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Effects of a Nurse-Supervised Intradialytic Isotonic Exercise Program on Happiness, Appetite, and Dialysis Adequacy in Patients Undergoing Hemodialysis: A Randomized Controlled Trial

Atye Babaii
Qom University of Medical Science and Health Services
Seyde Azam Vahedi
Qom University of Medical Sciences
Leila Ghanbari Afra
Qom University of Medical Science and Health Services
Mohammad Abbasinia
abbasinia64@gmail.com

Qom University of Medical Science and Health Services

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Abstract

Background: Patients undergoing maintenance hemodialysis frequently experience reduced happiness, appetite disturbances, and poor clinical outcomes. Nurses play a key role in implementing supportive interventions during dialysis sessions. This study evaluated the effects of a nurse-supervised intradialytic isotonic exercise program on happiness, appetite, and dialysis adequacy in patients undergoing hemodialysis.

Methods: In this parallel-group randomized controlled trial, 96 patients receiving maintenance hemodialysis were randomly assigned to either an intervention group (n = 48) or a control group (n = 48). The intervention group performed nurse-supervised intradialytic isotonic exercises for 30 minutes, three times weekly, for eight weeks, whereas the control group received routine care. Happiness was measured using the Oxford Happiness Inventory, appetite using the Simplified Nutritional Appetite Questionnaire, and dialysis adequacy using Kt/V. Analysis of covariance was used to compare post-intervention outcomes while controlling for baseline values.

Clinical trial number: Iranian Registry of Clinical Trials (IRCT20150724023314N6), registered on July 30, 2025. Available at: https://irct.ir/trial/85160.

Results: Eighty-two participants completed the study (intervention = 40, control = 42). After adjustment for baseline scores, happiness was significantly higher in the intervention group than in the control group (adjusted mean difference = 7.93, 95% CI: 1.46–14.39; p = 0.017). No significant between-group differences were observed for appetite (p = 0.444) or dialysis adequacy (p = 0.757).

Conclusions: A nurse-supervised intradialytic isotonic exercise program improved happiness among patients undergoing hemodialysis but did not significantly affect appetite or dialysis adequacy. Incorporating structured exercise into routine nursing care may provide a feasible and low-cost approach to promoting emotional well-being in this population.

Introduction

Chronic kidney disease (CKD) is a silent and progressive condition that represents a major public health burden worldwide [1]. For patients with end-stage renal disease (ESRD), dialysis remains an essential life-sustaining therapy [2]. However, despite its vital role in prolonging survival, hemodialysis is accompanied by numerous physical, psychological, and social challenges that adversely affect patients' overall health and quality of life [3]. A study focusing on Iranian hemodialysis patients reported a high prevalence of depression and emphasized that early detection and management can improve quality of life and clinical outcomes [4]. In contrast, a recent systematic review indicated that although selective serotonin reuptake inhibitors (SSRIs) are commonly prescribed to manage depression in this population, their therapeutic effectiveness remains limited and inconsistent across studies [5].

Malnutrition and inadequate dialysis adequacy are other major concerns among hemodialysis patients. A comprehensive review highlighted that despite technological advances in dialysis techniques, these patients continue to face a high risk of malnutrition. Both iatrogenic factors, such as low dialysis adequacy leading to uremia and metabolic acidosis, and non-iatrogenic factors, including poor appetite and physical debility, contribute to this problem [6]. Anorexia is highly prevalent among hemodialysis patients and is strongly associated with protein–energy wasting, muscle weakness, and increased mortality [7]. Addressing appetite disturbances may therefore play a key role in reducing inflammation, hospitalization rates, and mortality in this vulnerable population [8]. Moreover, dialysis adequacy is considered a critical determinant of treatment effectiveness, quality of life, and survival [9].

