

Original Research Article

Impact of food and nutrition literacy on knowledge, attitude and practices among adults with hypertension in Jalgaon, Maharashtra

Zoya Shaikh*, Panchali Moitra

Department of Postgraduate Programs and Research, SVT College of Home Science, SNDT Women's University, Mumbai, Maharashtra, India

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*Correspondence:

Dr. Zoya Shaikh,

E-mail: shaikhzoya1706@gmail.com

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ABSTRACT

Background: Hypertension affects 28-30% of Indian adults, yet fewer than 9% achieve adequate blood pressure control. Low-socioeconomic-status (SES) adults face barriers including limited food and nutrition literacy, food insecurity, poor dietary practices. This study evaluated the impact of a six-week food and nutrition literacy intervention on knowledge, attitude, practice (KAP) outcomes and clinical parameters among low-SES adults with hypertension in Jalgaon, Maharashtra.

Methods: A pre-post intervention study was conducted among 80 low-SES adults with hypertension attending the OPD of a multispecialty hospital in Jalgaon. Six educational sessions were delivered over five weeks using a Hindi flipbook, illustrated posters, and locally relevant recipe cards, reinforced through WhatsApp reminders. KAP was assessed using knowledge and attitude questionnaires, a food frequency questionnaire, and healthy habits practice scale. SBP, DBP, and body weight were measured at baseline and post-intervention. Appropriate statistical tests were applied.

Results: Significant improvements were observed in knowledge (median 11.0 to 13.0, $p < 0.001$), attitude (46.5 to 47.5, $p < 0.001$), and multiple dietary practice indicators. Significant reductions occurred in SBP (144.5 to 140.5 mmHg), DBP (85.0 to 83.5 mmHg), and body weight (74.0 to 73.0 kg; all $p < 0.001$).

Conclusions: A structured, culturally adapted food and nutrition literacy intervention significantly improved KAP and clinical outcomes among low-SES hypertensive adults. This feasible, low-cost model may be replicated in hypertension management programmes.

Keywords: Attitude, Blood pressure, Dietary behaviour change, Food and nutrition literacy, Hypertension, Knowledge, Low socioeconomic status, Practice

INTRODUCTION

Hypertension remains the single most important modifiable risk factor for cardiovascular disease, stroke, and premature death worldwide, affecting over one billion adults globally.¹ In India, approximately 28-30% of adults are hypertensive, yet fewer than 9% have their blood pressure adequately controlled- one of the most significant gaps in chronic disease management in the country.^{2,3} The India state-level disease burden initiative

has attributed 57% of stroke deaths and 24% of coronary artery disease deaths in India to hypertension, making effective, scalable management strategies a public health priority.⁴

Dietary behaviour is the most important modifiable determinant of blood pressure. Sodium restriction of approximately 4.4 gm/day reduces systolic blood pressure by 4.2 mmHg and diastolic blood pressure by 2.1 mmHg.⁵ The ratio of dietary sodium to potassium is an

even stronger predictor of blood pressure than sodium alone, underlining the importance of simultaneously increasing fruits, vegetables, and pulses while reducing sodium-rich foods.⁶ Despite this strong evidence, dietary behaviour among Indians with hypertension remains poor, not because people lack access to information, but because they lack the functional skills to act on it.⁷

Low socioeconomic status (SES) makes this worse. Low-SES adults in India eat more sodium-heavy preserved and processed foods and fewer fruits and vegetables and have lower health literacy and self-management capacity than higher-income groups.^{8,9} Low health literacy is independently linked to delayed diagnosis, poor medication adherence, inadequate dietary self-management, higher hospitalization rates, and increased mortality.¹⁰ Structural barriers- food insecurity, economic constraints, and limited healthcare access- further restrict dietary change.¹¹

Food and nutrition literacy is not the same as nutrition education. It refers to the practical knowledge, skills, and motivation that allow people to make healthier food choices within the real constraints of their everyday lives.¹² A nutrition-literate person can identify hidden sodium in packaged foods, read food labels, modify familiar recipes to reduce sodium, and make affordable dietary choices that work within a tight budget. Evidence from India and comparable settings shows that structured, culturally adapted, multi-session nutrition literacy interventions produce significant improvements in KAP outcomes and blood pressure.¹³⁻¹⁶

However, hospital OPD-based nutrition literacy interventions specifically targeting low-SES adults with hypertension in semi-urban Maharashtra have not been studied. Most Indian intervention research has been done in urban or southern Indian settings, and no validated tool exists for simultaneously assessing food and nutrition literacy and KAP in low-SES hypertensive Indian adults.^{13,14,16} This study was designed to fill that gap by developing, implementing, and evaluating a structured six-week food and nutrition literacy intervention in a hospital OPD in Jalgaon, Maharashtra.

