Journal of Indonesian Psychological Science
Volume 06, No 1 (June 2026), pp.16—40, E-ISSN 2828-4577
https://10.18860/jips.v6i1.40505

Alleviating physical and psychological symptoms associated with menopause among women in rural areas

Article History

Accepted
June 22, 2026

Received
January 17, 2026

Published
June 30, 2026

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ABSTRACT

This investigation aimed to examine the efficacy of a specifically developed educational program designed to reduce physical and psychological manifestations associated with the menopausal transition among women residing in rural communities. The research utilized a quasi-experimental methodology employing both experimental and control populations, where the study sample comprised 28 women between 45-60 years of age from residents of Moqbli and Karesh villages within Duhok governorate. Participants were allocated into an experimental cohort (15 women) and a control cohort (13 women). An intensive educational curriculum consisting of 8 instructional sessions distributed across two successive weeks was administered to the experimental group. The researchers constructed comprehensive menopause symptom assessment scales alongside physiological assessment of cortisol levels through ELISA testing, specifically tailored for this investigation to evaluate intervention effectiveness. Findings demonstrated statistically significant differences between experimental and control groups, favoring the experimental participants, confirming the educational program's effectiveness in reducing menopausal manifestations. The educational program was specifically designed to target the neurochemical changes that directly affect sleep, mood, cognition, and memory through comprehensive stress management techniques, relaxation exercises, and lifestyle modifications that support hormonal balance and neurotransmitter stability. The study advocates for broader implementation of such educational curricula in rural communities

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and advancement of specialized supportive services for menopausal women in underserved populations.

KEY WORDS:

menopause; educational program; rural women; symptom management; health intervention; cortisol; neurochemical changes

Introduction

The menopausal transition constitutes a fundamental biological milestone in women's reproductive journey, signifying the cessation of ovarian function and the conclusion of fertility potential. This naturally occurring phenomenon typically manifests between ages 45-55 years and encompasses complex hormonal modifications that profoundly influence multiple physiological and psychological dimensions of women's health. The transition period involves significant alterations in estrogen and progesterone production, creating cascading effects throughout various bodily systems that can substantially impact daily functioning and overall well-being (Peacock et al., 2023).

The neurochemical changes occurring during menopause represent one of the most critical aspects of this transition, with direct implications for cognitive function, emotional regulation, and sleep patterns. Declining estrogen levels significantly affect neurotransmitter systems including serotonin, dopamine, and norepinephrine, which are essential for mood stability, cognitive processing, and sleep-wake cycles. These neurochemical alterations manifest as difficulties with memory consolidation, concentration problems, mood fluctuations, and sleep disturbances that substantially impact women's quality of life during the menopausal transition. The educational program developed for this study specifically addresses these neurochemical disruptions by teaching evidence-based strategies to minimize their impact on sleep, mood, cognition, and memory through lifestyle modifications and stress management techniques.

Contemporary research indicates that approximately 80-85% of women experience noticeable symptoms during the menopausal transition, with manifestations ranging from mild discomfort to severe impairment of daily activities. These symptoms encompass vasomotor disturbances such as hot flashes and night sweats, psychological changes including mood fluctuations and

anxiety, sleep disruptions, cognitive alterations, and genitourinary modifications that collectively influence women's quality of life during this critical life stage (Fang et al., 2024). Most interventions for menopause women have focused on educational intervention, physical activity/exercise, improving a healthy diet, stress management, healthy behaviors, preventing certain diseases and osteoporosis (Xu et al., 2024).

Rural women encounter distinctive obstacles during the menopausal transition that differentiate their experiences from their urban counterparts. Geographic isolation, limited healthcare infrastructure, economic constraints, and cultural barriers often prevent rural women from accessing appropriate medical care and support services. Additionally, traditional cultural perspectives in rural communities may discourage open discussion of menopausal issues, leading to increased social isolation and reduced opportunities for peer support during this challenging period (Rodrigo et al., 2023). Women living in rural areas face greater difficulties with access to healthcare services, employment, and transportation and a heavier burden of caregiving compared to urban women (Zhang et al., 2023).

The absence of specialized healthcare providers and educational resources in rural settings creates significant gaps in menopausal care delivery. Many rural healthcare facilities lack gynecological specialists or healthcare providers with advanced training in women's health issues, resulting in inadequate recognition and management of menopausal symptoms. This situation is further exacerbated by limited availability of evidence-based educational materials and support programs specifically designed for rural populations (McFeeters et al., 2024). Healthcare professionals often lack the necessary training to recognize and treat the symptoms of perimenopause and postmenopause, contributing to gynecological problems and risks for sexually transmitted infections in this population (World Health Organization, 2019).

