

Effect of a behavioral strategy program on quality of life: A quasi-experimental study in women with cognitive impairment receiving chemotherapy

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ABSTRACT

Background: Women who undergo chemotherapy for cancer frequently develop cognitive problems referred to as chemo brain. These cognitive deficits harm memory functions and attention skills as well as processing speed, which leads to decreased quality of life (QoL). Behavioral approaches are non-drug solutions that show promise in enhancing cognitive abilities and everyday functioning in this specific group.

Objectives: To evaluate the effectiveness of a behavioral strategy program compared with conventional occupational therapy in improving quality of life among women with chemotherapy-related cognitive impairment.

Materials and methods: A quasi-experimental pre- post study design was employed. Thirty women aged 45-60 years undergoing chemotherapy were recruited from Madras Cancer Care Foundation, Kumaran Hospital, Chennai. Participants were allocated into two groups (N=15 each): an experimental group receiving structured behavioral strategies and a control group receiving conventional occupational therapy for 12 weeks (36 sessions). Quality of life was measured using the WHOQOL-BREF. Data were analyzed using non-parametric tests (Wilcoxon signed-rank test and Mann-Whitney U test).

Results: Both groups demonstrated significant improvement in quality of life following intervention. The control group improved from 49.53 ± 6.14 to 52.27 ± 7.36 ($p=0.029$), while the experimental group improved from 47.33 ± 5.58 to 59.73 ± 6.58 ($p=0.001$). Between-group comparison showed a statistically significant difference in favor of the experimental group ($p=0.015$). Effect size analysis demonstrated large improvements in the experimental group.

Conclusion: Behavioral strategies showed greater improvement in quality of life compared with conventional occupational therapy among women with chemotherapy-related cognitive impairment. Integrating structured behavioral interventions into oncology rehabilitation may enhance patient outcomes.

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Introduction

Cancer continues to pose a major public health challenge globally, with increasing incidence and improved survivorship contributing to a growing population living with the long-term consequences of cancer and its treatment. According to the World Health Organization (2022), India reports more than 1.4 million new cancer cases annually, reflecting a substantial and rising disease burden. Women account for a significant proportion of this burden, particularly due to the high prevalence of

breast, cervical, ovarian, and other gynecological cancers. Urban centers such as Chennai report comparatively higher cancer incidence rates, influenced by population density, lifestyle factors, and improved access to diagnostic and tertiary healthcare services.

Although advances in oncology care have improved survival outcomes, chemotherapy is frequently associated with adverse cognitive and psychosocial effects. Chemotherapy-related cognitive impairment (CRCI), commonly referred to as “chemo brain,” includes deficits in attention, memory, processing speed, and executive functioning.^{1,2} These cognitive changes may persist beyond active treatment and can significantly interfere with daily functioning, occupational roles, and overall quality of life (QoL).^{1,2}

Quality of life has therefore emerged as a critical outcome in cancer rehabilitation, reflecting physical, psychological, social, and environmental well-being. Women undergoing chemotherapy in India often experience reduced QoL due to treatment-related fatigue, emotional distress, cognitive difficulties, and restricted participation in meaningful activities. Sociocultural expectations, caregiving responsibilities, and limited access to structured rehabilitation services may further exacerbate these challenges.^{3,12-14}

In the Indian context, the impact of cancer on women's quality of life is further intensified by their culturally defined roles within the family and society. Women often function as primary caregivers and are central to household management; therefore, cancer-related impairments significantly disrupt both personal independence and family dynamics. The presence of chemotherapy-related cognitive impairment further compromises their ability to perform daily activities, manage responsibilities, and engage in meaningful occupations. These combined cognitive and psychosocial challenges contribute to a substantial decline in overall quality of life. Therefore, evaluating quality of life is crucial for comprehensively understanding the multidimensional effects of cancer and its treatment, thereby providing a rationale for selecting standardized outcome measures such as WHOQOL-BREF in the present study.^{4-6,12}

Occupational therapy plays a central role in oncology rehabilitation by promoting functional independence and participation in meaningful life roles despite disease- or treatment-related limitations.⁷ Behavioral strategies have gained recognition as structured, non-pharmacological approaches that address both cognitive and psychosocial dimensions of health. Techniques such as goal setting, behavioral activation, problem-solving, and stress management have demonstrated effectiveness in improving functional outcomes and quality of life among populations with chronic illness.^{8,9}

The present study was conducted at the Madras Cancer Care Foundation (MCCF) at Kumaran Hospital, Chennai, which provides comprehensive oncology and

rehabilitation services to women from urban and peri-urban populations, with a strong focus on improving functional outcomes and quality of life among cancer survivors. The involvement of this institution provided an appropriate clinical and rehabilitative setting for examining the effectiveness of occupational therapy-led behavioral interventions. Given the limited evidence on occupational therapy-led behavioral interventions for CRCI in the Indian context, this study aimed to evaluate the effectiveness of behavioral strategies in improving quality of life among women undergoing chemotherapy.^{10,11,15}

Materials and methods

Study design

A quasi-experimental pre-post study design was employed to evaluate the effectiveness of behavioral strategies on quality of life among women with chemotherapy-induced cognitive impairment. Participants were recruited via convenience sampling and assigned to experimental and control groups.