METHODS

Study design and setting

A pre-post intervention design was used. The study was conducted from February 2026 to March 2025. It was conducted in a dedicated room adjacent to the OPD of a multispecialty hospital in Jalgaon, a semi-urban district in northern Maharashtra with a predominantly low-income population that relies heavily on public healthcare.

Participants

Adults aged 18 years and above with diagnosed hypertension attending the OPD were eligible.

Participants needed to be able to communicate in Hindi or Marathi and provide written informed consent. Exclusion criteria included pregnancy or lactation, severe comorbidities that would prevent participation, and enrollment in an existing dietary counselling programme. Convenience sampling was used, and participants were enrolled consecutively until the target of 80 was reached. Each participant received a unique coded identifier (P01-P80) to maintain confidentiality. Sample size was based on 80% power to detect moderate behavioural and clinical changes, consistent with comparable pre-post designs.¹³⁻¹⁵ Ethics approval was obtained from the Inter System Biomedica Ethics Committee (ISBEC) before the study began.

Intervention

The intervention consisted of six structured educational sessions delivered in small groups of five to seven participants over five weeks. Baseline data were collected in week 1 and post-intervention data in week 6. Each session was 25-30 minutes long and was facilitated by the principal researcher. The six sessions covered: (1) overview of hypertension, what it is, why it is called a silent killer, its complications, and the role of diet; (2) eating right for blood pressure control, DASH principles adapted for the Indian context, the balanced plate, and potassium-rich foods; (3) hidden salt in everyday foods, identifying high-sodium items and hands-on food label reading using real product packets; (4) healthy cooking on a tight budget, measuring oil, steaming and boiling instead of frying, and low-cost, low-sodium meal planning; (5) daily habits, shopping choices, and BP self-care, physical activity, medication adherence, BP monitoring, and smarter grocery shopping; and (6) a recap, reinforcement, and Q and A.

Educational materials were purpose-designed for this study population and included a comprehensive Hindi flipbook with illustrations, two illustrated posters (a traffic-light food guide and a daily self-management checklist), and recipe cards featuring affordable low-sodium dishes from local Jalgaon food culture. Between sessions, participants received WhatsApp reminders as text messages, Hindi audio notes, and health awareness reels.

Data collection instruments

All instruments were administered in an interviewer-assisted format in Hindi or Marathi. The battery included:

Knowledge questionnaire

15 multiple-choice items covering hypertension complications, balanced diet, sodium in food labels, high-sodium food identification, and healthy cooking. Each correct response scored 1 (maximum composite score =15). McNemar's test was used for individual items, and the Wilcoxon signed-rank test for the composite score.

Attitude questionnaire

12 items assessing attitudes toward dietary self-management on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree; maximum composite score = 60). Wilcoxon signed-rank test was used.

Food frequency questionnaire (FFQ)

32 food items assessed for consumption frequency on a 6-point scale (0 = rarely/never to 5 = daily), covering high-sodium foods, fried foods, sugar-sweetened beverages, staple foods, and health-promoting foods. Wilcoxon signed-rank test was used.

Healthy habits practice scale

12 self-reported habit items on a 5-point Likert scale (1 = never to 5 = always) covering salt avoidance, dietary compliance, physical activity, medication regularity, and BP monitoring. Wilcoxon signed-rank test was used.

Clinical measurements

SBP and DBP (mmHg) and body weight (kg) were measured at baseline and post-intervention using validated digital equipment with the assistance of a hospital staff member.