In recent years, non-pharmacological interventions such as exercise have gained increasing attention in the management of hemodialysis patients. Exercise, particularly when performed during dialysis sessions, has been shown to enhance dialysis efficiency and improve both physical and psychological outcomes [10]. Exercise, particularly when delivered under nursing supervision during dialysis sessions, may offer a practical and cost-effective approach to improving patient outcomes [11]. Emerging evidence suggests that regular physical activity may improve appetite by mitigating systemic inflammation, promoting anabolic pathways, and modulating gut-derived appetite hormones such as ghrelin [12]. A recent randomized controlled trial demonstrated that intradialytic aerobic exercise significantly increased dialysis adequacy and quality of life [13]. Similarly, nurse-led home-based exercise programs have been found to improve patients' functional capacity and general well-being [14]. A meta-analysis demonstrated that exercise interventions effectively alleviate depressive symptoms in hemodialysis patients, with aerobic exercises yielding greater improvements compared with resistance or combined modalities [15]. Furthermore, a recent randomized controlled trial found that intradialytic exercise significantly reduced both anxiety and depression levels [16]. In addition to its physical and emotional benefits, exercise may positively influence psychological constructs such as happiness and well-being. Exercise is established as a potent stimulator for the release of endogenous opioids (e.g., endorphins) and monoamine neurotransmitters, which are directly linked to improved mood states and heightened subjective well-being [17]. An earlier study explored the effect of laughter yoga—a mind–body intervention involving physical activity—on hemodialysis patients. While no statistically significant improvement in standardized happiness scores was observed, qualitative nursing reports indicated a noticeable enhancement in patients' mood and optimism, highlighting the need for further investigation through larger trials [18]. These physical and psychological domains are not independent; rather, appetite, emotional well-being, and dialysis adequacy interact dynamically and may collectively influence clinical outcomes in hemodialysis patients.

Collectively, the literature indicates that depression, loss of appetite, and reduced happiness are prevalent and distressing problems among hemodialysis patients. These conditions not only impair patients' mental health and nutritional status but may also compromise dialysis adequacy and survival outcomes. Hence, the identification of simple, accessible, and low-cost interventions to mitigate these complications is of great clinical relevance. Nurses play a central role in the ongoing care of patients undergoing hemodialysis because they spend substantial time monitoring patients during dialysis

sessions and are often the first healthcare professionals to identify physical and psychological concerns [19]. Consequently, nursing interventions that are safe, feasible, and easily integrated into routine dialysis care are of particular importance. Intradialytic exercise represents a potentially valuable nursing strategy that may promote both physical and psychosocial well-being without imposing additional pharmacological burden on patients [20].

Although numerous studies have evaluated the impact of exercise on depression and anxiety in hemodialysis patients, few have explored its potential influence on happiness or appetite—two critical but often neglected aspects of patient well-being. Moreover, there is a paucity of evidence regarding the use of isotonic exercises in this population. Given that isotonic exercise is relatively easy to perform, less physically demanding, and can be safely performed by patients with a functional arteriovenous fistula during hemodialysis sessions, it may serve as a practical and safe intervention. Therefore, this study aimed to evaluate the effects of a nurse-supervised intradialytic isotonic exercise program on happiness, appetite, and dialysis adequacy in patients undergoing hemodialysis. We hypothesized that a nurse-supervised intradialytic isotonic exercise program would improve happiness, appetite, and dialysis adequacy compared with routine hemodialysis care and could serve as a feasible nursing intervention to enhance patient outcomes.

Methods

Design

This study was a two-arm parallel-group randomized controlled trial with a 1:1 allocation ratio. Due to the nature of the intervention, participants and intervention providers could not be blinded.

Setting

The study was conducted in the hemodialysis unit of Kamkar-Arabnia Hospital, Qom, Iran. Participants were recruited and followed between August 30 and December 26, 2025.

Participants

Eligible participants were adults aged 18–65 years who had been receiving maintenance hemodialysis three times per week, with each session lasting approximately four hours, for at least six months. Participants were required to have stable clinical and hemodynamic conditions, a functional arteriovenous fistula, and medical clearance from a nephrologist to participate in isotonic exercise. Additional inclusion criteria included the ability to communicate in Persian, willingness to provide written informed consent, and absence of participation in any structured exercise program within the previous three months. Patients were excluded if they presented with uncontrolled hypertension (systolic blood pressure > 180 mmHg or diastolic > 100 mmHg), active infection, severe anemia, musculoskeletal or

neurological disorders limiting mobility, hospitalization in the previous six months, or acute psychiatric illness. Patients taking psychotropic or appetite-stimulating drugs were also excluded. During the intervention, participants were withdrawn if they experienced hemodynamic instability, acute medical complications, changes in dialysis modality (e.g., transition to peritoneal dialysis or kidney transplantation), or voluntarily withdrew from the study.

