

Outcomes of the Advanced Practice Nurse–Led Self–Care Support Program among People with Gastrointestinal Cancer and Cachexia: A Mixed–Methods Study

Nuttapimon Bhirommuang, Suchira Chaiviboontham, Phichai Chansriwong*

Abstract: Cancer cachexia is a common and debilitating condition among people with gastrointestinal cancer, contributing to malnutrition, functional impairment, and reduced quality of life. In Thailand, evidence regarding advanced practice nurse-led self-care support programs specifically designed for this population remains limited. This explanatory sequential mixed-methods study evaluated an Advanced Practice Nurse-Led Self-Care Support Program for people with gastrointestinal cancer and cachexia and explored participants' experiences with the program. The study was conducted at a university hospital in Bangkok, Thailand, from August 2024 to February 2025. Thirty-three participants were assigned according to clinic attendance day: 16 to the intervention group and 17 to the control group. The intervention group received the 12-week program, while the control group received standard hospital care. Outcomes included body composition, fatigue, physical function measured by the 6-minute walk test and handgrip strength, and quality of life. We analyzed quantitative data using descriptive statistics, independent t-tests, and Mann–Whitney U tests. Subsequently, 22 participants—12 from the intervention group and 10 from the control group—completed in-depth interviews, which were analyzed thematically.

No significant between-group differences were found in body composition, fatigue, handgrip strength, or quality of life. However, the intervention group demonstrated significantly greater improvement in 6-minute walk distance, whereas the control group experienced a significantly greater decline. Thematic analysis identified two themes: 1) eating problems associated with cancer treatment and 2) exercise difficulties related to cachexia during illness and treatment. Treatment-related symptoms and fatigue hindered program adherence, while individualized support helped participants maintain eating and exercise behaviors. The findings suggest that this advanced practice nurse-led program may help preserve or improve physical function in people with gastrointestinal cancer and cachexia. Further evaluation using larger, more diverse samples across multiple settings is warranted before integration into routine clinical practice.

Keywords: Advanced practice nurse, Cachexia, Gastrointestinal cancer, Mixed-methods, Program development, Self-care, Thailand

Received 8 May 2026; Revised 1 August 2026;
Accepted 3 August 2026

Introduction

Cancer cachexia is a multifactorial, hypercatabolic syndrome characterized by the progressive loss of skeletal muscle mass, with or without the depletion of

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adipose tissue.^{1,2} This syndrome frequently affects patients with gastrointestinal cancer across all stages of disease development and treatment trajectories.^{3–5} Clinical manifestations include anorexia, involuntary weight loss, debilitating fatigue, and a decline in physical activity, all of which severely impair activities of daily living, exacerbate treatment intolerance, and diminish overall quality of life.^{2,4,6} Skeletal muscle wasting represents a particularly critical facet of this syndrome, as it correlates strongly with increased chemotherapy toxicity, unscheduled alterations in treatment regimens, and a poor clinical prognosis.^{5,7}

Critically, cancer cachexia cannot be fully reversed through conventional nutritional therapy alone.⁸ Current evidence indicates that optimal management requires a multimodal framework integrating nutritional support, structured exercise, targeted symptom management, and comprehensive patient education.^{9,10} While empirical studies demonstrate that combined nutritional and exercise interventions can improve physical function, alleviate symptom burden, and enhance quality of life,^{9,10} many patients undergoing chemotherapy struggle to adhere to these recommendations due to severe treatment-related side effects and functional decline.^{7,8} These barriers highlight the critical need for a structured approach that offers individualized intervention delivery, proactive monitoring, and continuous psychosocial support to optimize adherence and sustain self-care management throughout the treatment cycle.^{11–13}

Given the clinical complexity of managing cachexia during active oncology treatment,¹² the specialized expertise of an advanced practice nurse (APN)¹⁴ is highly warranted. However, extensive evidence supports the effectiveness of advanced practice nurses in managing medically complex populations, particularly in patients with multimorbidity and complex chronic conditions.¹⁴ Advanced practice nurse–led care improves continuity of care through comprehensive

symptom assessment, care coordination, post-discharge follow-up, and self-management support, resulting in reduced healthcare utilization.^{14,15} However, there is a critical shortage of data regarding the efficacy of self-care management programs specifically tailored for cancer cachexia. To address this gap, this mixed-methods study aimed to develop and evaluate the effectiveness of a self-care support program led by an advanced practice nurse, while concurrently exploring patients' experiences with self-care management.