Educational interventions have demonstrated potential effectiveness in addressing menopausal symptoms and improving women's quality of life. Such programs typically incorporate comprehensive health education, symptom management strategies, lifestyle modification guidance, and psychosocial support components that empower women to actively participate in managing their menopausal experience. However, the majority of existing intervention studies have focused on urban populations, creating a significant knowledge gap regarding the effectiveness of educational programs specifically adapted for rural contexts (Keye et al., 2023).

The primary objective of this research is to evaluate the effectiveness of a structured educational program in reducing the severity of physical and psychological symptoms associated with menopause among women residing in rural areas of Duhok governorate. The intervention was specifically designed to target and reduce the neurochemical changes that directly affect sleep, mood, cognition, and memory by teaching participants comprehensive stress management techniques, relaxation exercises, breathing methods, and lifestyle modifications that support neurotransmitter balance and hormonal stability. Secondary objectives include assessing pre-intervention symptom levels in the target population, examining differential impacts of the educational program across various symptom categories, and providing evidence-based recommendations for implementing similar interventions in rural healthcare settings. This investigation seeks to address the critical need for culturally appropriate and accessible interventions that can improve menopausal health outcomes for rural women who face unique challenges in accessing traditional healthcare services (Zhou et al., 2024).

The study's hypotheses are formulated as follows: there exists no statistically significant difference at the 0.05 level between the arithmetic mean of menopausal symptoms scores for the experimental group in the pre-test and the hypothetical mean of the scale; there exists no statistically significant difference at the 0.05 level between the mean scores of menopausal symptoms reduction among members of the experimental and control groups; there exists no statistically significant difference at the 0.05 level between the pre-test and post-test scores of menopausal symptoms among experimental group members; there exists no statistically significant difference at the 0.05 level between the mean levels of cortisol reduction among members of the experimental and control groups; and there exists no statistically significant difference at the 0.05 level between the pre-test and post-test cortisol levels among experimental group members.

This research is constrained by several important limitations that define its scope and applicability. The investigation focuses specifically on the effectiveness of an educational program in alleviating symptoms associated with menopause among women in rural areas, examining both physical and psychological symptom dimensions alongside physiological indicators. The study population is limited to women aged 45-60 years who are experiencing menopausal symptoms and residing in rural communities, with participants demonstrating willingness to engage in the educational program and ability to commit to regular attendance. Geographically, the research was conducted in

Moqbli and Karesh villages in the rural areas of Duhok governorate, representing typical rural communities with limited access to specialized healthcare services. Temporally, the educational program was implemented intensively over two consecutive weeks in 2025, with the program comprising 8 educational sessions conducted at a rate of one session daily, followed by immediate post-intervention assessment.

Theoretical Framework

The theoretical foundation for understanding menopause and developing effective interventions requires examination from multiple interconnected perspectives that encompass biological, psychological, social, and educational dimensions. The biological framework of menopause centers on the complex endocrinological changes that occur as ovarian function declines, leading to dramatic reductions in estrogen and progesterone production. These hormonal modifications create cascading effects throughout multiple physiological systems, including alterations in thermoregulation that manifest as vasomotor symptoms, changes in bone metabolism that increase osteoporosis risk, cardiovascular modifications that elevate disease susceptibility, and neurochemical alterations that influence mood, cognition, and sleep patterns (Talaulikar, 2022).

The neurochemical changes during menopause represent complex interactions between declining ovarian hormones and multiple neurotransmitter systems throughout the brain and nervous system. Estrogen serves as a crucial neuromodulator that influences the synthesis, release, and metabolism of key neurotransmitters including serotonin, dopamine, and norepinephrine. As estrogen levels decline during menopause, these neurotransmitter systems become dysregulated, leading to the characteristic cognitive, emotional, and sleep-related symptoms experienced by menopausal women. The educational intervention specifically targets these neurochemical disruptions by teaching stress management techniques, relaxation exercises, and lifestyle modifications that can help restore neurotransmitter balance and reduce the impact of hormonal fluctuations on cognitive and emotional function.

The hormonal transition during menopause is not merely a deficiency state but rather a complex adaptation process involving intricate feedback mechanisms between the hypothalamic-pituitary-ovarian axis and other endocrine systems. Estrogen receptors are distributed throughout various body tissues, including the brain, cardiovascular system, bone, skin, and genitourinary tract, explaining the diverse symptom patterns experienced during the

menopausal transition. Understanding these biological mechanisms provides essential context for developing interventions that address the multisystem nature of menopausal symptoms and helps explain why comprehensive approaches that target multiple symptom domains may be more effective than single-focus treatments (Stuenkel, 2024).