Sampling

Sample size estimation was performed using G*Power software (version 3.1.9.7). The sample size was estimated based on dialysis adequacy because sufficient effect size data from previous randomized controlled trials were available for this outcome. Nevertheless, the study was designed to evaluate multiple primary outcomes, including dialysis adequacy, appetite, and happiness. Using data reported by Hatef et al. [21], an effect size (Cohen's d) of 0.50 was assumed, with a significance level of 0.05 and a statistical power of 80%. The analysis indicated that a minimum of 40 participants per group was required. To account for a potential attrition rate of 20%, the final sample size was increased to 48 participants per group, yielding a total sample of 96 patients.

Participants were recruited through convenience sampling from the hemodialysis unit of Kamkar_ Arabnia Hospital. After eligibility assessment and obtaining written informed consent, participants were randomly assigned to the intervention or control group using permuted block randomization with equal allocation ratio (1:1). The randomization sequence was generated by an independent researcher using the Sealed Envelope online randomization service and was concealed from the investigators responsible for participant enrollment and outcome assessment.

Instruments

Happiness was measured using the Oxford Happiness Inventory (OHI), a validated instrument developed by Michael Argyle and colleagues in 1989. The questionnaire consists of 29 items designed to assess multiple dimensions of happiness, including positive affect (degree of positive and pleasant emotions), average satisfaction level (overall life satisfaction), and absence of negative affect (lack of unpleasant emotions). Each item is rated on a six-point Likert scale, and total scores range from 29 to 174, with higher scores indicating greater happiness [22]. The Cronbach's alpha coefficient of 0.92 was calculated for the Persian version of this questionnaire [23].

Appetite was evaluated using the Simplified Nutritional Appetite Questionnaire (SNAQ), which comprises four items rated on a six-point Likert scale, with higher scores reflecting better appetite [24]. The Cronbach's alpha coefficient of 0.70 was calculated for the Persian version of this questionnaire [25].

Dialysis adequacy was assessed using two standard clinical indicators, Urea Reduction Ratio (URR) and Kt/V, which were extracted from patients' medical records. In the Kt/V formula, K represents the dialysis clearance rate, t is the dialysis session duration, and V is the urea distribution volume [26].

Interventions

Following baseline assessment, participants were randomly allocated to either the intervention or control group using a computer-generated block randomization sequence. The study was conducted over an eight-week period. All participants continued to receive routine hemodialysis three times per week, with each session lasting approximately four hours. To minimize potential confounding, all participants received dialysis in the same center using the same dialysis machines and dialyzers.

Participants in the intervention group performed intradialytic isotonic exercises during hemodialysis sessions three times per week for eight consecutive weeks. Each exercise session lasted 30 minutes and was supervised by a trained nurse. The exercise program consisted of a 5-minute warm-up phase (stretching and breathing exercises), a 20-minute isotonic exercise phase involving repetitive upper- and lower-extremity movements and the use of a stationary mini-cycle adapted for hemodialysis patients, and a 5-minute cool-down phase (stretching and relaxation exercises). Before each session, blood pressure, heart rate, and respiratory rate were assessed to ensure participant safety. Exercise sessions were postponed in the presence of abnormal vital signs or clinical instability. Participants who experienced recurrent intradialytic hypotension, dizziness, or other clinically significant adverse events that precluded safe continuation of the intervention were withdrawn from the study. Participants in the control group received routine hemodialysis care without any structured exercise intervention. Outcome measures, including happiness, dialysis adequacy, and appetite, were assessed at baseline and immediately after completion of the eight-week intervention.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including mean, standard deviation, frequency, and percentage, were used to summarize participants' demographic, clinical, and outcome variables. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Baseline demographic and clinical characteristics were compared between groups using the independent-samples t-test for continuous variables and the chi-square test for categorical variables. To evaluate the effects of the intervention on happiness, appetite, and dialysis adequacy, analysis of covariance (ANCOVA) was performed, with post-intervention scores as dependent variables, study group as the fixed factor, and corresponding baseline scores as covariates. Adjusted means, 95% confidence intervals (CIs), and partial eta-squared (η^2) effect sizes were reported. Statistical significance was set at $p < 0.05$.