Literature Review and Conceptual Framework

Orem's Self-Care Deficit Nursing Theory¹⁶ served as the theoretical framework guiding this investigation. According to Orem, individuals require nursing intervention when their self-care agency is insufficient to satisfy their therapeutic self-care demand—a state conceptualized as a self-care deficit.¹⁶ Self-care agency is the human capability to assess self-care demands, make informed health-related decisions, and carry out self-care activities to meet those demands. When a self-care deficit manifests, nurses design targeted nursing systems to either augment the patient's self-care agency or directly fulfill their unmet demands. Orem¹⁶ demarcates these nursing operations into three distinct systems—wholly compensatory, partially compensatory, and supportive-educative—underpinned by five primary methods of helping: acting for or doing for another, teaching, supporting, guiding, and providing a developmental environment.¹⁶

People with gastrointestinal cancer and secondary cachexia present with complex, multifaceted clinical challenges—including progressive weight loss, nutritional impairment, profound fatigue, and compromised physical function. These manifestations impose high-level,

intricate self-care demands that frequently exceed the patient's limited functional capability.^{1,3,4} Consequently, a structured supportive-educative nursing system is essential to augment the patient's self-care agency and mitigate the resultant self-care deficits.¹⁶

Advanced practice nurses play an important role in supporting these patients due to their advanced expertise in clinical assessment, evidence-based practice, patient education, symptom management, and care coordination. Previous evidence has demonstrated that supportive care interventions led by advanced practice nurses can address patients' self-care needs through individualized education, nutritional guidance, physical activity support, symptom management, goal setting, and continuous follow-up.^{11,17,18} Based on Orem's supportive-educative system, these nurses can help patients overcome self-care deficits by enhancing their self-care agency, promoting active participation in disease management, and improving functional outcomes and quality of life.¹⁹

Evidence from scoping reviews indicates that nurse-led telemedicine models effectively support continuous monitoring, individualized patient education, symptom management, and self-care practices.^{20,21} These structured digital approaches offer significant clinical utility for patients navigating complex chronic conditions—such as cancer—by streamlining communication pathways, increasing treatment adherence, and ensuring robust continuity of care.^{20,21} To operationalize these benefits, the current study leveraged the LINE application as an accessible mobile health (mHealth) platform, facilitating synchronous, real-time two-way communication and providing ongoing self-care infrastructure between nursing staff and patients.

Because cancer cachexia is complex and cannot be evaluated solely by numerical variables, understanding the human factor is vital.²² Previous qualitative and mixed-methods studies have explored patients' experiences in cardiac cachexia²³ or exercise interventions

and adherence to oral nutritional supplements among individuals with gastrointestinal cancer and cancer cachexia.^{24,25} These studies identified several factors influencing self-care behaviors, including perceived benefits, treatment-related challenges, professional support, and the need for ongoing encouragement.^{24,25} They also demonstrated that exercise and nutrition interventions were feasible and meaningful to patients. However, existing studies have primarily examined exercise or nutrition separately or focused on barriers to supportive care,²⁶ rather than on integrated self-care interventions. Furthermore, evidence on patients' experiences with an advanced practice nurse-led self-care support program that combines exercise and nutrition remained limited. Therefore, we opted for an explanatory sequential mixed-methods design²⁷ in this study. This combination allowed us to assess the Program's quantitative results in tandem with the qualitative narratives of individual experience. Patient assessment should not focus solely on clinical outcomes but also consider individuals' experiences, barriers, and self-care needs, consistent with Orem's concept of self-care assessment.¹⁶ Integrating quantitative and qualitative findings provides a more comprehensive understanding of not only whether the Program was effective but also how and why it influenced patients' self-care behaviors and health outcomes.

Study Aim and Hypotheses

This study examined the impact of a self-care support program led by an advanced practice nurse on body composition, physical function, fatigue, and quality of life in people with gastrointestinal cancer and cachexia, while exploring their experiences with exercise and diet. We hypothesized that the intervention group would exhibit improved body composition, enhanced functional capacity, reduced fatigue, and better quality-of-life outcomes than the control group.

