3). Likewise, findings from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia [SKI]) indicated that approximately one in three Indonesian adults has hypertension (4). Although the proportion of patients receiving antihypertensive medication increased from 10.4% to 22.4%, only 4.2% achieved adequate blood pressure control (3). These findings suggest that expanding treatment coverage alone is insufficient and should be accompanied by effective health promotion strategies that encourage sustained lifestyle modification and medication adherence.

At the regional level, routine health-service reports indicate that hypertension remains a continuing burden in West Sulawesi Province (5). In the service area of UPTD Puskesmas Tampapadang, local service records showed an increase in recorded hypertension cases from 1,210 in 2023 to 1,461 in 2024. Because routine case counts are influenced by service coverage and reporting practices, these figures should be interpreted as health-service data rather than population prevalence. Nevertheless, they support the need for sustained hypertension prevention, treatment, and health promotion at the primary-care level.

According to the World Health Organization, lifestyle modification is a cornerstone of hypertension management and includes a healthy diet, regular physical activity, smoking cessation, and reduction of other modifiable cardiovascular risk factors (1). These recommendations are reinforced by the 2024 European Society of Cardiology guideline, which places lifestyle measures at the foundation of hypertension management before and during pharmacological treatment (6). The International Society of Hypertension likewise emphasizes patients' active participation in sustained lifestyle change and adherence to prescribed treatment (7). Health promotion strategies should therefore extend beyond information delivery by facilitating and reinforcing long-term healthy behaviours in primary health care.

Health education is a health promotion strategy that supports behaviour change among patients with chronic diseases. Educational interventions may help reduce risky behaviours, strengthen protective behaviours, and support adherence to treatment recommendations (8). Beyond knowledge acquisition, health education can promote positive attitudes and healthier daily practices (9). In primary health care, printed leaflets are widely used because they are affordable, easy to distribute, and allow patients to revisit information after education sessions (10). In hypertension management, leaflet-assisted interventions have been associated with improvements in knowledge, self-efficacy, medication adherence, and self-care practices (8,11,12). Leaflets have also been combined with short-message services or counselling, although their independent contribution as a stand-alone intervention remains uncertain (13).

Although leaflet-based health education has been widely implemented among patients with hypertension, the available evidence remains inconsistent. Several studies have reported improvements in knowledge, adherence, self-efficacy, or self-care after leaflet-assisted education (11,12,14). In contrast, evidence on printed educational materials suggests that leaflets may be more effective when combined with other educational approaches rather than used as the sole behaviour-change strategy (9). These inconsistent findings suggest that effectiveness may vary across health-behaviour outcomes. Furthermore, most previous studies have focused on one or two outcomes, whereas simultaneous evaluation of multiple behaviour domains remains limited. This study therefore investigated whether leaflet-assisted health education was associated with changes in physical activity, dietary behaviour, medication adherence, sleep quality, perceived stress, and nicotine dependence among patients with hypertension attending UPTD Puskesmas Tampapadang.

METHODS

Research Type

This study adopted a quasi-experimental pretest–posttest design consisting of intervention and control groups. Individuals assigned to the intervention group received health education accompanied by printed leaflets, whereas participants in the control group received standard health counselling without leaflet materials. Eligible participants were selected through a simple random sampling procedure. Group assignment was not randomized following participant recruitment. Following enrolment, participants were assigned to the intervention or control group based on the scheduled Posbindu sessions within the UPTD Puskesmas Tampapadang service area before baseline data collection. Participants attending Posbindu sessions scheduled for leaflet-assisted education comprised the intervention group, whereas those attending routine counselling sessions without leaflets formed the control group. The same eligibility criteria were used for both study groups to reduce the risk of selection bias. Different implementation schedules were arranged for each group to minimise information exchange and reduce contamination between participants.

Population and Sample

The final analytical sample comprised 174 participants, with 87 participants in each study group. The original sample-size calculation worksheet was unavailable; consequently, the previously stated “paired-sample formula” and the derivation of the

assumed effect parameter could not be independently reproduced and are not reported. Participants meeting all predefined eligibility criteria were recruited using a simple random sampling approach.