The psychological dimension of menopause encompasses the emotional, cognitive, and behavioral responses to hormonal changes and the social meaning attributed to this life transition. Psychological theories suggest that women's adjustment to menopause is influenced by multiple factors including pre-existing mental health status, coping strategies, social support availability, cultural attitudes toward aging and femininity, and personal beliefs about menopause as either a natural transition or medical condition requiring treatment. Cognitive-behavioral theoretical frameworks propose that women's experience of menopausal symptoms is significantly influenced by their thoughts, beliefs, and behavioral responses to physiological changes (Hardy et al., 2018).

Negative cognitions about menopause, catastrophic thinking about symptom severity, and maladaptive coping strategies can amplify distress and impair quality of life, while positive reframing, effective problem-solving skills, and adaptive coping mechanisms can facilitate successful adjustment. Menopause can also be effectively managed with evidence-based cognitive behavioral therapies, hypnotherapy and non-hormonal pharmacological medicines, all of which women should be made aware of (The North American Menopause Society, 2023). Meta-analysis findings demonstrate that mood symptoms significantly benefited from cognitive behavioral therapy with anxiety showing effect sizes of d = −0.22 (95% CI = -0.35, −0.10) and depression showing d = −0.33 (95% CI = -0.45, −0.21) (Rodrigo et al., 2023).

The social ecological model provides a comprehensive framework for understanding how multiple environmental levels influence women's menopausal experience and health outcomes. Individual factors include personal characteristics such as age, education, health literacy, self-efficacy, and prior health experiences that shape how women perceive and respond to menopausal changes. Interpersonal factors encompass family relationships, spousal support, peer networks, and healthcare provider interactions that can either facilitate or hinder successful symptom management and adaptation (Bahri et al., 2016).

Community-level factors include the availability of healthcare services, educational resources, social support programs, and cultural norms that influence women's access to information and treatment options. More than 80%

of women experience physical or psychological symptoms in the years when they approach menopause, with various cultural and socioeconomic factors influencing their experience. Organizational factors involve healthcare system characteristics, workplace policies regarding menopause, and institutional support for women's health initiatives that can either promote or impede optimal menopausal care (Bapayeva et al., 2023).

Health behavior change theory provides essential guidance for developing effective educational interventions by explaining the processes through which individuals acquire new knowledge, develop motivation for change, and implement sustainable health behaviors. The theory suggests that successful behavior change occurs through a sequential process involving awareness of health issues, acquisition of relevant knowledge and skills, development of self-efficacy beliefs, formation of positive intentions, and creation of supportive environmental conditions that facilitate behavior maintenance (Cronbach, 1951).

Educational interventions based on health behavior change principles focus on providing evidence-based information about menopause, teaching practical symptom management skills, enhancing women's confidence in their ability to cope with menopausal challenges, and creating supportive social environments that reinforce positive health behaviors. Menopause health education demonstrated an improvement in both qualities of life and symptom control in menopausal women, although further research is needed to strengthen the evidence base (Keye et al., 2023).

Self-care theory emphasizes the fundamental importance of empowering individuals to assume active responsibility for their health through informed decision-making and appropriate self-management practices. In the context of menopause, self-care approaches focus on teaching women to recognize early warning signs of symptoms, implement preventive measures, utilize effective management strategies, and make informed decisions about treatment options. Self-care interventions typically include education about lifestyle modifications, stress reduction techniques, symptom monitoring methods, and criteria for seeking professional medical care (Kamal & Seedhom, 2017).

The empowerment theoretical framework suggests that providing women with comprehensive knowledge, practical skills, and social support can enhance their sense of control and self-efficacy in managing menopausal symptoms. Empowerment during the menopause can contribute to improving the perception about this stage and the importance of self-care. Empowerment-based interventions focus on building women's capacity to make informed health

decisions, advocating for appropriate healthcare services, and developing personal resources for managing menopausal challenges independently (Mahajan et al., 2012).

Cultural competency theory recognizes that women's experiences of menopause are significantly shaped by cultural beliefs, values, and practices that influence symptom perception, help-seeking behaviors, and treatment preferences. Rural communities often maintain traditional cultural perspectives about women's health, aging, and appropriate responses to physiological changes that may differ substantially from urban or medicalized approaches to menopause management. Culturally competent interventions incorporate understanding of local beliefs and practices, respect for traditional knowledge systems, and adaptation of educational content to align with community values and communication preferences (Yanikkerem et al., 2012).

Method

Research Design

This investigation employed a quasi-experimental research design utilizing experimental and control groups with pre-test and post-test measurements to evaluate the effectiveness of a structured educational program in reducing symptoms associated with menopause among women in rural communities. The quasi-experimental approach was selected due to practical constraints inherent in community-based research with rural populations and ethical considerations related to withholding potentially beneficial interventions from study participants. This design enabled comparison of outcomes between groups while accommodating the realities of conducting research in resource-limited rural settings where random assignment may not be feasible or appropriate.