Integrative Research Question: How do the qualitative findings regarding participants' experiences contextualize and explain the quantitative outcomes of the self-care support program led by the advanced practice nurse?

Methods

Study Design: This research employed an explanatory sequential mixed-methods design,²⁷ with quantitative data collected and analyzed first, followed by a qualitative descriptive phase.²⁸ Qualitative data were collected through in-depth interviews and analyzed using thematic analysis²⁹ to explain participants' experiences with the self-care support program. A mixed-methods approach was appropriate because quantitative analysis evaluated program outcomes, whereas qualitative data provided insights into participants' experiences with exercise and nutrition, the program's main focus. The two datasets were integrated during interpretation using joint display analysis to identify complementarity and expanded understanding. This report followed the Mixed Methods Reporting in Rehabilitation & Health Sciences (MMR-RHS) checklist.³⁰

Study Setting and Sampling for Quantitative Phase: This study was conducted at the oncology clinic of a university hospital in Bangkok, Thailand. The sample size was calculated using G*Power 3.1.9.7. Based on an effect size of 0.56 from a previous study,³¹ with a significance level of 0.05 and 80% power, the required sample size was 20 participants per group. To account for a predicted 26%³² attrition rate, we targeted a total recruitment of 40.

The inclusion criteria were: 1) aged 18 or older; 2) screened for cancer cachexia using a weight loss of > 5% within 6 months, unrelated to starvation, or > 10% within 6 months or more, or > 2% weight loss along with a body mass index (BMI) of less than 18.5 kg/m² if under 70 years. For those over 70, the criteria

were a BMI of less than 20 kg/m²; 3) good level of consciousness, able to communicate in Thai, and without any communication difficulties; 4) free from depression, as assessed by the Thai Depression Screening Tool (2Q);³³ If both questions on the 2Q were answered as "None," the result was normal; 5) those aged 60 and older had a score of more than 3 on the Mini-Cog test;³⁴ 6) the Eastern Cooperative Oncology Group's (ECOG)³⁵ Performance Status Score was 0–2; 7) for surgical cases, the patient must have undergone surgery at least six weeks prior; and 8) no history of comorbidities, including heart failure, chronic obstructive pulmonary disease, neurological disorders, or musculoskeletal limitations. Exclusion criteria were: 1) failure to adhere to the study protocol; 2) inability to swallow food or receive nutrition via a feeding tube or intravenously; 3) implanted pacemakers or defibrillators; and 4) having edema or ascites.

Forty patients with newly diagnosed gastrointestinal cancer receiving chemotherapy within 12 weeks of diagnosis and treated with regimens of minimal to moderate emetogenic risk were recruited. Participants were enrolled on Tuesdays and Thursdays, the busiest clinic days. Random allocation was not feasible because patients attended the gastrointestinal oncology outpatient clinic on a fixed schedule. Therefore, participants were assigned according to their clinic attendance day to minimize disruption to routine care and reduce treatment contamination. Patients attending on Tuesdays were allocated to the intervention group, whereas those attending on Thursdays were allocated to the control group.

During the study, seven participants withdrew, six because of chemotherapy-related side effects (intervention group, n = 3; control group, n = 3). One participant in the intervention group was lost to follow-up. Consequently, data from 33 participants were included in the final analysis (intervention group, n = 16; control group, n = 17).