Statistical analysis

Data were analysed using Jamovi v2.6.26. Continuous variables were expressed as median and interquartile range (IQR) given non-normal distributions; categorical variables as frequency and percentage (N %). McNemar's test was used for paired binary knowledge item comparisons. The Wilcoxon signed-rank test was used for all Likert-scale and composite outcome comparisons. Spearman's rank correlation assessed inter-domain relationships. A p value of <0.05 was considered statistically significant; p<0.005 is additionally indicated. Significance was denoted as "*" (p<0.05) and "***" (p<0.005) throughout.

RESULTS

Participant characteristics

Eighty participants completed the study. Their sociodemographic, medical, and lifestyle characteristics are presented in Table 1. The sample was mostly female (56%), married (80%), and from low-to-middle-income households; 52% earned less than ₹20,000 per month. The largest occupational group was homemakers (40%). Half the participants had been diagnosed with hypertension for 1-5 years. Medication regularity was poor: only 28% took antihypertensive medication regularly, and 25% took it sometimes.

BP self-monitoring was inconsistent; 38% monitored regularly and 45% occasionally. High rates of smoking (64%) and alcohol use (86%) further highlighted the cardiometabolic risk burden of this cohort.

Table 1: Sociodemographic, medical, and lifestyle characteristics of participants (n=80).

Variables	N (%)
Sex	
Male	35 (44)
Female	45 (56)
Marital Status	
Married	64 (80)
Unmarried	9 (11)
Widowed/Separated	7 (9)
Education	
No formal education	5 (6)
Primary	14 (18)
Secondary	21 (26)
Higher secondary	21 (26)
Graduate and above	19 (24)
Occupation	
Homemaker	32 (40)
Private job	20 (25)
Daily wage worker	10 (13)
Farmer	6 (8)
Unemployed	5 (6)
Other	7 (9)
Monthly household income	
<₹10,000	13 (16)
₹10,000-20,000	29 (36)
₹20,000-30,000	19 (24)
>₹30,000	19 (24)
Duration of HTN diagnosis	
<1 year	19 (24)
1-5 years	40 (50)
>5 years	21 (26)
Medication regularity	
Regular	22 (28)
Sometimes	20 (25)
BP self-monitoring	
Yes	30 (38)
Occasionally	36 (45)
Smoking	51 (64)
Alcohol Use	69 (86)

Clinical outcomes: blood pressure and body weight

Pre- and post-intervention clinical measurements are presented in Table 2. Statistically significant reductions were observed in SBP (144.5 to 140.5 mmHg), DBP (85.0 to 83.5 mmHg), and body weight (74.0 to 73.0 kg; all p<0.001).

Table 2: Comparison of hypertension-related knowledge scores before and after the intervention.

Item	Knowledge statement	Pre-intervention N (%)	Post-intervention N (%)	Test value	P value
K01	Definition of hypertension	66 (83)	69 (86)	0.69	0.405
K02	Organs affected (heart, brain, kidneys, eyes)	33 (41)	53 (66)	12.50	<0.001**
K03	Serious complication (stroke)	58 (73)	70 (88)	9.00	0.003**
K04	Frequency of BP checks	52 (65)	65 (81)	8.05	0.005*
K05	Hypertension requires long-term control	56 (70)	65 (81)	3.86	0.050
K06	Meaning of balanced diet	50 (63)	68 (85)	16.20	<0.001**
K07	Low-fat food choice (steamed vegetables)	64 (80)	74 (93)	8.33	0.004**
K08	Dietary diversity	57 (71)	64 (80)	1.96	0.162
K09	High-salt food identification (pickles)	72 (90)	73 (91)	0.11	0.739
K10	Importance of reducing salt	51 (64)	63 (79)	6.55	0.011*
K11	Healthy snack choice (fruit/roasted peanuts)	66 (83)	71 (89)	1.92	0.166
K12	Benefit of daily fruit consumption	66 (83)	70 (88)	1.00	0.317
K13	Healthy cooking methods (steaming/boiling)	62 (78)	71 (89)	4.26	0.039*
K14	Lifestyle control factors	73 (91)	74 (93)	0.11	0.739
K15	Importance of sodium content on food labels	44 (55)	63 (79)	14.44	<0.001**
Knowledge composite score [median (IQR)]		11.0 (9.0-14.0)	13.0 (12.0-14.0)	392.5	<0.001**

*p<0.05; **p<0.005; McNemar's test for individual items; Wilcoxon signed-rank test for composite score; IQR = interquartile range.