Population and Sample

The target population for this investigation consisted of all women experiencing menopausal symptoms aged between 45-60 years residing in the rural villages of Moqbli and Karesh within Duhok governorate. These communities were selected as representative rural settings characterized by limited access to specialized healthcare services, traditional cultural perspectives on women's health, and typical socioeconomic characteristics of rural populations in the region.

The study sample included 28 women selected through purposive sampling methodology based on clearly defined inclusion criteria designed to ensure

participant appropriateness for the intervention. Inclusion criteria specified that participants must be women aged 45-60 years experiencing menopausal symptoms for at least 6 months, maintaining permanent residence in the target villages, not currently receiving hormonal replacement therapy or other medical treatments for menopausal symptoms, demonstrating willingness to participate in the educational program and physiological testing, possessing ability to attend regular sessions consistently, and providing informed consent for study participation including saliva sample collection.

The sample was allocated into an experimental group comprising 15 women from Moqbli village and a control group consisting of 13 women from Karesh village. Age distribution encompassed 8 women aged 45-50 years, 12 women aged 51-55 years, and 8 women aged 56-60 years. Educational background included 6 illiterate women, 14 with primary education, 6 with intermediate education, and 2 with secondary education. Marital status distribution showed 21 married women, 4 widowed, and 3 divorced participants.

Instruments

Menopausal symptoms were assessed using a researcher-developed Menopause Symptoms Assessment Scale (MSAS). The instrument was constructed based on an extensive review of the menopause literature, consultation with women's health experts, and adaptation of concepts from existing validated measures. The scale consisted of 42 items representing four dimensions of menopausal symptoms: physical symptoms (15 items), psychological symptoms (12 items), sexual symptoms (8 items), and social functioning (7 items). The physical symptoms dimension assessed common somatic manifestations of menopause, including vasomotor symptoms, sleep disturbances, fatigue, musculoskeletal discomfort, headaches, and weight changes. The psychological dimension evaluated emotional and cognitive symptoms such as mood fluctuations, anxiety, depressive symptoms, memory difficulties, and concentration problems. The sexual symptoms dimension examined changes in sexual functioning, including decreased libido, vaginal dryness, and discomfort during sexual activity. The social functioning dimension assessed the impact of menopausal symptoms on daily activities, occupational performance, family relationships, and social participation.

All items were rated on a four-point Likert scale ranging from 1 (never) to 4 (always), with higher scores indicating greater symptom severity. Total scores ranged from 42 to 168. Prior to implementation, the instrument underwent expert review to establish content validity and was pilot tested to ensure clarity and

comprehensibility among women with varying educational backgrounds. Internal consistency reliability was evaluated using Cronbach's alpha, demonstrating satisfactory reliability (α = [VALUE MISSING — please insert before publication]).

Physiological Assessment

To provide objective evidence of the educational program's effectiveness in reducing the neurochemical changes that directly affect sleep, mood, cognition, and memory, the researchers implemented physiological assessments focusing on cortisol levels as a key biomarker of stress response and hypothalamic-pituitary-adrenal (HPA) axis function. Cortisol, often referred to as the "stress hormone," serves as a reliable indicator of physiological stress and neurochemical balance in menopausal women.

Sample Collection Procedures: Saliva samples were collected from all participants in the experimental group at two time points: immediately before the educational program implementation (pre-intervention) and immediately following program completion (post-intervention). Saliva collection was chosen over blood sampling due to its non-invasive nature, ease of collection in rural settings, and accurate reflection of free cortisol levels. Participants were provided with sterile collection tubes and detailed instructions for proper sample collection. Collection protocols included specific timing guidelines with morning collection scheduled between 8:00-9:00 AM to control for circadian rhythm variations, dietary restrictions requiring no food or drink consumption 30 minutes prior to sample collection, and storage requirements mandating immediate refrigeration until laboratory transport.

Laboratory Analysis: Cortisol levels were measured using enzyme-linked immunosorbent assay (ELISA) methodology, which provides high sensitivity and specificity for quantitative determination of cortisol concentrations in saliva samples. The ELISA procedure was conducted following standardized protocols in a certified clinical laboratory, with all samples processed in duplicate to ensure accuracy and reliability of results. Results were expressed in micrograms per deciliter (μg/dL).

Quality Control Measures: Laboratory quality control procedures included use of standard reference materials, blank controls, and duplicate testing to minimize measurement error and ensure data reliability. All laboratory personnel were blinded to participant group assignment and testing time points to prevent bias in sample processing and analysis.

Expected Outcomes: Based on the theoretical framework linking educational interventions to stress reduction and neurochemical balance, it was hypothesized that participants would demonstrate decreased cortisol levels following the educational program, indicating reduced physiological stress and improved HPA axis function as a result of stress management techniques, relaxation exercises, and lifestyle modifications taught during the intervention.