Results

A total of 121 patients undergoing maintenance hemodialysis were assessed for eligibility. Of these, 25 patients were excluded, including 17 who did not meet the inclusion criteria and 8 who declined to participate. The remaining 96 patients were randomly allocated to the intervention (n = 48) or control group (n = 48). During the study period, 8 participants in the intervention group and 6 in the control group withdrew from the study. In the intervention group, 6 participants were withdrawn due to intradialytic

hypotension and 2 withdrew voluntarily. In the control group, 5 participants experienced intradialytic hypotension and 1 withdrew voluntarily. Consequently, data from 40 participants in the intervention group and 42 participants in the control group were included in the final analysis (Fig. 1).

Baseline demographic and clinical characteristics of the participants are presented in Table 1. No statistically significant differences were observed between the intervention and control groups with respect to age, sex, marital status, educational level, duration of hemodialysis, or comorbidities ($p > 0.05$), indicating that the groups were comparable at baseline.

Table 1
Demographic and clinical characteristics of participants

Variables		**Groups**		**P value**
		Intervention (n = 40) **Mean ± SD or n (%)**	**Control (n = 42)** **Mean ± SD or n (%)**	
Age (Year)		53.85 ± 12.47	55.047 ± 12.88	0.670*
Dialysis time (Years)		5.95 ± 4.67	7.66 ± 5.74	0.143*
Gender	Male	24 (60)	25 (59.5)	0.572[b]
	Female	16 (40)	17 (40.5)	
Marital status	Single	5 (12.5)	8 (19)	0.439[b]
	Married	34 (85)	34 (81)	
	Divorced	1 (2.5)	0 (0)	
Education	Illiterate	16 (40)	15 (35.7)	0.748[b]
	Under diploma	18 (45)	23 (54.8)	
	University degree	6 (15)	4 (9.5)	
Comorbidities	No comorbidity	2 (5)	7 (16.7)	0.240[b]
	One comorbidity	22 (55)	20 (47.6)	
	Two or more comorbidities	16 (40)	15 (35.7)	

Data are presented as mean ± standard deviation or n (%).

[a] Independent-samples t-test.

[b] Chi-square test.

Table 2 presents the ANCOVA results after adjustment for baseline values. After controlling for baseline happiness scores, participants in the intervention group demonstrated significantly higher post-intervention happiness scores than those in the control group (adjusted mean difference = 7.93, 95% CI: 1.46–14.39; F (1,79) = 5.96, p = 0.017, partial η^2=0.070). In contrast, no significant between-group differences were observed for appetite scores following adjustment for baseline values (adjusted mean difference = 0.52, 95% CI: −0.83–1.88; F (1,79) = 0.593, p = 0.444, partial η^2=0.007). Similarly, dialysis adequacy did not differ significantly between groups after controlling for baseline measurements (adjusted mean difference = − 0.03, 95% CI: −0.18–0.13; F (1,79) = 0.096, p = 0.757, partial η^2=0.001).

Table 2
ANCOVA-adjusted comparison of post-intervention outcomes between the intervention and control groups

Outcome	Intervention (Adjusted Mean ± SE)	Control (Adjusted Mean ± SE)	Mean Difference (95% CI)	F (df = 1,79)	p-value	Partial η^2
Happiness	105.68 ± 2.32	97.76 ± 2.27	7.93 (1.46 to 14.39)	5.96	0.017	0.070
Appetite	14.00 ± 0.49	13.48 ± 0.48	0.52 (-0.83 to 1.88)	0.59	0.444	0.007
Dialysis Adequacy	1.23 ± 0.06	1.26 ± 0.06	-0.03 (-0.18 to 0.13)	0.10	0.757	0.001

Discussion

The present randomized controlled trial examined the effects of an eight-week intradialytic isotonic exercise program on happiness, appetite, and dialysis adequacy among hemodialysis patients. These findings provide important insights into the potential contribution of nurse-supervised exercise interventions to patient-centered outcomes. The findings revealed a statistically significant positive effect of isotonic exercise on happiness, as evidenced by both within-group and between-group comparisons. In contrast, the intervention had no significant effect on either appetite or dialysis adequacy.