Table 3: Comparison of attitude scores toward hypertension dietary self-management before and after the intervention (n=80).

Items	Attitude statement	Pre-intervention median (IQR)	Post-intervention median (IQR)	Test value	P value
A1	Dietary control can manage BP	4.0 (3.0-5.0)	4.0 (3.8-5.0)	28.5	0.001**
A2	Reducing salt helps BP control	4.0 (3.0-4.0)	4.0 (3.0-5.0)	96.0	0.028*
A3	Importance of fruits and vegetables	4.0 (3.0-4.3)	4.0 (3.8-5.0)	63.0	0.014*
A4	Belief in long-term dietary adherence	4.0 (3.0-4.0)	4.0 (3.0-5.0)	62.0	<0.001**
A5	Confidence in dietary change	4.0 (3.0-4.0)	4.0 (3.0-5.0)	112.5	0.015*
A6	Motivation to limit oily/fried foods	4.0 (3.0-5.0)	4.0 (4.0-5.0)	121.5	<0.001**
A7	Willingness to adopt healthy cooking	4.0 (3.0-4.0)	4.0 (3.0-5.0)	66.0	0.005*
A8	Belief in benefit of home-cooked food	4.0 (3.0-4.0)	4.0 (4.0-4.0)	66.0	0.009*
A9	Attitude toward label reading	4.0 (3.0-5.0)	4.0 (3.0-5.0)	108.0	0.010*
A10	Importance of medication adherence	4.0 (3.0-4.0)	4.0 (3.0-5.0)	40.0	<0.001**
A11	Attitude toward physical activity	4.0 (3.0-4.0)	4.0 (3.0-5.0)	78.0	0.003**
A12	Belief in BP self-monitoring	4.0 (3.0-4.0)	4.0 (3.0-5.0)	91.0	0.009*
Attitude Composite Score		46.5 (40.0-50.3)	47.5 (44.0-52.0)	243.5	<0.001**

Wilcoxon signed-rank test; 5-point Likert scale (1 = strongly disagree to 5 = strongly agree); * p<0.05; ** p<0.005.

Changes in hypertension-related knowledge following the intervention

Knowledge results are presented in Table 3. The knowledge composite score improved significantly from a median of 11.0 (IQR: 9.0-14.0) to 13.0 (IQR: 12.0-14.0) post-intervention (p<0.001). Eight of fifteen items reached statistical significance. The biggest gains were in awareness of organs affected by hypertension (K02: 41% to 66%, p<0.001), understanding of a balanced diet (K06: 63% to 85%, p<0.001), importance of sodium on food labels (K15: 55% to 79%, p<0.001), and identification of low-fat food choices (K07: 80% to 93%, p=0.004). The seven items that did not reach significance largely showed ceiling effects at baseline, particularly K09 (high-

salt food identification: 90% baseline) and K14 (lifestyle factors: 91% baseline).

Changes in attitudes towards hypertension self-management

All twelve attitude items improved significantly following the intervention (Table 4). The composite attitude score increased from a median of 46.5 (IQR: 40.0-50.3) to 47.5 (IQR: 44.0-52.0; p<0.001). The strongest improvements were in motivation to limit oily and fried foods (A6: p<0.001), belief in long-term dietary adherence (A4: p<0.001), importance of medication adherence (A10: p<0.001), and confidence in dietary control of blood pressure (A1: p=0.001). The modest

median shift reflects near-ceiling baseline scores; significant changes in the IQR confirm real distributional

movement, particularly among participants who were initially neutral or disagreed.

Table 4: Comparison of food frequency questionnaire responses before and after the intervention.