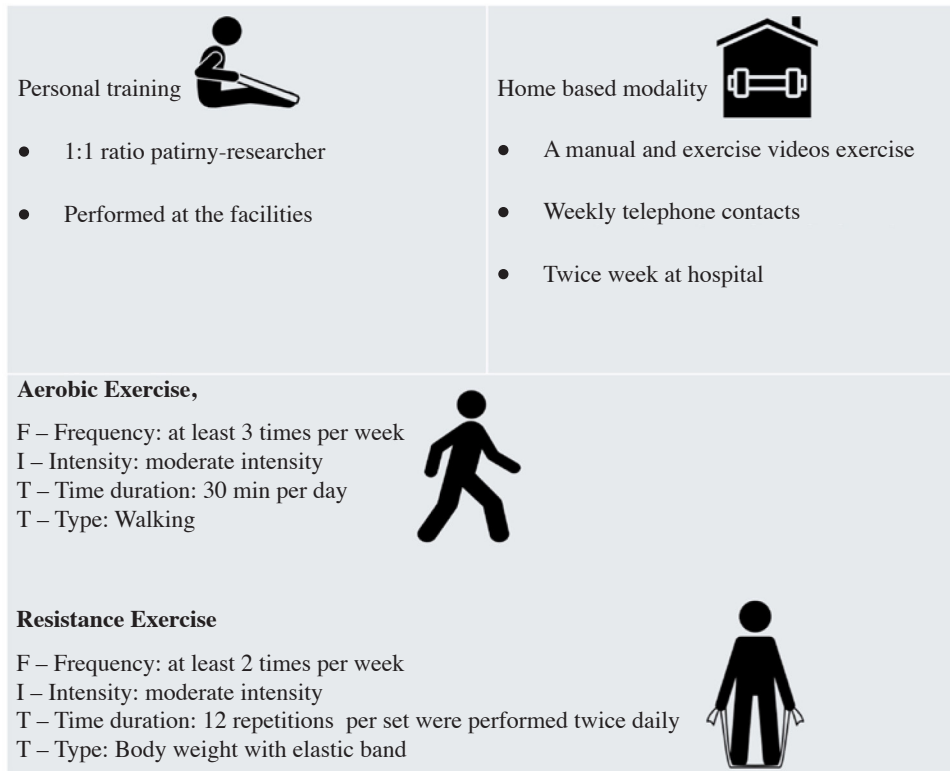
Sampling for Qualitative Phase: 22 participants (12 intervention and 10 control) were purposively selected from the quantitative sample to provide diverse perspectives and further explain the quantitative findings.

Self-Care Support Program, Development and Implementation: The Program was developed through a theory- and evidence-based approach. Orem's theory¹⁶ provided strategies for implementing the program, while recommendations from the American College of Sports Medicine,³⁶ the American Society of Clinical Oncology,¹³ and the European Society for Medical Oncology¹² informed the evidence-based content of the nutrition and exercise interventions. The evidence was translated into clinical practice by adapting guideline recommendations to the needs, functional status, symptom burden, and treatment conditions of people with gastrointestinal cancer and cachexia.

According to Orem's self-care theory,¹⁶ baseline assessments focus on identifying therapeutic self-care demands, self-care agency, and self-care deficits related to nutrition, physical activity, symptom management, and treatment-related side effects. Based on these assessments, the primary investigator (PI) implemented a supportive-educative nursing system based on Orem's notion of helping methods. Teaching was delivered through individualized education. Guidance was provided using skills training, goal setting, and problem-solving strategies to strengthen patients' self-care agency and promote self-care management behaviors. Counseling was offered to provide emotional support and encourage adherence throughout the program. An environment for personal development was fostered through the LINE mobile application, which enabled information sharing, ongoing support, and two-way communication. Individualized intervention plans were developed based on each individual's clinical condition, physical function, nutritional status, and exercise capacity.

The intervention was delivered in three parts: Part 1 involved a comprehensive assessment of patients' health status, self-care deficits, nutritional status, exercise capacity, and symptom burden. Part 2 focused on implementing individualized nutrition and exercise interventions through face-to-face education, demonstration, and collaborative goal setting. Part 3 consisted of ongoing monitoring, telephone and LINE follow-up every 2–3 weeks, reinforcement of self-management strategies, review of exercise and dietary records, symptom assessment, and modification of care plans according to patients' progress and treatment-related needs.

The Self-Care Support Program incorporated exercise and nutrition components to support patients with cancer cachexia. The exercise component (see **Figure 1**) consisted of a 12-week multimodal intervention combining aerobic and resistance training designed per the American College of Sports Medicine exercise guidelines for cancer.^{31,36} The Program was personalized using baseline records and adapted to patients' daily lifestyles. Prior to training, safety was confirmed via a treatment side-effect assessment form; participants who failed to meet safety thresholds were restricted to low-intensity activities (e.g., walking). The prescribed aerobic regimen required walking for at least 30 minutes daily, three days per week, at a moderate intensity verified via the talk test. Resistance training utilized elastic bands for two sets of 12 repetitions, performed 2–3 days per week with 2–3-minute rest intervals, followed by stretching. Home-based adherence was supported by instructional manuals and videos. Participants tracked their compliance immediately post-session using a structured exercise log that captured repetitions, sets, perceived intensity, and walking durations. The PI collected these logs during clinical follow-up visits every three weeks to track trends in frequency, intensity, and adherence.