Eligibility criteria included: (1) age ≥ 40 years with physician-diagnosed hypertension; (2) active registration at UPTD Tampapadang Community Health Center; (3) current antihypertensive medication use; and (4) willingness to provide written informed consent. Individuals with cognitive impairment, mental disorders affecting communication, hospitalization, or critical illness during the study period were excluded from participation.

Research Location

This study was conducted at UPTD Tampapadang Community Health Center (Puskesmas), Mamuju District, West Sulawesi Province, Indonesia. The research was performed from September to October 2025. UPTD Tampapadang serves as a primary healthcare facility responsible for hypertension prevention and control programs in the community.

Instrumentation or Tools

Data were collected using printed educational leaflets, structured questionnaires, and participants' medical records. The leaflet included the definition of hypertension, risk factors, symptoms, complications, healthy lifestyle practices, the importance of regular check-ups, treatment information, and motivational messages. Leaflet validity was assessed by two experts: one media expert evaluated visual design and presentation, and one content expert evaluated material accuracy, language, and contextual relevance. Feasibility was categorized as very feasible (85–100%), feasible (69–84%), moderately feasible (53–68%), less feasible (37–52%), not feasible (20–36%), and very infeasible (0–19%), following the feasibility classification described by Ernawati and Sukardiyono (15). Structured questionnaires were used for pre-test and post-test outcome assessment, and additional clinical information was extracted from medical records.

Outcome Measurement

Study outcomes were assessed using structured questionnaires and medical records. Medication adherence was assessed with the eight-item Morisky Medication Adherence Scale (MMAS-8), scored from 0 to 8, with higher scores indicating greater adherence; a score of 8 was classified as high adherence (16). Physical activity was measured using the 16-item World Health Organization Global Physical Activity Questionnaire (GPAQ) and expressed as MET-minutes per week; at least 600 MET-min/week was classified as sufficient activity (17). Dietary behaviour was evaluated using a study-specific modified 30-item Food Frequency Questionnaire (FFQ), scored from 0 to 150, with higher scores indicating healthier dietary practices; scores of 84 or higher were classified as good dietary behaviour. The item-level FFQ modifications and the derivation of the 84-point threshold were not documented in sufficient detail to permit independent replication. Perceived stress was measured using the 10-item Perceived Stress Scale (PSS-10), scored from 0 to 40, with higher scores indicating greater perceived stress (18). Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI); global scores range from 0 to 21, with higher scores indicating poorer sleep quality and scores greater than 5 indicating poor sleep quality (19). Nicotine dependence was assessed using the six-item Fagerström Test for Nicotine Dependence (FTND), scored from 0 to 10, with higher scores indicating greater nicotine dependence (20). For the inferential analyses reported in Tables 2 and 3, the smoking-related outcome is presented as the FTND total score.

Data Collection Procedures

Data collection began with a pretest using all study instruments. Subsequently, the intervention group received leaflet-based health education delivered by the researcher in two sessions (approximately 30 minutes per session) at a one-week interval. Participants were allowed to take the leaflet home for independent reading. The control group received routine health counseling covering the same educational content but without the use of leaflets. A posttest was conducted two weeks after the intervention using the same instruments. Demographic and clinical characteristics were obtained from participants' medical records. Blood pressure data were included only for baseline description and were not analysed as study outcomes.

Data Analysis

Statistical analyses were conducted using IBM SPSS Statistics, version 29 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarise baseline participant characteristics and study variables. Baseline characteristics were compared between groups using Pearson's chi-squared test. Changes within each group were evaluated using the Wilcoxon signed-rank test, whereas differences in change-score distributions between groups were examined using the Mann–Whitney U test. Change scores (Δ) were defined as follow-up minus baseline. Positive Δ values indicated improvement for physical activity, medication adherence, and dietary behaviour, whereas negative Δ values indicated improvement for PSS-10 perceived stress, PSQI sleep quality, and FTND nicotine dependence. Findings are presented as medians, interquartile ranges (IQRs), Z statistics, U statistics, effect sizes (r), and corresponding p values. Effect size was estimated as $r = Z/\sqrt{N}$. Statistical significance was defined as a two-sided p value < 0.05 .