Food item	Pre-intervention median (IQR)	Post-intervention median (IQR)	P value
Pickles	3.0 (1.0-4.0)	2.0 (1.0-3.0)	<0.001**
Papad	3.0 (1.0-4.0)	3.0 (1.0-4.0)	<0.001**
Packaged namkeen/farsan	2.0 (0.0-3.0)	2.0 (0.0-3.0)	0.003*
Instant noodles	0.0 (0.0-2.0)	0.0 (0.0-2.0)	0.792
Chinese food items	0.5 (0.0-2.0)	0.0 (0.0-2.0)	0.202
Street food	1.5 (0.0-3.0)	1.0 (0.0-2.0)	0.001*
Fast food	1.0 (0.0-2.0)	1.0 (0.0-2.0)	0.276
Salted biscuits/crackers	2.0 (0.0-4.0)	2.0 (0.0-3.0)	0.005*
Sauces, ketchup, and chutneys	2.0 (0.0-4.0)	2.0 (0.0-3.0)	0.002*
Adding extra salt to food	1.0 (0.0-3.0)	1.0 (0.0-3.0)	0.007*
Salted peanuts/chana	3.0 (2.0-4.0)	2.0 (1.0-4.0)	<0.001**
Fried foods	2.0 (1.0-3.0)	2.0 (1.0-3.0)	<0.001**
Puri/bhatura	2.0 (1.0-3.3)	2.0 (0.0-3.0)	<0.001**
Butter/ghee spread on food	2.0 (1.0-4.0)	2.0 (1.0-4.0)	0.215
Bakery items	2.0 (0.0-3.0)	2.0 (0.0-3.0)	0.067
Cream biscuits	1.0 (0.0-2.3)	1.0 (0.0-2.0)	0.679
Indian sweets	2.0 (1.0-3.0)	2.0 (1.0-3.0)	0.003*
Ice cream/kulfi	2.0 (1.0-3.0)	2.0 (0.8-3.0)	0.005*
Sugared tea/coffee	5.0 (3.0-5.0)	4.0 (2.0-5.0)	<0.001**
Soft drinks	1.0 (0.0-3.0)	1.0 (0.0-3.0)	0.85
Packaged fruit juice	1.0 (0.0-3.0)	1.0 (0.0-3.0)	0.59
Fresh fruits	4.0 (3.0-5.0)	4.0 (3.0-5.0)	0.337
Green leafy vegetables	4.5 (3.0-5.0)	4.0 (3.0-5.0)	0.491
Other vegetables	5.0 (3.0-5.0)	4.5 (3.0-5.0)	0.314
Pulses	4.0 (3.0-5.0)	4.0 (3.0-5.0)	1
Sprouted grains	3.0 (2.0-5.0)	3.0 (2.0-4.3)	0.024
Curd/buttermilk	3.0 (2.0-5.0)	3.0 (2.0-5.0)	0.01*
Homemade sabzi	5.0 (3.0-5.0)	5.0 (3.0-5.0)	0.24
Chapati/bhakri	5.0 (3.8-5.0)	5.0 (4.0-5.0)	0.346
Simple rice	5.0 (3.0-5.0)	5.0 (3.0-5.0)	0.028*
Unsalted nuts	3.0 (1.0-5.0)	3.5 (1.8-5.0)	0.007*
FFQ composite scores	78.5 (64.0-98.0)	74.5 (60.8-92.3)	<0.001**

*p<0.05; **p<0.005; IQR = interquartile range. Wilcoxon signed-rank test Note: For unhealthy foods, a decrease in score = reduction in frequency (improvement); responses were scored on a 6-point scale: 5 = daily, 4 = 5-6 times/week, 3 = 3-4 times/week, 2 = 1-2 times/week, 1 = 2-3 times/month, and 0 = rarely/never.

Changes in dietary and lifestyle practices following the intervention

Changes in food frequency questionnaire following the intervention

The FFQ composite score decreased significantly from 78.5 (IQR: 64.0-98.0) to 74.5 (IQR: 60.8-92.3; p<0.001). Of 32 items, 17 showed statistically significant changes. The most striking change was in sugared tea/coffee, which went from daily consumption (median 5.0) to 5-6 times per week (median 4.0; p<0.001), the single largest median shift in the FFQ. Significant reductions were also seen in pickles (3.0 to 2.0, p<0.001), salted peanuts/chana (3.0 to 2.0, p<0.001), street food (1.5 to 1.0, p=0.001),

fried foods (p<0.001), and sauces/ketchup/chutneys (p=0.002). Items with no significant change included instant noodles (p=0.792), fast food (p=0.276), and soft drinks (p=0.850), attributable to near-zero baseline consumption. Fresh fruits, vegetables, and pulses showed no significant change, reflecting economic and structural barriers that limit healthy food access in low-income households.