Note. The exercise intervention included a 12–week combined aerobic and resistance training program.

Figure 1. Exercise program modalities and prescription

The PI assessed nutritional status by reviewing each individual’s medical history and discussing their current and previous dietary habits. Also, the Nutrition Alert Form³⁷ was used for a nutritional risk screen, including physical appearance, dietary changes, gastrointestinal symptoms, disease status, and BMI (or albumin/total lymphocyte count if BMI was not available). We used biweekly telephone interviews with a 24–hour food recall to measure dietary intake. Throughout the study, we computed daily energy and protein intake to track supplement use and dietary compliance. This information was then used to guide the planning of appropriate nutrition education to determine individual energy needs of 25–30 kilocalories/body weight/day, determine protein needs of 1–2 grams/

body weight/day, and provide reference manuals based on the guidelines of the American Society of Clinical Oncology¹³ and the European Society for Medical Oncology¹² by following food intake with a 24–hour recall diet and assessing nutrition status every 2 weeks. The program was validated by three experts, with a scale–level content validity index/averaging method (S–CVI/Ave) of 1.

Data Collection, Quantitative Phase: Data were collected by the PI between August 2024 and February 2025, using the five instruments (three questionnaires and two physical test) described below.

The Personal Information Form: A structured demographic and clinical record form was developed by the researcher to collect baseline participant

characteristics, including age, sex, education, occupation, income, healthcare coverage, health-related variables, including exercise history, drug and food allergies, cancer diagnosis, disease stage, histological type, and current treatment. Data were collected from participant self-reports and verified with medical records.

Bioelectrical impedance analysis (BIA) with the TANITA brand, model MC-780MA, was used to analyze body composition, including skeletal muscle mass (SMM). The muscle mass percentage, an indicator of muscle loss associated with cancer cachexia, was used as the operational measure, with higher percentages indicating greater skeletal muscle mass. The instrument has demonstrated acceptable diagnostic accuracy, with specificity of 92.7% and sensitivity of 75.0%.

The Cancer Fatigue Scale (CFS), developed by Okuyama and colleagues in English,³⁸ was translated into Thai with permission by the researchers using the Brislin back-translation technique.³⁹ There are 15 items that measure physical, emotional, and cognitive subscales, with responses given on Likert-like scales ranging from 1 not agree to 5 totally agree. Scores are calculated using the instrument's prescribed scoring formula. The physical subscale consisted of seven items. Scores were calculated by summing the seven item scores and subtracting 7, resulting in a total score ranging from 0 to 28. The emotional subscale consisted of four items. Scores were calculated by subtracting the sum of the four item scores from 20, yielding a total score ranging from 0 to 16. The cognitive subscale consisted of four items. Scores were calculated by summing the four item scores and subtracting 4, yielding a total score ranging from 0 to 16. A total score ranging from 0 to 60 is calculated by summing the subscale scores; higher scores indicate greater fatigue. Examples of items are: "Do you become tired easily?"; "Do you feel interest in anything?"; and "Do you feel you have become forgetful?" Cronbach's alpha coefficient was 0.88 in this study.

There were two *Physical Function Tests*: The **6-Minute Walk Test (6MWT)** was performed to determine the total distance in meters walked by the participant in 6 minutes. A greater distance indicates better functional cardiopulmonary endurance capacity. The reference distance walked in 6 minutes ranged from 350 to 600 meters at baseline and increased to 407 to 625 meters after 12 weeks of exercise.⁴⁰ Hand strength was tested using a *handgrip dynamometer*. Participants performed three maximal voluntary contractions with the dominant hand, with a 30–60-second rest interval between trials. The highest grip strength value (in kg) was recorded for analysis. Higher values indicate greater muscle strength. Gender-specific reference criteria are used, with low values for males less than 26 kg and females less than 18 kg, based on the criteria of the Asian Working Group for Sarcopenia 2019.^{41,42}