The present study demonstrated a significant improvement in happiness levels among participants in the exercise intervention group. This finding is of high clinical relevance given the heavy psychological burden, high prevalence of depression, and reduced quality of life typically experienced by patients with end-stage renal disease. Our results are consistent with recent literature highlighting the robust psychological benefits of physical activity in this population. Recent systematic reviews and clinical trials indicate that structured exercise interventions—whether intradialytic or home-based—significantly alleviate depressive symptoms, mitigate anxiety, and enhance overall subjective well-being in hemodialysis patients [27, 28]. By incorporating isotonic exercise into their routine, patients likely experience a positive shift in emotional status that counteracts the psychological fatigue associated

with chronic dialysis dependency [29]. The observed improvement in happiness is particularly relevant to nursing practice because nurses are uniquely positioned to implement and supervise intradialytic exercise programs while maintaining patient safety. As happiness and emotional well-being are increasingly recognized as important patient-reported outcomes, incorporating structured exercise into routine nursing care may represent a practical, low-cost, and non-pharmacological strategy for enhancing psychosocial health among patients receiving maintenance hemodialysis.

The favorable impact of exercise on happiness can be elucidated through a combination of physiological and psychosocial mechanisms. Physiologically, regular physical exertion stimulates the release of endogenous opioids (endorphins) and upregulates brain-derived neurotrophic factor (BDNF), which play vital roles in mood regulation and combating depressive pathways [30]. Furthermore, exercise helps attenuate systemic inflammation and oxidative stress, which are key pathophysiological features of chronic kidney disease and are associated with a wide range of adverse health outcomes [31]. Psychosocially, engaging in a regular exercise regimen may foster independence and self-management while supporting a greater sense of personal autonomy, enabling patients to take a more active role in managing their health and daily activities [32].

In the present study, isotonic exercise did not result in a statistically significant improvement in appetite among patients undergoing hemodialysis. This finding reflects the complex nature of appetite regulation in this population, where appetite is heavily suppressed by multiple factors, including the metabolic and hormonal disturbances, chronic inflammation, gastrointestinal alterations, and psychological factors [33]. The management of anorexia in end-stage kidney disease is highly challenging, as highlighted by recent clinical guidelines [34]. Consequently, non-pharmacological interventions such as exercise, while beneficial for physical function [35], have demonstrated limited efficacy in improving appetite scores [36], underscoring the pressing need for integrated nutritional and psychological support strategies tailored to the individual patient [37].

Furthermore, the specific characteristics of the exercise protocol—namely its intensity, duration, and timing—may explain the absence of a significant orexigenic effect. Intradialytic exercise is typically prescribed at a low-to-moderate intensity to maintain hemodynamic stability [38]; however, this intensity may be insufficient to meaningfully alter the circulating levels of appetite-regulating hormones [39], which remain deeply dysregulated due to uremic anabolic resistance [40]. Additionally, the hemodialysis procedure itself is an inherently stressful event that induces acute intradialytic fatigue [41], which can effectively counteract the potential appetite-stimulating benefits of physical activity performed during the session [42]. These complexities suggest that future interventions should investigate whether combining intradialytic exercise with targeted oral nutritional supplementation, or scheduling exercise on non-dialysis days, could offer a more synergistic approach to overcoming anorexia and improving dietary intake in this vulnerable population [43]. These findings highlight the importance of collaborative nursing care, in which exercise interventions are integrated with nutritional assessment, patient education, and individualized dietary counseling to address appetite-related problems more effectively.

The lack of a significant improvement in nutritional status observed in the present study may also be related to the duration and nature of the exercise intervention. Improvements in nutritional status generally require sustained positive changes in energy and protein balance, which may may require longer intervention periods before measurable changes become evident [44, 45]. Furthermore, the modality of the exercise program plays a critical role; recent comparative evidence in hemodialysis patients indicates that resistance training and combined exercise (aerobic plus resistance) provide a superior anabolic stimulus for structural muscle adaptations compared to standard aerobic training alone [46]. Additionally, the uremic and inflammatory environment in end-stage kidney disease induces anabolic resistance, meaning that exercise alone may not be sufficient to achieve a positive nitrogen balance [40]. Recent meta-analytical data suggest that to effectively overcome this catabolic environment, prevent muscle wasting, and maximize improvements in body composition, it is necessary to combine exercise interventions with targeted nutritional support, particularly adequate protein supplementation [47].