Changes in healthy habit practice scale following the intervention

The practice composite score decreased significantly from 118.0 (IQR: 105.0-135.0) to 114.5 (IQR: 101.0-132.3; p<0.001). Nine of twelve habit items improved

significantly. Items with actual median shifts included eating fruits and vegetables, limiting oily foods, daily physical activity, and following dietary advice- all shifting from 3.0 to 4.0 ($p \leq 0.003$). Five items showed significant distributional improvements despite stable medians, including avoiding extra salt ($p < 0.001$),

checking food labels ($p = 0.006$), and regular BP monitoring ($p < 0.001$). Items that did not reach significance included preference for home-cooked food (ceiling effect; baseline median 4.0), medication regularity ($p = 0.325$), and adequate sleep ($p = 0.252$).

Table 5: Comparison of healthy habit practice scores before and after the intervention.

Habit	Pre-intervention median (IQR)	Post-intervention median (IQR)	Test value	P value
Avoiding extra salt	3.0 (2.0-4.0)	3.0 (2.0-4.0)	186.5	<0.001**
Reducing salty foods	3.0 (2.0-4.0)	3.5 (2.8-5.0)	175.5	0.006*
Eating fruits and vegetables	3.0 (2.0-5.0)	4.0 (2.0-5.0)	84.0	0.002**
Limiting oily foods	3.0 (2.0-4.0)	4.0 (3.0-5.0)	101.5	0.003**
Preference for home-cooked food	4.0 (2.0-5.0)	4.0 (2.0-5.0)	108.0	0.183
Checking food labels	3.0 (2.0-4.0)	3.0 (2.0-4.0)	108.0	0.006*
Medication regularity	4.0 (2.0-5.0)	4.0 (2.0-5.0)	130.0	0.325
Daily physical activity	3.0 (2.0-4.0)	4.0 (3.0-5.0)	153.0	0.002**
Regular BP monitoring	3.0 (2.0-4.0)	3.0 (2.8-5.0)	70.0	<0.001**
Stress management	3.0 (2.0-5.0)	4.0 (2.0-5.0)	34.0	0.027*
Adequate sleep	3.0 (2.0-4.0)	3.0 (2.0-4.0)	195.0	0.252
Following dietary advice	3.0 (3.0-4.0)	4.0 (3.0-4.3)	81.0	0.001**
Practice Composite Score	118.0 (105.0-135.0)	114.5 (101.0-132.3)	2280.5	<0.001**

* $p < 0.05$; ** $p < 0.005$; Wilcoxon signed-rank test; IQR = interquartile range.

Table 6: Comparison of PHQ-2 scores before and after the intervention.

PHQ-2 Item	Pre-intervention median (IQR)	Post-intervention median (IQR)	P value
Little interest or pleasure in doing things	2.0 (1.0-3.0)	2.0 (1.0-3.0)	0.018*
Feeling down, depressed or hopeless	2.0 (0.0-3.0)	2.0 (0.0-3.0)	0.008*
PHQ-2 Composite Score	2.0 (1.0-3.0)	2.0 (0.0-3.0)	0.001**

* $p < 0.05$; ** $p < 0.005$; Wilcoxon signed-rank test; Median (IQR) = interquartile range; PHQ-2 = patient health questionnaire-2; 0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly everyday.

Table 7: Summary of pre- and post-intervention composite score changes across all KAP domains and clinical parameters (n=80).

Outcome Domain	Pre-intervention median (IQR)	Post-intervention median (IQR)	P value
Knowledge composite (/15)	11.0 (9.0-14.0)	13.0 (12.0-14.0)	<0.001**
Attitude composite (/60)	46.5 (40.0-50.3)	47.5 (44.0-52.0)	<0.001**
FFQ composite	78.5 (64.0-98.0)	74.5 (60.8-92.3)	<0.001**
Practice (healthy habits) composite	118.0 (105.0-135.0)	114.5 (101.0-132.3)	<0.001**
Systolic BP (mmHg)	144.5 (138.0-151.3)	140.5 (131.5-151.0)	<0.001**
Diastolic BP (mmHg)	85.0 (80.0-90.3)	83.5 (77.8-89.3)	<0.001**
Body weight (kg)	74.0 (66.5-80.3)	73.0 (66.0-80.3)	<0.001**