Ethical Approval

Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Public Health, Hasanuddin University (Approval No. 2225/UN4.14.1/TP.01.02/2025) before participant recruitment commenced. All participants provided written informed consent before taking part in the study. Participant confidentiality was strictly maintained throughout the research process, and all collected information was used solely for research purposes in accordance with established ethical principles.

RESULTS

Table 1 presents the baseline demographic and clinical characteristics of the study participants.

Table 1. Baseline Demographic and Clinical Profile of the Study Participants (n = 174)

Characteristics	Categories	Intervention (n = 87)	Control (n = 87)	p-value
Gender	Male	10 (11.5%)	9 (10.3%)	0.808
	Female	77 (88.5%)	78 (89.7%)	
Age (years)	40–49	21 (24.1%)	27 (31.0%)	0.036
	50–59	29 (33.3%)	22 (25.3%)	
	60–69	30 (34.5%)	20 (23.0%)	
	≥70	7 (8.0%)	18 (20.7%)	
Education	Primary school (SD)	62 (71.3%)	55 (63.2%)	0.013
	Junior high school (SMP)	13 (14.9%)	17 (19.5%)	
	Senior high school (SMA)	6 (6.9%)	15 (17.2%)	
	Bachelor's degree (S1)	6 (6.9%)	0 (0.0%)	
Occupation	Farmer	36 (41.4%)	35 (40.2%)	0.118
	Housewife	47 (54.0%)	52 (59.8%)	
	Civil servant	4 (4.6%)	0 (0.0%)	
Hypertension stage	Stage 1 (140–159/90–99 mmHg)	27 (31.0%)	47 (54.0%)	0.002
	Stage 2 (≥160/≥100 mmHg)	60 (69.0%)	40 (46.0%)	

Data are expressed as frequency and percentage, n (%). Comparisons of baseline characteristics between the intervention and control groups were performed using Pearson's chi-square test.

As presented in Table 1, the study included 174 participants, with 87 allocated to the intervention group and 87 to the control group. Women constituted the majority of participants in both groups. No statistically significant between-group differences were observed in sex distribution or occupational status (both $p > 0.05$). In contrast, significant baseline differences were identified for age ($p = 0.036$), educational attainment ($p = 0.013$), and hypertension stage ($p = 0.002$), indicating that complete baseline comparability between the two groups was not achieved.

Table 2. Within-Group Changes in Health Behaviour Outcomes and Medication Adherence

Outcome	Group	Baseline Median (IQR)	Follow-up Median (IQR)	Z	p-value	Effect size (r)
Physical activity	Intervention	428 (480)	960 (780)	-8.102	<0.001	0.87
	Control	960 (780)	1340 (1140)	-4.618	<0.001	0.50
Medication adherence	Intervention	7 (2)	8 (2)	-5.251	<0.001	0.56
	Control	7 (2)	8 (2)	-4.243	<0.001	0.45
Dietary pattern	Intervention	83 (32)	84 (32)	-4.197	<0.001	0.45
	Control	83 (32)	84 (32)	-3.873	<0.001	0.42
Perceived stress (PSS-10)	Intervention	12 (9)	14 (8)	-3.734	<0.001	0.40
	Control	12 (9)	14 (8)	-2.908	0.004	0.31
Sleep quality	Intervention	6 (5)	5 (5)	-4.660	<0.001	0.50
	Control	7 (5)	5 (5)	-2.857	0.004	0.31
Nicotine dependence (FTND)	Intervention	0 (0)	0 (0)	-2.207	0.027	0.24
	Control	0 (0)	0 (0)	-2.692	0.007	0.29

Results are presented as median (IQR). Within-group differences were evaluated using the Wilcoxon signed-rank test, and effect size (r) was calculated as $r = Z/\sqrt{N}$. Higher scores indicate improvement for physical activity, medication adherence, and dietary behaviour; lower scores indicate improvement for perceived stress, sleep quality, and nicotine dependence.