In the present study, isotonic exercise did not result in a statistically significant improvement in dialysis adequacy among patients undergoing hemodialysis. The effect of exercise on dialysis adequacy remains inconclusive in the current literature. While some studies have reported significant improvements in Kt/V following intradialytic exercise interventions [48], findings have not been entirely consistent across studies. For example, Bogataj et al. (2020) reported significant and comparable improvements in Kt/V in both a cycling-only group and a combined cycling and functional training group, suggesting a potential beneficial effect of exercise on dialysis adequacy irrespective of the specific exercise modality [49]. Nevertheless, a recent network meta-analysis concluded that the available evidence remains insufficient to determine with certainty whether any particular type of intradialytic exercise is superior to others or to usual care in improving dialysis adequacy [50]. Therefore, the lack of a significant effect observed in the present study may be related to differences in exercise protocols, intervention duration and intensity, patient characteristics, and the heterogeneity of findings reported across previous studies.

One possible explanation for the absence of a significant improvement in dialysis adequacy is that it is influenced by multiple factors beyond physical activity, including dry weight, vascular access type, ultrafiltration volume, β2-microglobulin levels, and oxygen supplementation [9]. Consequently, the independent contribution of an exercise intervention may be relatively small compared with these established determinants of dialysis adequacy. Furthermore, the physiological effects of exercise on solute clearance may vary according to the type, intensity, frequency, and duration of the exercise program, which may partly explain the heterogeneity of findings reported in previous studies [46]. Therefore, the isotonic exercise program implemented in the present study may not have been sufficiently intensive or prolonged to induce measurable changes in Kt/V. From a nursing perspective, these findings suggest that although intradialytic isotonic exercise can be safely implemented during routine dialysis care, its isolated use may not be sufficient to improve dialysis adequacy and should be considered as part of a broader multidisciplinary care strategy.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, the study employed a non-blinded design, which may have introduced performance and response biases, particularly for self-reported outcomes such as happiness and appetite. Second, the intervention period lasted eight weeks; although this duration was sufficient to detect changes in happiness, longer intervention periods may be required to fully evaluate the potential effects of intradialytic isotonic exercise on physiological outcomes such as appetite and dialysis adequacy. Third, appetite was assessed using a self-reported questionnaire, and objective measures such as dietary intake records or biomarkers of appetite regulation (e.g., ghrelin and leptin) were not collected. Finally, although the sample size was determined a priori based on dialysis adequacy, larger studies may be warranted to confirm the observed effects across different patient-reported and clinical outcomes.

Conclusion

An eight-week nurse-supervised intradialytic isotonic exercise program significantly improved happiness among patients undergoing hemodialysis but did not significantly affect appetite or dialysis adequacy. These findings support the incorporation of structured intradialytic exercise into routine nursing care as a feasible and low-cost approach to promoting emotional well-being in this population. Further studies with longer follow-up periods are warranted to clarify its effects on nutritional and clinical outcomes.

The findings of this study have several implications for nursing practice. Intradialytic isotonic exercise was feasible to implement during routine hemodialysis sessions and was associated with improved happiness among patients. Given that nurses spend substantial time with patients during dialysis treatment, they are well positioned to incorporate structured exercise programs into routine care, monitor patient safety, and encourage participation. Although no significant effects were observed for appetite or dialysis adequacy, the positive impact on happiness suggests that nurse-supervised exercise may contribute to improving patient-centered outcomes and emotional well-being in the hemodialysis setting.

Abbreviations

Chronic Kidney Disease
CKD
End-Stage Renal Disease
ESRD
Analysis of Covariance
ANCOVA

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Ethics Committee of Qom University of Medical Sciences, Qom, Iran (IR.MUQ.REC.1404.005). The trial was prospectively registered in the Iranian Registry of Clinical Trials (IRCT20150724023314N6). Written informed consent was obtained from all participants before enrollment. Participants were informed about the study objectives and procedures and were assured that participation was voluntary, that all collected information would be kept confidential, and that they could withdraw from the study at any time without affecting their care. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and relevant national guidelines for clinical research.

Consent for publication

Not applicable.

Competing Interests

The authors have no competing interests to declare.

Supplementary Information

The reporting of this randomized controlled trial followed the Consolidated Standards of Reporting Trials (CONSORT) 2025 guidelines. A completed CONSORT 2025 checklist is provided as a supplementary file.