Wilcoxon signed-rank test; ** $p < 0.005$; IQR = Interquartile Range

Changes in patient health questionnaire (PHQ-2) following the intervention

The practice composite score dropped significantly from 118.0 (IQR: 105.0-135.0) to 114.5 (IQR: 101.0-132.3; $p < 0.001$). Nine out of 12 habit items were significantly improved. Items with actual median shifts were eating

fruits and vegetables, limiting oily foods, daily physical activity, and following dietary advice, all shifting from 3.0 to 4.0 ($p \leq 0.003$). Five items demonstrated significant distributional improvements with stable medians, including avoiding extra salt ($p < 0.001$), checking food labels ($p = 0.006$), and regular BP monitoring ($p < 0.001$). Variables that did not achieve significance included

preference for home-cooked food (ceiling effect; baseline median 4.0), medication regularity ($p=0.325$; structural barriers beyond dietary education), and adequate sleep ($p=0.252$).

DISCUSSION

This study evaluated the impact of a six-week food and nutrition literacy intervention on KAP outcomes and clinical parameters among low-SES adults with hypertension attending a hospital OPD in Jalgaon, Maharashtra. The intervention produced significant improvements across all major outcome domains, knowledge, attitudes, dietary practices, blood pressure, and body weight, showing that a low-cost, structured, culturally adapted nutrition literacy programme can improve hypertension self-management in an underserved population.

The most important knowledge gains were in food label reading for sodium content, understanding of a balanced diet, and awareness of organ complications, all areas directly targeted by the intervention content. This finding is consistent with Jain et al., who reported that structured nurse-led counselling in Agra increased knowledge of recommended salt intake from 2% to 38% among hypertensive adults in similar settings.¹³ The improvement in food label reading deserves particular attention; this is a functional nutrition literacy skill with direct real-world application in food purchasing decisions. Items that did not improve significantly showed ceiling effects rather than intervention failure, reflecting that most participants were already answering those questions correctly at baseline. This is consistent with Berkman et al, who noted that literacy interventions are most effective when targeted at genuine knowledge deficits rather than areas of existing awareness.¹⁰

The improvement across all twelve attitude items is notable, particularly given that baseline attitude scores were already relatively high. The modest absolute median shift should be interpreted alongside the significant IQR changes, which reflect meaningful movement among participants who were initially neutral or in disagreement. This is consistent with findings from Rodrigues et al, who reported significant attitudinal improvements despite small median changes in a sodium restriction RCT.¹⁶ The fact that attitudinal improvement extended beyond diet to physical activity, medication adherence, and BP self-monitoring suggests that the comprehensive, multi-session format of the intervention influenced participants' broader self-management motivation, not just their dietary intentions.

The improvement in dietary practices, as captured by the FFQ, is clinically meaningful for a six-week intervention in a low-SES population. The reduction in sugared tea/coffee consumption from daily to 5-6 times per week was the most striking single-item change. Tea consumption multiple times daily is near-universal in

Indian households and carries meaningful implications for caloric intake and metabolic health when reduced consistently. The reductions in pickles, salted peanuts, sauces, and fried foods directly reflect the content of session 3 (hidden salt) and session 4 (healthy cooking), suggesting that participants were able to apply what they learned. Jain et al and Mondal and Kapoor both reported similar dietary practice improvements following structured dietary education in comparable Indian settings.^{13,14}

The absence of significant change in fruit, vegetable, and pulse consumption is not surprising and should not be read as a failure of the intervention. These foods are more expensive, seasonally variable, and less accessible in low-income semi-urban households. The literature consistently shows that reducing harmful food intake is more immediately achievable than increasing healthy food consumption in low-SES populations, where structural and economic barriers directly constrain food purchasing behaviour.^{11,16} This finding suggests that nutrition education alone is not enough; it needs to be paired with broader public health strategies that make affordable, nutritious foods more accessible.