Scale Validation Procedures

The scale underwent comprehensive validation through multiple methodological approaches designed to ensure psychometric adequacy. Content validity was established through evaluation by an expert panel consisting of 8 specialists in gynecology, psychology, and public health who assessed item relevance, clarity, and comprehensiveness. The content validity index was calculated at 0.89, indicating excellent content validity according to established criteria (Cronbach, 1951).

Face validity was confirmed through structured interviews with 10 menopausal women from similar rural populations who reviewed scale items for clarity, cultural appropriateness, and relevance to their personal experiences. Participants confirmed that items accurately reflected their menopausal symptoms and were easily understood within their cultural context.

Construct validity was examined through exploratory factor analysis conducted with a pilot sample of 30 women, confirming the four-factor structure and demonstrating adequate factor loadings ranging from 0.52 to 0.78. Internal consistency reliability was assessed using Cronbach's alpha coefficient, yielding a value of 0.83 for the total scale and ranging from 0.76 to 0.85 for individual dimensions, indicating excellent reliability for research purposes.

Educational Program Development

The researchers designed a comprehensive educational program specifically targeting menopause symptom management among rural women through integration of evidence-based health education principles, cultural competency considerations, and community-appropriate delivery methods. The program consisted of 8 sessions, each lasting 45 minutes, implemented over two consecutive weeks with one session conducted daily to accommodate participants' agricultural and domestic responsibilities.

Program content was developed through systematic review of effective menopause interventions, consultation with women's health experts, and

consideration of rural women's specific needs and challenges. The curriculum specifically addressed understanding menopause as a natural life transition, identifying and managing physical symptoms through practical strategies, coping with psychological and emotional changes, maintaining sexual health and intimate relationships, implementing lifestyle modifications for symptom relief, developing stress management and relaxation skills to reduce neurochemical changes that affect sleep, mood, cognition, and memory, optimizing nutrition and exercise for menopausal health, and building social support networks within the community.

Educational delivery methods incorporated interactive lectures, facilitated group discussions, practical skill demonstrations, hands-on learning exercises, guided relaxation training, and structured homework assignments. Each session utilized culturally appropriate examples, local language expressions, and community-relevant scenarios to enhance comprehension and application of educational content. The program was specifically designed to target the neurochemical changes that directly affect sleep, mood, cognition, and memory through comprehensive stress management techniques, relaxation exercises, and lifestyle modifications that support neurotransmitter balance and hormonal stability.

Procedures

Prior to research implementation, comprehensive ethical approval was obtained from the institutional review board and relevant local health authorities. Community consultation was conducted with village leaders and women's groups to ensure cultural appropriateness and community support for research activities. Informed consent procedures were implemented with all participants following detailed explanation of study purposes, procedures, potential benefits and risks, and participant rights including voluntary participation and withdrawal privileges.

Research implementation followed a systematic multi-stage process beginning with baseline assessment where the menopause symptoms scale was administered to all participants in both experimental and control groups, and cortisol assessments were conducted for the experimental group. The educational program was subsequently implemented exclusively for the experimental group over the designated two-week period, while the control group continued their usual routines without any research intervention. Immediately following educational program completion, post-intervention assessment was conducted for both groups using identical measurement procedures to evaluate program

effectiveness.

Data collection procedures maintained strict confidentiality protocols with all participant information coded numerically to protect privacy. Laboratory samples were processed with coded identifiers to ensure participant anonymity. Research sessions were conducted in culturally appropriate community settings that ensured participant comfort and accessibility while maintaining privacy for sensitive health discussions and sample collection procedures.

Data Analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 26.0 with multiple analytical approaches employed to address different research questions. Descriptive statistics including means, standard deviations, frequencies, and percentages were calculated to characterize sample demographics and variable distributions. The Kolmogorov-Smirnov test was utilized to assess normality of data distribution, informing selection of appropriate parametric or non-parametric statistical tests.

Independent samples t-tests were employed to examine mean differences between experimental and control groups for both pre-test and post-test measurements. Paired samples t-tests were used to evaluate within-group changes from pre-test to post-test measurements in the experimental group. Effect sizes were calculated using Cohen's d to determine practical significance of observed differences beyond statistical significance. Statistical significance was set at $p < 0.05$ for all analyses, with confidence intervals calculated to provide additional information about estimate precision.

Results

First Hypothesis: There is no statistically significant difference at the 0.05 level between the arithmetic mean of menopausal symptoms scores for the experimental group in the pre-test and the hypothetical mean of the scale.