Study setting and participants

The present study was conducted at the Madras Cancer Care Foundation (MCCF) in collaboration with Kumaran Hospital, Chennai, both of which provide comprehensive oncology and rehabilitation services to women from urban and peri-urban populations, with a strong emphasis on enhancing functional outcomes and quality of life among cancer survivors.

A total of 30 female patients, aged 45-60 years, diagnosed with cancer and undergoing chemotherapy, were recruited based on inclusion and exclusion criteria.

Inclusion and exclusion criteria

Inclusion criteria

1. Women aged 45-60 years
2. Diagnosed with cancer and undergoing chemotherapy
3. MMSE score indicating mild cognitive impairment (18-23)
4. Willing to participate

Exclusion criteria

1. Severe cognitive impairment
2. Psychiatric illness
3. Neurological disorders
4. Unstable medical condition

Sampling and group allocation

Eligible participants were recruited using convenience sampling. Based on feasibility and availability, participants were allocated into:

- Experimental group (N=15): behavioral strategy intervention
- Control group (N=15): conventional occupational therapy

Assessment Tools

1. Mini Mental State Examination (MMSE)

The MMSE (Folstein et al., 1975)¹⁵ is a 30-point tool that evaluates orientation, registration, attention, recall, language, and visuospatial skills. The Scores include 0-17: Severe cognitive impairment; 18-23: Mild cognitive impairment; 24-30: No cognitive impairment. The reliability of this tool is Cronbach's alpha = 0.70, and the validity is $p < 0.04$.

2. World Health Organization Quality of Life-BREF (WHOQOL-BREF)

The World Health Organization Quality of Life-BREF (WHOQOL-BREF) is a 26-item instrument assessing perceived quality of life across four domains: physical health, psychological health, social relationships, and environment. Items are rated on a 5-point Likert scale, with domain scores transformed to a 0-100

scale; higher scores indicate better quality of life. Domain scores are interpreted independently, as no standardized cut-off values are defined. The WHOQOL-BREF has demonstrated good reliability and validity across diverse populations (WHOQOL Group, 1998). The Reliability: Cronbach's alpha = 0.70 and the Validity: 0.89

Procedure

All subjects were screened using the Mini-Mental State Examination (MMSE) and the World Health Organization Quality of Life-BREF (WHOQOL-BREF) at baseline. Participants were allocated to the experimental and control groups based on availability and study feasibility following the baseline assessment. The intervention lasted 12 weeks, with three sessions per week. The intervention strategies are presented in Table 1.

Table 1. Intervention strategies.

Week	Focus area	Key strategies and activities	Mode of delivery
1	Orientation and psychoeducation	Introduction to intervention; education on cancer-related cognitive changes; normalization of symptom	Therapist led orientation and explanation
2	Mindfulness and grounding	Breathing exercises, body awareness, grounding techniques for attention and emotional regulation	Demonstration, guided practice
3	Attention training	Sustained and selective attention tasks; managing distractions	Guided exercises, in-session practice
4	Memory enhancement I	Chunking techniques; use of external memory aids (lists, reminders)	Demonstration, practice tasks
5	Memory enhancement II	Application of memory strategies to daily activities	Guided practice, homework
6	Behavioural activation	Activity scheduling; increasing engagement in meaningful activities	Planning exercises, discussion
7	Goal setting	SMART goal formulation; task planning and sequencing	Structured worksheets, practice
8	Problem-solving skills	Stepwise problem-solving methods for daily challenges	Role-play, guided discussion
9	Decision-making under stress	Cognitive strategies to manage decisions during emotional or cognitive overload	Case examples, practice
10	Stress management	Relaxation techniques; coping strategies for stress	Demonstration, guided practice
11	Sleep hygiene	Education on maintaining regular sleep routines, reducing screen time, relaxation before bedtime.	Psychoeducation, discussion
12	Emotional regulation and communication	Emotional awareness; assertive communication training; consolidation of skills	Role-play, review and feedback