The Functional Assessment of Anorexia/Cachexia Therapy (FAACT) was used to measure quality of life, developed and made available in Thai by FACIT.org, which permitted its use in this study. It's demonstrated acceptable validity and reliability in its original English version.^{43,44} However, a formal psychometric validation study of the Thai version has not yet been published. The instrument consists of 39 items across five domains: physical well-being (0–28), social/family well-being (0–28), emotional well-being (0–24), functional well-being (0–28), and additional concerns (0–48). Each item is rated on a 5-point Likert scale ranging from 0 ("not at all") to 4 ("very much"), with total scores ranging from 0 to 156. Higher scores indicate a better quality of life. In this study, the instrument demonstrated acceptable internal consistency, with a Cronbach's alpha coefficient of 0.775.⁴³

Eligible participants were assigned to intervention or control groups according to scheduled hospital visits. Baseline demographic and clinical data were collected at week 1. Nutritional status, weight loss, appetite, and

dietary intake were assessed at weeks 1, 3, 6, 9, and 12 in the intervention group to monitor participants' progress and provide individualized nutritional support based on their assessment results. Body composition (skeletal muscle mass: SMM), physical function (handgrip strength and the 6–Minute Walk Test), fatigue, and quality of life were evaluated at baseline and weeks 13–15, with qualitative interviews conducted thereafter. The intervention group received usual care plus the Self–care Support Program, which emphasized individualized nutrition counseling, resistance–band exercise, and weekly follow–up. The control group received usual care and completed the same assessments.

Data Collection, Qualitative Phase: Data were collected through semi–structured interviews to obtain a detailed understanding of how the intervention was implemented and experienced by participants, and to help explain and contextualize the quantitative results. A semi–structured interview guide was used to explore participants' experiences, consistency of participation, and satisfaction with the combined exercise and dietary program. Development of the guide was grounded in a process evaluation framework, focusing on fidelity of implementation, the extent of intervention delivery, the extent of participant receipt, and program reach.²⁸ Examples of the main open– and closed–ended questions included: “Could you describe your experiences with exercise?”; “What types of physical activities do you usually engage in, and why did you choose these activities?”; “What motivates you to continue exercising regularly?”; and “What factors help or hinder your ability to maintain regular exercise?”

The interviews took place between weeks 13 and 15 after participants had completed the quasi–experimental data collection. When possible, interviews were arranged to align with routine hospital visits. At the start of each session, the researcher explained the purpose of the interview and obtained permission to audio–record. Interviews lasted about 40–60 minutes and were conducted by the PI together with an advisor experienced

in qualitative interviewing. Audio recordings were transcribed verbatim and prepared for qualitative analysis.

Data Analysis, Quantitative Phase: SPSS version 30 was used to analyze the quantitative data. Statistical significance was set at $p < 0.05$. Normality of the continuous variables was assessed using the Shapiro–Wilk test given the small sample size. Descriptive statistics were used to describe participant characteristics and study outcomes. The categorical variables were presented as frequencies and percentages and were compared using the Chi–square test or Fisher's exact test, wherever applicable.

Continuous variables with normal distribution were analyzed using the independent t–test for between–group comparisons and the paired t–test for within–group comparisons. Non–normal distribution variables, including body composition (SMM), fatigue (CFS), and quality of life (FAACT), were analyzed using the Mann–Whitney U test for between–group comparisons and the Wilcoxon signed–rank test for within–group comparisons. Changes in physical function (6MWT and handgrip strength), fatigue, and quality of life were evaluated using change scores calculated as the difference between post–intervention and baseline values.

Data Analysis, Qualitative Phase: Interview data were analyzed using deductive thematic analysis following the framework described by Dawadi,⁴⁵ which included familiarization with the data, indexing, charting, mapping, and interpretation. Initial codes were generated based on participants' experiences, facilitators, and barriers to adherence to nutrition and exercise recommendations. NB conducted coding independently, and the coding framework, categories, and themes were reviewed and refined through discussion with SC and PC until consensus was reached.

All interviews were transcribed verbatim in Thai and translated into English by NB, a bilingual

APN and nurse researcher. A forward-translation approach was used. To ensure translation credibility, SC and PC, the study supervisor experienced in qualitative research, reviewed the English transcripts against the original Thai transcripts and audio recordings where necessary, and resolved any discrepancies in meaning by consensus. ATLAS.ti (version 25) was used to facilitate data management and organization.

Reflexivity: Our clinical experience in oncology and nutrition facilitated sensitive interviews and rapport with participants, while acknowledging potential interpretive bias. Reflexivity was maintained through field notes and reflection on personal assumptions to ensure that findings represented participants' perspectives on dietary and exercise barriers.