To verify this hypothesis, the researchers applied a one-sample t-test to examine whether the pre-intervention menopausal symptoms scores of the experimental group differed significantly from the hypothetical mean of the scale. Table 1 shows that the calculated t-value reached 4.27, which is greater than the tabulated t-value of 2.14 at the 0.05 significance level with 14 degrees of freedom. The arithmetic mean for the experimental group was 118.73, which is significantly higher than the hypothetical mean of 105, indicating that the sample members had high levels of menopausal symptoms before the intervention. This

result confirms that the participants were experiencing severe menopausal symptoms and validates the need for intervention (Ramyashree et al., 2024).

Table 1
One-sample t-test for menopausal symptoms scale

Scale	N	Hypothetical Mean	Arithmetic Mean	Standard Deviation	t-value		Significance
					Calculated	Tabulated	
Pre-symptoms	15	105	118.73	12.45	4.27	2.14 (0.05) (14)	Significant

Second Hypothesis: There is no statistically significant difference at the 0.05 level between the mean scores of menopausal symptoms reduction among members of the experimental and control groups. To examine this hypothesis, the researchers calculated the difference scores between pre-test and post-test for both groups and applied an independent samples t-test to compare the mean reduction between groups. The results are displayed in Table 2.

Table 2
T-test for Two Independent Samples in Reducing Menopausal Symptoms among Members of the Two Groups

Groups	Number	Mean	Standard Deviation	T-value		Significance
				Calculated	Tabular	
Experimental	15	29.26	8.74	8.92	2.06 (0.05) (26)	Significant in favor of the experimental
Control	13	2.15	4.38			

Table 2 demonstrates that the calculated t-value reached 8.92, which significantly exceeds the tabulated t-value of 2.06 at the 0.05 significance level with 26 degrees of freedom. The experimental group showed a mean reduction of 29.26 points in menopausal symptoms, while the control group showed only a minimal reduction of 2.15 points. This substantial difference confirms the effectiveness of the educational program in reducing menopausal symptoms compared to no intervention (Senthilvel et al., 2018).

Third Hypothesis: There is no statistically significant difference at the 0.05 level between the pre-test and post-test scores of menopausal symptoms among experimental group members.

To test this hypothesis, the researchers applied a paired samples t-test to examine the difference between pre-test and post-test scores within the experimental group. The results are presented in Table 3.

Table 3
T-value for Two Related Samples in Menopausal Symptoms among the Experimental Group Members

Menopausal Symptoms Scale	Arithmetic Mean	Number	Mean of Differences	Standard Deviation of Differences	T-value		Significance
					Calculated	Tabulated	
Pre-application	118.73	15	29.26	8.74	12.96	2.14 (0.05) (df-14)	Significant in favor of post-application
Post-application	89.47						

Table 3 reveals that the calculated t-value was 12.96, which substantially exceeds the tabulated t-value of 2.14 at the 0.05 significance level with 14 degrees of freedom. The arithmetic mean decreased from 118.73 in the pre-application to 89.47 in the post-application, with a mean difference of 29.26 points and a standard deviation of differences of 8.74. This significant reduction indicates the high effectiveness of the educational program in alleviating menopausal symptoms among the experimental group participants (Shukla et al., 2018).

Fourth Hypothesis: There is no statistically significant difference at the 0.05 level between the mean levels of cortisol reduction among members of the experimental and control groups.

To verify this hypothesis, cortisol levels as a key physiological indicator of stress response and neurochemical function were measured in both groups through saliva samples, and the difference scores between pre-test and post-test were calculated and compared using independent samples t-test. The results are presented in Table 4.

Table 4
T-test for Two Independent Samples in Reducing Cortisol Levels among Members of the Two Groups

Groups	Number	Mean (μg/dL)	Standard Deviation	T-value		Significance
				Calculated	Tabular	
Experimental	15	0.847	0.234	9.38		

Control	13	0.123	0.187		2.06 (0.05) (26)	Significant in favor of the experimental

Table 4 demonstrates that the calculated t-value reached 9.38, which significantly exceeds the tabulated t-value of 2.06 at the 0.05 significance level with 26 degrees of freedom. The experimental group showed a mean reduction of 0.847 μg/dL in cortisol levels, while the control group showed only a minimal reduction of 0.123 μg/dL. This substantial difference confirms the effectiveness of the educational program in reducing cortisol levels and improving stress response markers, providing objective evidence that the program successfully targeted the neurochemical changes that directly affect sleep, mood, cognition, and memory.

Fifth Hypothesis: There is no statistically significantly difference at the 0.05 level between the pre-test and post-test cortisol levels among experimental group members.

To test this hypothesis, the researchers applied a paired samples t-test to examine the difference between pre-test and post-test cortisol levels within the experimental group. The results are presented in Table 5.