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Author Contribution

A.B., L.G.A., and M.A. conceived and designed the study. A.B., S.A.V., and M.A. was responsible for participant recruitment, data collection, intervention implementation, and preparation of the initial manuscript draft. A.B., and M.A. supervised all stages of the study, performed the statistical analyses, interpreted the data, and critically revised the manuscript for important intellectual content. A.B., L.G.A., and M.A. contributed to the study design, methodological consultation, and critical revision of the manuscript. All authors read and approved the final manuscript.

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Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Figures

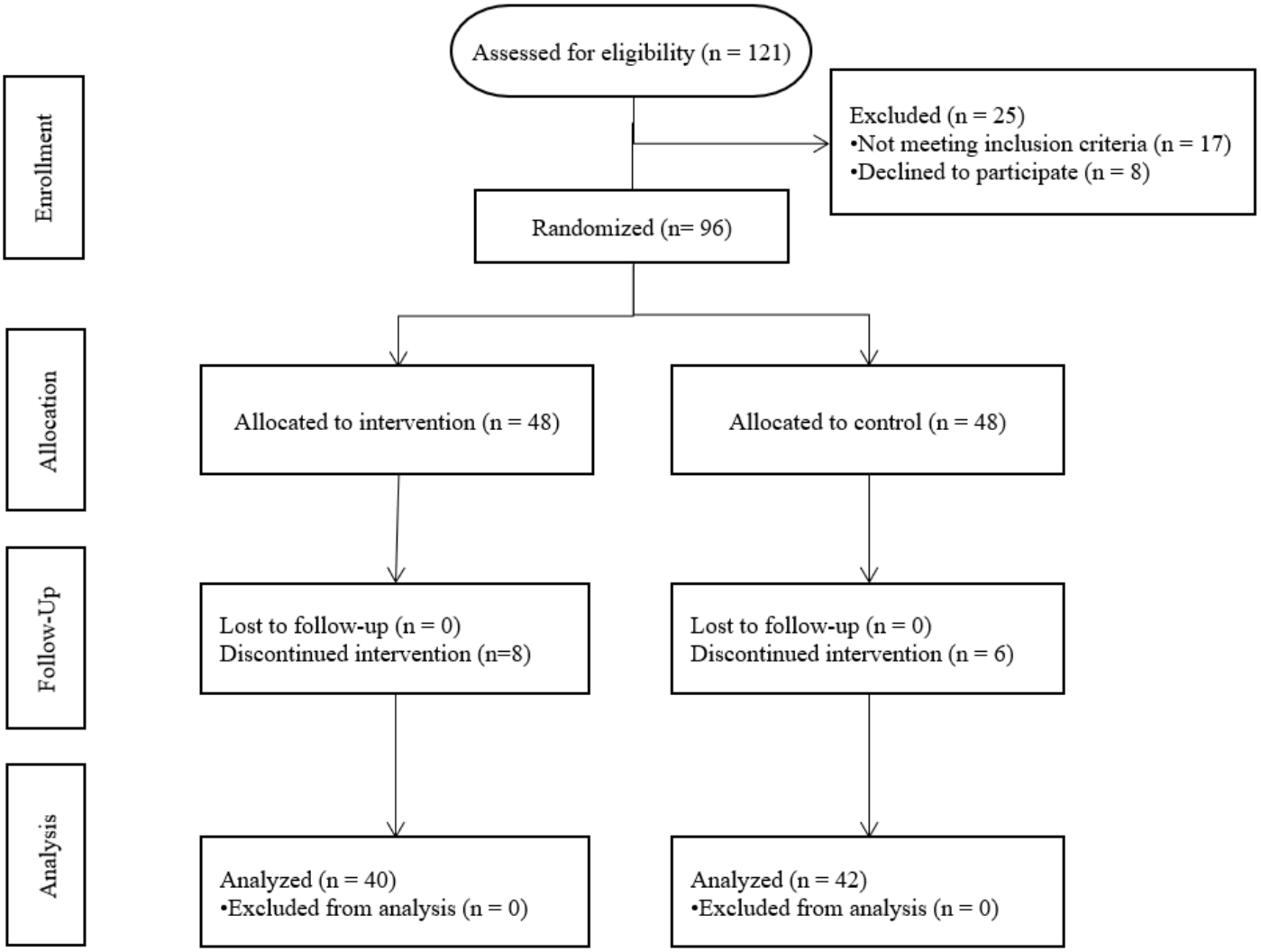


Figure 1

Consort flow diagram.

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