Within the intervention group, statistically significant pre-test to post-test changes were observed for all six outcomes. Physical activity, medication adherence, and dietary behaviour increased, while sleep-quality scores decreased. Perceived-stress scores increased from a median of 12 to 14; because higher PSS-10 scores indicate greater stress, this change should not be interpreted as improvement. FTND medians remained 0 (IQR 0), although the Wilcoxon test indicated a statistically significant distributional change. Significant within-group changes were also observed in the control group. These within-group findings do not by themselves establish an intervention effect.

Table 3. Between-Group Differences in Change Scores for Medication Adherence and Health Behaviour Outcomes Using the Mann–Whitney U Test

Outcome	Δ Median (IQR) Intervention	Δ Median (IQR) Control	Mann–Whitney U	Z	p-value	Effect size (r)
Physical activity	200 (476)	280 (1060)	3620.0	-0.495	0.620	0.038
Medication adherence	0 (1)	0 (0)	3112.5	-2.563	0.010	0.194
Dietary pattern	0 (0)	0 (0)	3478.5	-1.308	0.191	0.099
Perceived stress (PSS-10)	0 (0)	0 (0)	3391.5	-1.654	0.098	0.125
Sleep quality	0 (1)	-1 (6)	2754.0	-3.199	0.001	0.243
Nicotine dependence (FTND)	0 (0)	0 (0)	3159.0	-3.868	<0.001	0.293

Values are presented as median change (Δ = follow-up – baseline) and interquartile range (IQR). Positive Δ values indicate improvement for physical activity, medication adherence, and dietary behaviour; negative Δ values indicate improvement for perceived stress, sleep quality, and nicotine dependence. Between-group differences were analysed using the Mann–Whitney U test, and effect size (r) was estimated as $r = Z/\sqrt{N}$.

The Mann–Whitney U test identified statistically significant between-group differences in the distributions of change scores for medication adherence ($U = 3112.5$; $Z = -2.563$; $p = 0.010$), sleep quality ($U = 2754.0$; $Z = -3.199$; $p = 0.001$), and nicotine dependence ($U = 3159.0$; $Z = -3.868$; $p < 0.001$). The corresponding effect sizes were small ($r = 0.194, 0.243$, and 0.293 , respectively). Because the median changes were 0 in both groups for medication adherence and nicotine dependence, and because lower PSQI values indicate better sleep while the control-group median Δ was -1 compared with 0 in the intervention group, these findings should be interpreted as distributional between-group differences rather than uniformly greater median improvement in the intervention group. Physical activity, dietary behaviour, and perceived stress did not differ significantly between groups.

DISCUSSION

This study found that the distributions of change scores differed between the leaflet-assisted and routine-counselling groups for medication adherence, sleep quality, and nicotine dependence, whereas no statistically significant between-group differences were identified for physical activity, dietary behaviour, or perceived stress. Because the between-group effect sizes were small and the median change patterns did not consistently favour the leaflet group, the findings do not support a simple conclusion that leaflets produced uniformly greater behavioural improvement across outcomes. Instead, they suggest that printed leaflets may function as supportive educational tools whose effects vary by behavioural domain.

Medication-adherence change scores differed significantly between groups, but the median change was 0 in both groups and the effect size was small. This pattern suggests a modest distributional difference rather than a large clinical shift. Previous evidence indicates that health education can support medication adherence in hypertension, although effects vary according to intervention content, delivery, and intensity (21–23). Leaflets may help patients revisit information outside face-to-face sessions, but the present data should be interpreted as evidence of a small between-group difference rather than proof of a large adherence effect.

Sleep-quality change scores also differed significantly between groups, with a small effect size. However, PSQI scores are interpreted in the opposite direction to several other study outcomes: lower values indicate better sleep. The median change was 0 in the intervention group and -1 in the control group. Accordingly, the present results do not support a simple claim of greater median sleep improvement in the leaflet group. Evidence specifically linking leaflet-based hypertension education to sleep outcomes remains limited, and the finding should therefore be interpreted cautiously and confirmed in studies designed specifically to evaluate sleep.