In the experimental group, a structured, strategy-based intervention, in accordance with a planned therapy schedule, was provided. The intervention strategy focused on improving their cognitive skills, emotional control, and functional living skills. These included interventions addressing the cognitive effects of cancer, mindfulness and grounding strategies for greater awareness of the present moment, attention-training exercises, and memory-improvement strategies using chunking and external memory aids. Behavioral activation and activity scheduling were used alongside SMART goals to support task completion and implementation (Table 1). Problem-solving and decision-making strategies were taught to the intervention group to improve cognitive functioning under stressful conditions. Additional strategies in the intervention group included stress management techniques, sleep hygiene instruction, and emotional regulation strategies focused on assertiveness in communication.

Sessions were conducted three times per week (36 sessions total), each lasting approximately 75 minutes. The control group was given standard occupational therapy (OT) of equal intensity and duration to that of the experimental group, consisting of 36 sessions conducted over 12 weeks (three sessions per week, approximately 75 minutes per session). Thus, there was equality in intervention exposure for comparison. Vocational activities encompassed graded tasks related to their jobs, aimed at increasing endurance and basic work skills for their daily roles. The basic cognitive stimulation activities encompassed attention, orientation, and problem-solving (e.g., sorting, sequencing, and basic memory recall) and did not use structured strategies for behaviour and cognitive modification.

The control group received the intervention in accordance with the conventional principles of occupational therapy. The intervention in the control

group did not include psychoeducation aimed at improving cognitive function. After 12 weeks of the intervention, the WHOQOL-BREF was administered again to the subjects to measure quality-of-life outcomes. Unlike the experimental group, the control group did not receive structured behavioral strategies or psychoeducation targeting cognitive and emotional regulation, which explains the difference in outcomes.

Data analysis

Data were analyzed using IBM SPSS Statistics (Version 23.0). Descriptive statistics (mean, standard deviation, range) were calculated. As the data did not meet the assumptions of normality, non-parametric tests were used. Within-group comparisons were performed using the Wilcoxon signed-rank test, and between-group comparisons were conducted using the Mann-Whitney U test. In addition to statistical significance testing, the effect size (r) was calculated for non-parametric analyses using the formula $r = Z/\sqrt{N}$, where Z is the standardized test statistic, and N is the total number of observations. Effect sizes were interpreted as small (0.1), medium (0.3), and large (0.5) according to established guidelines. Statistical significance was set at $p < 0.05$.¹⁷

Results

As shown in Table 2, A total of 30 women undergoing chemotherapy who met the inclusion criteria participated in the study and were allocated to the experimental group ($N=15$) or the control group ($N=15$). Baseline comparison of demographic and clinical variables demonstrated no statistically significant differences between the experimental and control groups ($p > 0.05$), indicating comparability of groups prior to intervention. Effect size analysis also showed small effect sizes across baseline variables.

Table 2. Participant characteristics and baseline comparability.

Variable	Group (Mean±SD)		p value	Effect size
	Experimental (N=15)	Control (N=15)		
Age (years)	54.1±4.2	53.6±4.5	0.754	0.11
Baseline WHOQOL-BREF Score	47.33±5.58	49.53±6.14	0.312	0.37
MMSE score	21.13±1.41	20.87±1.36	0.621	0.19

Note: Data are presented as mean±SD. Effect size was calculated using Cohen's d , where 0.2 indicates a small effect, 0.5 a medium effect, and 0.8 a large effect.

Therefore, non-parametric statistical tests were used for further analysis. The results of the Shapiro

– Wilk test used to assess normality of the data are presented in Table 3.

Table 3. Shapiro-wilk test for normality.

Group	Test	W statistic	p value	Interpretation
Control	Pre-test	0.882	0.050	Normal
	Post-test	0.895	0.080	Normal
Experimental	Pre-test	0.875	0.039	Non-normal
	Post-test	0.902	0.103	Normal

Note: The Shapiro-Wilk test indicated a non-normal distribution in the experimental group pre-test scores ($p=0.039$), whereas the remaining variables showed normal distributions ($p>0.05$).

As shown in Table 4, Within-group analysis demonstrated statistically significant improvement in WHOQOL-BREF scores following intervention in both groups. The experimental group had better post-

intervention quality-of-life scores than the control group. Effect size analysis indicated a large effect in both groups, with a greater magnitude of improvement observed in the experimental group.

Table 4. Within-group comparison of pre- and post-test WHOQOL-BREF scores using the Wilcoxon Signed-Rank Test.