Beyond food intake, significant improvements in physical activity, BP self-monitoring, food label checking, and dietary advice adherence show that the intervention had a wider behavioural reach than its dietary content alone. This mirrors the findings of Lukitasari and Nugroho, who reported simultaneous improvements across dietary adherence and medication adherence domains following CHW-led health education.¹⁵ The non-significance of medication regularity despite improved attitudes toward it is a consistent finding in the literature. Berkman et al noted that health literacy interventions improve self-management capacity but do not fully overcome the structural barriers that affect medication adherence, including prescription continuity, cost, and healthcare access.¹⁰

The statistically significant reductions in SBP (-4.0 mmHg), DBP (-1.5 mmHg), and body weight (-1.0 kg) are clinically meaningful for a six-week intervention, even if smaller than those reported in longer studies. Mondal and Kapoor reported SBP reductions of 13 mmHg over 4-6 months; Gamage et al achieved SBP reductions of 6 mmHg over 12 months; Khattak et al reported 10.7 mmHg over eight weeks.^{14,17,18} The smaller magnitude in the present study likely reflects the shorter intervention period, the group delivery format rather than individual counselling, and the economic constraints of the low-SES population, which limit how fully dietary recommendations can be implemented even when knowledge improves. Even so, small reductions in blood pressure at the population level are associated with meaningful long-term reductions in stroke and cardiovascular disease risk.

The lack of significant correlation between KAP domain changes and blood pressure changes should not be over-interpreted. Blood pressure is influenced by many interacting factors beyond diet, including medication adherence, stress, physical activity, and comorbidities. Behavioural improvements typically precede physiological changes, and a six-week window is too short to capture cumulative physiological benefit.¹⁷ Longer follow-up is needed to evaluate whether the KAP improvements observed here translate into sustained blood pressure reductions.

Two methodological considerations are important to acknowledge. First, post-intervention data collection coincided with Ramadan for some participants. Ramadan substantially modifies dietary patterns, particularly reducing snack and fried food consumption during daylight hours, which may have independently contributed to some of the dietary changes observed. This was not anticipated at the design stage and is an important confound to control for in future studies. Second, self-reported dietary measures carry social desirability bias; participants may have reported healthier behaviours following six weeks of interaction with the researcher. However, the selective pattern of significant and non-significant changes, including several items showing no improvement due to low baseline consumption, suggests that participants did not simply report uniform improvements across all items, which supports the credibility of the findings.

The findings have clear implications for practice and policy. The intervention required no specialist equipment, used inexpensive, locally designed materials, and was successfully delivered within routine OPD operations in 25–30-minute group sessions. This makes it genuinely scalable. The incorporation of WhatsApp reminders, including audio notes and health awareness reels, is an innovative, low-cost digital reinforcement strategy that is well-suited to the mobile phone accessibility of even low-income populations in India. National hypertension management programmes, including IHCI, NPCDCS, and WHO HEARTS, would benefit from integrating structured nutrition literacy modules like those used in this study alongside their existing clinical protocols.^{19,20}

Limitations of this study should be acknowledged. First, the pre-post design without a control group limits causal inference, as regression to the mean, seasonal dietary variation, and other contemporaneous exposures cannot be entirely excluded as contributing factors. Second, the six-week intervention period is relatively short, and the durability of KAP improvements beyond the post-intervention assessment point remains unknown. Third, self-reported dietary measures carry the risk of social desirability bias, particularly following six weeks of structured educational engagement with the same researcher. Fourth, post-intervention data collection coincided with the Ramadan period for a proportion of participants, which may have independently influenced

self-reported dietary patterns. Fifth, convenience sampling from a single hospital OPD in Jalgaon limits the generalizability of findings to the broader population of low-SES adults with hypertension in Maharashtra. Finally, the absence of an objective dietary biomarker, such as 24-hour urinary sodium excretion, means that self-reported reductions in sodium intake cannot be independently verified.

CONCLUSION

A structured, six-week, culturally adapted food and nutrition literacy intervention delivered in a hospital OPD setting produced statistically significant improvements in dietary knowledge, attitudes, dietary practices, blood pressure, and body weight among low-SES adults with hypertension in semi-urban Maharashtra. The intervention was low-cost, practically deliverable within existing healthcare infrastructure, and digitally reinforced, making it scalable and replicable within national hypertension management frameworks. These findings support the integration of food and nutrition literacy as a core component of hypertension management in public health systems serving low-SES communities in India.

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