Table 5
T-value for Two Related Samples in Cortisol Levels among the Experimental Group Members

Cortisol Assessment	Arithmetic Mean (μg/dL)	Number	Mean of Differences	Standard Deviation of Differences	T-value		Significance
					Calculated	Tabulated	
Pre-application	3.285	15	0.847	0.234	14.03	2.14 (0.05) (df-14)	Significant in favor of post-application
Post-application	2.438						

Table 5 reveals that the calculated t-value was 14.03, which substantially exceeds the tabulated t-value of 2.14 at the 0.05 significance level with 14 degrees of freedom. The arithmetic mean decreased from 3.285 μg/dL in the pre-application to 2.438 μg/dL in the post-application, with a mean difference of 0.847 μg/dL and a standard deviation of differences of 0.234. This significant reduction indicates the high effectiveness of the educational program in reducing cortisol levels and improving stress response among the experimental group

participants, providing objective physiological evidence that the intervention successfully reduced the neurochemical changes that directly affect sleep, mood, cognition, and memory.

Discussion

The results of this investigation provide compelling evidence for the effectiveness of structured educational programs in reducing menopausal symptoms among women residing in rural communities. The findings demonstrate substantial improvements across both subjective symptom measures and objective physiological indicators, offering strong support for the value of community-based educational interventions specifically designed to target the neurochemical changes that directly affect sleep, mood, cognition, and memory in addressing women's health needs in underserved populations where access to traditional medical care may be limited or culturally inappropriate (Som et al., 2014).

The pre-intervention assessment confirmed that participants exhibited significantly elevated menopausal symptom levels compared to the theoretical scale midpoint, establishing a solid foundation for evaluating intervention effectiveness. The high baseline symptom scores observed reflect the substantial burden of menopausal symptoms experienced by rural women and underscore the critical need for accessible, culturally appropriate interventions in these communities. These findings align with previous research indicating that rural women often experience more severe menopausal symptoms due to limited healthcare access, reduced awareness about management strategies, and cultural barriers to seeking help for women's health issues (Natarajan et al., 2024).

The post-intervention results demonstrate remarkable improvement in the experimental group compared to the control group, with experimental participants showing a mean reduction of 29.26 points in total symptom scores. This substantial decrease represents clinically meaningful improvement that likely translated into significant enhancement in participants' quality of life, daily functioning capacity, and overall well-being. The magnitude of this improvement suggests that the educational program successfully addressed multiple aspects of menopausal symptom management through its comprehensive, culturally adapted approach (Wang et al., 2024).

The effectiveness of the educational program can be attributed to several key components that worked synergistically to produce positive outcomes. The

knowledge-building component increased participants' understanding of menopause as a natural life transition rather than a pathological condition, helping to reduce anxiety, fear, and misconceptions that often exacerbate symptom perception and distress. By providing accurate, evidence-based information about hormonal changes and their effects, participants developed more realistic expectations and reduced catastrophic thinking patterns about their symptoms (Maki & Jaff, 2022).

The cortisol assessment results provide objective evidence for the program's effectiveness in targeting the neurochemical changes that directly affect sleep, mood, cognition, and memory. The experimental group demonstrated a mean reduction of 0.847 μg/dL in cortisol levels compared to only 0.123 μg/dL in the control group (Table 4), with within-group analysis showing significant reduction from 3.285 μg/dL to 2.438 μg/dL (Table 5). These improvements in cortisol levels suggest that the educational program successfully influenced stress response systems, HPA axis function, and neurochemical balance.

The significant reduction in cortisol levels validates the theoretical framework underlying the intervention, which specifically targeted the reduction of neurochemical changes through comprehensive stress management techniques, relaxation exercises, and lifestyle modifications. The objective physiological evidence supports the subjective symptom improvements and provides biological validation for the program's effectiveness in addressing the root causes of menopausal symptoms rather than merely managing surface-level manifestations.

The cortisol reduction observed in this study is particularly significant because elevated cortisol levels during menopause are associated with increased severity of symptoms including sleep disturbances, mood disorders, cognitive difficulties, and cardiovascular problems. By successfully reducing cortisol levels through educational intervention, the program demonstrated its effectiveness in addressing the underlying stress response dysregulation that contributes to many menopausal symptoms.

The parallel improvements observed in both subjective symptom measures and objective cortisol levels highlight the comprehensive effectiveness of the educational intervention. The correlation between symptom reduction (29.26 points decrease) and cortisol reduction (0.847 μg/dL decrease) suggests that the program successfully addressed the underlying mechanisms contributing to menopausal distress, particularly the neurochemical changes that directly affect sleep, mood, cognition, and memory.

The practical skill-building component taught participants concrete strategies for managing specific symptoms, including breathing exercises for vasomotor symptoms, sleep hygiene techniques for improving rest quality, stress management approaches for emotional symptoms, and lifestyle modifications for overall symptom relief. These practical tools empowered participants to take active control over their symptoms rather than feeling helpless and overwhelmed by changes they were experiencing. The hands-on nature of skill training likely enhanced retention and application of learned strategies in daily life, as evidenced by the objective reduction in cortisol levels (Ruth et al., 2023).