A statistically significant between-group difference was also observed for FTND change scores, although the effect size was small and the median change was 0 in both groups. These findings indicate a difference in the distribution of nicotine-dependence change scores but do not demonstrate a clinically meaningful smoking-cessation effect. Leaflets may reinforce smoking-risk messages as part of broader health promotion, but smoking cessation generally requires more intensive and sustained support than printed information alone.

The absence of significant between-group differences for physical activity, dietary behaviour, and perceived stress suggests that printed educational materials alone may be insufficient for behaviours requiring sustained practice, environmental support, or skills-based intervention. Reviews of hypertension education indicate that multicomponent strategies are often needed to support long-term lifestyle modification (24,25). For physical activity, monitoring, feedback, and ongoing support may be more effective than printed information alone (24,26). Dietary behaviour is also shaped by habits, socioeconomic conditions, culture, and food availability, so leaflet information may need to be combined with practical dietary support (27,28). Similarly, perceived stress is unlikely to improve through information provision alone and may require counselling or structured coping support (29,25).

The findings highlight a potential role for leaflet-assisted education within primary health care, particularly as a low-cost tool for reinforcing information delivered during counselling. However, the small effect sizes and inconsistent direction of change across outcomes indicate that leaflets should be positioned as adjuncts rather than stand-alone behaviour-change interventions. Integrating printed materials with face-to-face counselling, ongoing follow-up, self-monitoring, and other supportive strategies is more consistent with contemporary hypertension health-promotion approaches (7,24,25).

This study has several strengths. First, it evaluated multiple health behavior domains simultaneously, providing a more comprehensive assessment of the effectiveness of leaflet-based health education among patients with hypertension. Second, the quasi-experimental design enabled the evaluation of the intervention under real-world primary healthcare conditions, thereby enhancing the practical relevance of the findings for health promotion programs. Furthermore, the study reported not only statistical significance but also median values, interquartile ranges, and effect sizes, allowing for a more comprehensive interpretation of the findings.

Limitations and Cautions

The findings of this study should be interpreted in light of several limitations. First, individual randomisation was not performed, and baseline differences in age, educational attainment, and hypertension stage persisted between groups, increasing the possibility of residual confounding. Second, most outcomes were self-reported, creating potential recall and social-desirability

bias. Third, the follow-up period was brief and did not establish whether behavioural changes were sustained. Fourth, the interpretation of change scores requires attention to the scoring direction of each instrument, particularly PSQI, PSS-10, and FTND. Fifth, the original sample-size calculation worksheet and detailed FFQ modification record were unavailable for verification. Finally, the single-centre setting limits generalisability to other populations and health systems.

Recommendations for Future Research

Future studies should incorporate longer follow-up periods to determine whether behavioural improvements can be sustained after the intervention. In addition, multicentre randomized controlled trials are warranted to improve both the internal validity and external generalizability of future evidence. Further research should compare the effectiveness of leaflet-based education delivered alone with its use as one component of broader behavioural interventions, such as combinations of leaflets with counseling, digital media, or family support, should be further investigated, particularly for behaviors requiring long-term lifestyle modification. Incorporating objective outcome measures, such as blood pressure readings or pharmacy refill records, would further strengthen future investigations.

CONCLUSION

The impact of leaflet-assisted health education differed across the health-behaviour domains evaluated. Statistically significant between-group differences in change-score distributions were observed for medication adherence, sleep quality, and nicotine dependence, whereas physical activity, dietary behaviour, and perceived stress did not differ significantly. Because the effect sizes were small and the direction of median change did not uniformly favour the leaflet group, printed leaflets should be regarded as supportive educational resources rather than stand-alone evidence of broad behaviour change. Behaviours requiring sustained lifestyle modification are likely to benefit from integrating leaflets with counselling, follow-up, and other health-promotion strategies.

DECLARATIONS

Author contributions: AB: conceptualization, investigation, methodology, data curation, formal analysis, visualization, writing—original draft, writing—review and editing; S: conceptualization, methodology, formal analysis, supervision, writing—review and editing; RA: conceptualization, methodology, supervision, writing—review and editing; AUS: writing—review and editing; SR: methodology, validation, writing—review and editing. All authors reviewed and approved the final manuscript.

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