Trustworthiness: In this study, the researchers used the concept of data trustworthiness based on Lincoln and Guba's four criteria: credibility, transferability, dependability, and confirmability.⁴⁶ Credibility was ensured through member checking with participants to validate the accuracy of researchers' interpretations. Transferability was enhanced by providing detailed descriptions of participants, treatment context, and clinical setting. Participants were adults with newly diagnosed gastrointestinal cancer receiving chemotherapy at a university hospital oncology clinic. The intervention group completed the 12-week APN-Led Self-Care Support Program in accordance with the study protocol, whereas the control group received standard care. Dependability was maintained through an audit trail of the research process, coding procedures, and decisions. To ensure coding consistency, 20% of transcripts were reviewed by a second researcher. Any discrepancies were discussed until a consensus was reached. Confirmability was enhanced by grounding findings in participants' data and supporting themes with direct quotations.

Mixed Methods Validity/Legitimacy⁴⁷: The rigor of the mixed-methods study was ensured through attention to design legitimacy, integration validity,

inference quality, and inside-outside legitimacy. Methodological rigor was strengthened through the use of appropriate mixed-methods procedures, systematic integration and triangulation of quantitative and qualitative findings, and careful interpretation of meta-inferences. In addition, consistency between participants' perspectives and researchers' interpretations was continuously examined to enhance the credibility, coherence, and overall trustworthiness of the study conclusions.

Ethical Considerations: This study was approved by the Human Research Ethics Committee of the Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand (Approval number ID COA.MURA2024/406). Before enrollment, all participants received all information about the study and provided written informed consent. Participation was voluntary, confidentiality, and anonymity were ensured, and participants were free to withdraw at any time without consequence. All data were securely encrypted and stored on the researcher's password-protected devices, with access restricted to the research team. Participants were assigned identification codes (e.g., ID2C) in interview transcripts and quotations to protect their identities. Audio recordings were deleted upon completion of the study, and all results were presented in aggregate form to ensure that no individuals or institutions could be identified.

Results from the Quantitative Phase

Data from 33 participants suffering from gastrointestinal cancer were analyzed (intervention group, $n = 16$; control group, $n = 17$). The initial demographic and clinical data are presented in **Table 1**. There were no statistically significant differences between the groups before the intervention (all $p > 0.05$).

Table 1. Baseline characteristics of participants (N = 33)

Variables	Intervention group (n = 16)	Control group (n = 17)	χ^2 /Fisher/t	p-value
Age (years), mean $\pm$ SD	60 $\pm$ 12	64 $\pm$ 10	t = -1.023, df = 31	0.314 ^a
Sex, n (%)				
Male	8 (50.0)	9 (52.9)	$\chi^2 = 0.029$	0.866 ^b
Female	8 (50.0)	8 (47.1)		
Educational level, n (%)				
Below bachelor's degree	5 (31.3)	11 (68.8)	Fisher's exact test	0.076 ^c
Bachelor's degree or higher	11 (68.7)	6 (35.3)		
Employment status, n (%)				
Regular income	9 (56.3)	9 (52.9)	Fisher's exact test	1.000 ^c
No regular income	7 (43.7)	8 (47.1)		
Monthly income, n (%)				
$\leq$ 30,000 THB (892 USD)	10 (66.7)	10 (58.8)	Fisher's exact test	0.372 ^c
> 30,000 THB (892 USD)	5 (33.3)	7 (41.2)		
Health insurance coverage, n (%)				
Universal Coverage Scheme and the Civil Servant Medical Benefit Scheme	14 (87.5)	16 (94.1)	Fisher's exact test	0.282 ^c
Non-health insurance	2 (12.5)	1 (5.9)		
ECOG performance status, median (IQR)	1 (0–1)	0 (0–1)	z = -0.877	0.381 ^d
Nutritional status (NAF)				
Mild	11 (68.8%)	12 (70.6%)		1.000 ^c
Moderate	5 (31.3%)	5 (29.4%)		
Comorbidities				
Diabetes mellitus	6 (37.5%)	2 (11.8%)	$\chi^2 = 0.061$, df = 1	0.118 ^c
Cardiovascular disease	10 (62.5%)	5 (29.4%)		
Respiratory disease	3 (18.8%)	1 (5.9%)		
Liver disease	1 (6.3%)	2 (11.8%)		
Other	11 (68.8%)	11 (64.7%)		
Cancer type				0.601 ^c
Stomach	1 (6.3%)	1 (5.9%)		1.000 ^c
Colon	11 (68.8%)	15 (88.2%)		
Rectum	2 (12.5%)	0 (0.0%)		
Pancreas	2 (12.5%)	1 (5.9%)		
Cancer stage				
Stage I	1 (6.3%)	0 (0.0%)		1.000 ^c
Stage II	1 (6.3%)	1 (5.9%)		
Stage III	8 (50.0%)	10 (58.8%)		
Stage IV	6 (37.5%)	6 (35.3%)		