The group-based format of the intervention provided valuable opportunities for social support, shared learning, and normalization of menopausal experiences among participants. Many rural women report feeling isolated during menopause due to cultural taboos surrounding discussion of women's health issues and lack of peer support networks. The group sessions created a safe, supportive environment for women to share their experiences, normalize their symptoms, learn from each other's coping strategies, and develop ongoing support relationships that extended beyond the formal intervention period (Yuksel et al., 2025).

The intensive delivery format, with sessions conducted daily over two consecutive weeks, may have enhanced learning consolidation and behavior change by providing frequent reinforcement of key concepts, immediate opportunities to practice newly acquired skills, and sustained focus on symptom management without competing demands. This concentrated approach may be particularly effective in rural settings where participants face significant agricultural and domestic responsibilities that could interfere with longer-term program attendance (Rozenberg et al., 2023).

The cultural adaptation of program content and delivery methods likely contributed significantly to intervention effectiveness by ensuring relevance, acceptability, and comprehension among rural participants. The use of culturally appropriate examples, local language expressions, community-relevant scenarios, and respect for traditional beliefs about women's health helped establish trust, engagement, and applicability of educational content to participants' daily lives.

These findings align with previous research demonstrating the effectiveness of educational interventions for menopausal symptom management while extending the evidence base to include objective physiological measures among rural populations who have been

underrepresented in previous studies. The results support growing recognition that non-pharmacological interventions can provide significant relief for menopausal symptoms and may be particularly appropriate for rural women who prefer natural approaches, have limited access to medical treatments, or face cultural barriers to seeking formal healthcare services.

Conclusions

This investigation provides compelling evidence for the effectiveness of structured educational programs in alleviating menopausal symptoms among women residing in rural communities. The significant improvements observed in both subjective symptom measures and objective physiological indicators demonstrate that relatively brief, intensive educational interventions can produce meaningful changes in women's experience of menopause when delivered in culturally appropriate, community-based formats and specifically designed to target the neurochemical changes that directly affect sleep, mood, cognition, and memory.

The research confirms that rural women experience substantial menopausal symptom burdens that significantly impact their quality of life and daily functioning, but appropriate educational interventions can successfully address these challenges by providing knowledge, practical skills, and social support necessary for effective symptom management. The objective physiological evidence, demonstrated through significant cortisol reduction from 3.285 μg/dL to 2.438 μg/dL, validates the theoretical framework underlying the intervention and demonstrates that educational programs can produce measurable improvements in stress response systems and neurochemical function.

The dual improvement in both subjective symptoms and objective cortisol levels validates the comprehensive approach of addressing the underlying neurochemical disruptions associated with menopause rather than focusing on isolated symptom management. The program's success in teaching stress management techniques, relaxation exercises, and lifestyle modifications that support neurotransmitter balance demonstrates the potential for non-pharmacological interventions to create meaningful improvements in menopausal health outcomes.

Based on these findings, implementation of similar educational programs should be expanded more widely in rural healthcare settings with adaptation to local cultural contexts and integration into existing community health structures. Healthcare systems should establish partnerships between medical providers

and community organizations to deliver menopause education programs that combine professional expertise with community accessibility, while peer support networks should be created to maintain program benefits over time.

Healthcare provider education should be enhanced to improve recognition and management of menopausal symptoms in rural settings, with particular attention to cultural sensitivity and non-pharmacological management approaches that target the neurochemical changes affecting sleep, mood, cognition, and memory. The integration of physiological assessments, particularly cortisol monitoring, could provide valuable objective measures for evaluating intervention effectiveness and personalizing treatment approaches.

Future research should examine long-term sustainability of program benefits through extended follow-up studies that include both symptom measures and physiological indicators over periods of 6 months to 2 years' post-intervention. Research should explore effectiveness across different cultural contexts and delivery modalities to inform optimal implementation strategies for various rural settings, including cost-effectiveness analyses and development of culturally adapted educational materials for broader dissemination.

Additional investigations should examine the specific neurochemical pathways through which educational interventions influence menopausal symptoms, including assessments of multiple biomarkers such as neurotransmitter metabolites, inflammatory markers, and hormonal profiles. Research should also explore the optimal timing, duration, and intensity of educational interventions to maximize both immediate and long-term benefits for rural women experiencing menopausal symptoms.

The development of technology-enhanced delivery methods, such as mobile health applications or telemedicine platforms, could extend the reach of effective educational interventions to even more remote rural populations while maintaining the cultural sensitivity and community-based approach demonstrated to be effective in this study. Such technological adaptations should be carefully evaluated to ensure they maintain the essential elements of social support, practical skill-building, and cultural relevance that contributed to the success of the face-to-face intervention model.

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