Group	Pre-test (Mean±SD)	Post-test (Mean±SD)	Z value	p value	Effect size (r)
Control	49.53±6.14	52.27±7.36	-2.179	0.029	0.56
Experimental	47.33±5.58	59.73±6.58	-3.439	0.001	0.89

Note: The effect size (r) was calculated using the formula $r = Z/\sqrt{N}$, where Z is the standardized test statistic, and N is the total number of observations. Values of 0.1, 0.3, and 0.5 indicate small, medium, and large effects, respectively.¹⁷

As shown in Table 5, both groups demonstrated improvements in WHOQOL-BREF scores following the intervention. Effect size analysis indicated a large effect in both groups, with a greater magnitude of improvement in the experimental group ($r=0.89$) than in the control group ($r=0.56$). Between-group analysis revealed a statistically significant difference in favor

of the experimental group ($p=0.015$), indicating greater improvement in quality of life among women with chemotherapy-related cognitive impairment. The comparison of pre-test and post-test WHOQOL-BREF scores between the experimental and control groups is presented in Figure 1.

Table 5. Comparison of baseline and post-intervention WHOQOL-BREF scores between groups.

Group	N	Baseline (Mean±SD)	Post-intervention (Mean±SD)	Within-group comparison (p value)	Effect size (r)	Between-group comparison (post-test p value)
Control (conventional occupational therapy)	15	49.53±6.14	52.27±7.36	0.029	0.56	-
Experimental (behavioral strategies)	15	47.33±5.58	59.73±6.58	0.001	0.89	0.015

Note: The effect size (r) was calculated using the formula $r = Z/\sqrt{N}$. Values of 0.1, 0.3, and 0.5 indicate small, medium, and large effects, respectively. Between-group comparison of baseline and post-intervention.

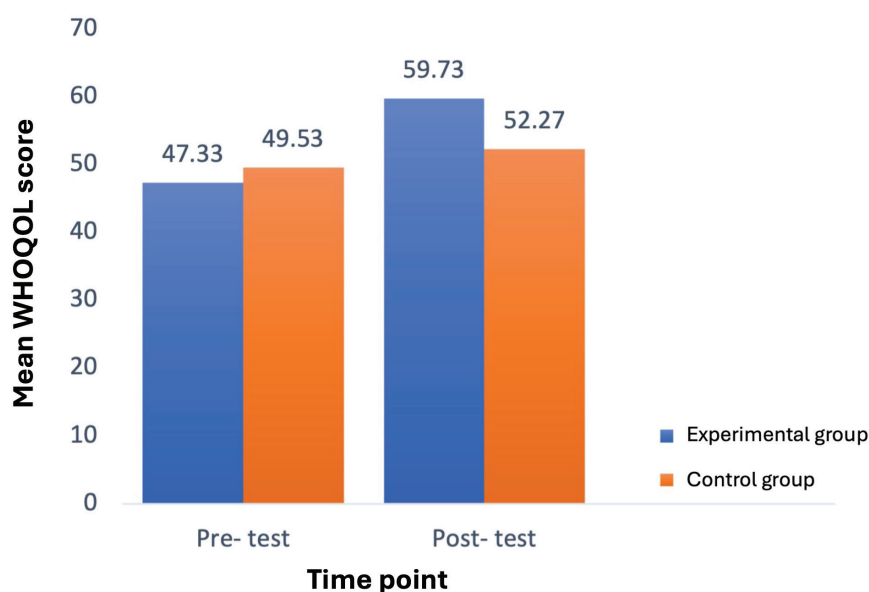


Figure 1. Comparison of pre- and post-test WHOQOL-BREF scores between control and experimental groups.

Discussion

The present study examined the effectiveness of behavioral strategies compared with conventional occupational therapy in improving quality of life among women undergoing chemotherapy who experienced cognitive impairment. The findings indicate that although both intervention approaches resulted in statistically significant improvements in quality of life, behavioral strategies were associated with substantially greater gains, as measured using the WHOQOL-BREF.

Quality of life impairment among women receiving chemotherapy has been widely documented, with previous studies using the WHOQOL-BREF reporting reduced scores across physical, psychological, and social domains during and following cancer treatment.^{6,12} Indian studies have similarly demonstrated compromised WHOQOL-BREF scores among women with breast and gynecological cancers, highlighting the multidimensional burden of cancer and its treatment on daily functioning and well-being.^{3,13,14} The baseline findings in the present study are consistent with this literature, supporting the relevance of WHOQOL-BREF as an appropriate outcome measure for this population.

The modest improvement observed in the control group suggests that conventional occupational therapy interventions, such as range-of-motion exercises, vocational activities, and basic cognitive stimulation, can positively influence quality of life. Previous studies have shown that supportive and activity-based interventions improve physical comfort and psychosocial adjustment, as reflected in WHOQOL-BREF domain scores.⁷ However, the relatively smaller magnitude of improvement in the control group indicates that conventional approaches alone may not fully address the cognitive and emotional challenges associated with chemotherapy-related cognitive impairment, particularly in the absence of structured behavioral or cognitive strategy training.

In contrast, participants who received behavioral strategy interventions demonstrated significantly greater improvement in quality of life. This finding aligns with prior research indicating that behavioral and cognitive-behavioral interventions can lead to meaningful improvements in WHOQOL-BREF outcomes among individuals with chronic illness and cancer.^{8,9,15} The structured and multidimensional nature of behavioral strategies encompassing goal setting, behavioral activation, problem-solving, memory compensation, and stress management may have enhanced self-efficacy and adaptive coping, thereby positively influencing multiple domains of quality of life.

Consistent with earlier studies on chemotherapy-related cognitive impairment, interventions that emphasize compensatory strategies and engagement in meaningful activities showed greater improvement in patient-reported outcomes than those focusing solely on symptom reduction.^{10,11,15} By addressing both functional performance and psychosocial well-being, behavioral strategies may support sustained improvements in perceived quality of life.

From a clinical perspective, these findings underscore the value of integrating behavioral strategies into occupational therapy-led oncology rehabilitation. Given their client-centered focus and emphasis on participation, occupational therapists are uniquely positioned to implement such interventions. Incorporating structured behavioral approaches may therefore enhance rehabilitation outcomes for women undergoing chemotherapy and experiencing cognitive impairment.

These findings should be interpreted in the context of the study design. As a quasi-experimental study employing convenience sampling, the ability to establish strong causal relationships is limited. Although baseline comparability between groups

was observed, unmeasured confounding factors and individual differences may have influenced the outcomes. Further research using larger samples, diverse settings, and randomized controlled designs is recommended to strengthen the evidence base and extend the generalisability of these findings.

Limitations

The scope of the present study was limited by a relatively small sample size and restricted generalisability, as it was conducted within a single hospital-based clinical setting. Participants were recruited via convenience sampling, which may have affected the sample's representativeness. In addition, the quasi-experimental design without randomization limits the ability to establish strong causal relationships between the intervention and outcomes. Furthermore, the small number of participants in specific cancer subgroups limited statistical power and increased the risk of Type II error in subgroup analyses. The study relied on self-reported WHOQOL-BREF responses, which may have been influenced by participants' personal perceptions and experiences. Due to the nature of the behavioral strategy program, blinding of participants and therapists was not feasible. However, standardized assessment procedures were followed for all participants to minimize potential bias. The intervention lasted 12 weeks, and long-term follow-up assessments were not conducted; therefore, the sustainability of the observed improvements in quality of life remains unclear. Additionally, the study was not prospectively registered in a WHO-recognized clinical trial registry, which may limit alignment with current international recommendations for interventional research transparency. Future studies should include larger sample sizes, diverse settings, extended intervention periods, and consideration of individual-difference variables to strengthen the interpretation and generalisability of the findings.

Conclusion

The findings of this study indicate that behavioral strategies show greater improvement than conventional occupational therapy in improving the quality of life among women with chemotherapy-induced cognitive impairment. While conventional therapy resulted in modest improvements, behavioral interventions produced significantly greater gains by addressing cognitive, emotional, and functional dimensions simultaneously. Integrating behavioral strategies into occupational therapy-led oncology rehabilitation may offer a comprehensive and effective approach to enhancing quality of life in this population.

Ethical approval

The study protocol was reviewed and approved by the Institutional Scientific Review Board and Institutional Ethics Committee of Saveetha College

of Occupational Therapy, Saveetha Institute of Medical and Technical Sciences, Chennai, India, prior to participant recruitment (Ethical Certificate No: SCOT/ISRB/005/2025). Written informed consent was obtained from all participants before enrolment. Although the present study involved a behavioral intervention within a quasi-experimental design, it was not prospectively registered in a WHO-recognized clinical trial registry. However, all study procedures were conducted in accordance with institutional ethical standards and the principles of research involving human participants.

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Conflict of Interest

The authors declare no conflicts of interest.

CRediT Authorship Contribution Statement

M. Arun Kumar: conceptualization, methodology, writing: review and edit, supervision; **Jamima Jamesraj:** investigation, data curation, formal analysis, writing: original draft, review and edit.

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