Table 1. Baseline characteristics of participants (N = 33) (Cont.)

Variables	Intervention group (n = 16)	Control group (n = 17)	χ^2 /Fisher/t	p-value
Histological differentiation				0.464 ^c
Well differentiated	2 (15.4%)	3 (20.0%)		
Moderately differentiated	10 (76.9%)	12 (80.0%)		
Poorly differentiated	1 (7.7%)	0 (0.0%)		
Treatment intent				1.000 ^c
Neoadjuvant	1 (6.3%)	0 (0.0%)		
Adjuvant	9 (56.3%)	11 (64.7%)		
Palliative	6 (37.5%)	6 (35.3%)		
Chemotherapy regimen				
Fluoropyrimidine-based	7 (43.8%)	7 (41.2%)	$\chi^2 = 0.022$, df = 1	0.881 ^b
Platinum-based	14 (87.5%)	13 (76.5%)	$\chi^2 = 0.047$, df = 1	0.656 ^c
Irinotecan	2 (12.5%)	2 (11.8%)		1.000 ^c
Targeted therapy	1 (6.3%)	2 (11.8%)		1.000 ^c
Oral regimen	10 (62.5%)	10 (58.8%)		0.829 ^b
Gemcitabine	0 (0.0%)	1 (5.9%)		1.000 ^c
Chemotherapy modification				0.273 ^c
Dose escalation	2 (12.5%)	2 (11.8%)		
Dose reduction	7 (43.8%)	5 (29.4%)		
No change	6 (37.5%)	2 (11.8%)		
Regimen change	1 (6.3%)	7 (41.2%)		
Neuropathy*				0.656 ^c
< Grade 3	13 (81.3%)	15 (88.2%)	Fisher's exact test	
≥ Grade 3	3 (18.8%)			

Note. ECOG = Eastern Cooperative Oncology Group;

^a Independent t-test; ^b Chi-square test; ^c Fisher's exact test; ^d Mann-Whitney U test

Categorical variables are presented as frequency (%).

*Common Terminology Criteria for Adverse Events (CTCAE) grade < 3 indicates no symptoms to mild-moderate symptoms; CTCAE grade ≥ 3 indicates severe symptoms.

Effectiveness of the Self-Care Support Program: Comparison of outcomes between the intervention and control groups is shown in **Table 2**. Changes in fatigue, quality of life, body composition, and physical function were compared between the groups after the 12-week intervention. No significant

between-group differences were observed in changes in total fatigue, fatigue subscales (physical, affective, and cognitive), total quality of life, or any quality-of-life subdomains (all $p > 0.05$). Similarly, no significant between-group differences were found in changes in SMM or handgrip strength (all $p > 0.05$). Regarding

physical function, participants in the intervention group demonstrated a within–group improvement in the 6MWT with walking distance increasing by 30.63 ± 30.23 m, whereas the control group showed a decrease of

-5.65 ± 36.49 m. The between–group difference in the change in 6–meter distance is statistically significant ($p = 0.004$).

Table 2. Comparison of outcomes between experiment and control groups

Outcome	Intervention (n = 16) Δ Mean $\pm$ SD/ Median (IQR)	Control (n = 17) Δ Mean $\pm$ SD/ Median (IQR)	t	df	p	95% CI
Cancer fatigue (total)	1.31 $\pm$ 8.13	1.52 $\pm$ 5.09	-0.092	31	0.927	-5.00 to 4.57
Physical subscale	1.44 $\pm$ 4.26	1.76 $\pm$ 3.75	-0.235	31	0.816	-3.17 to 2.52
Affective subscale	-0.44 $\pm$ 3.54	-0.35 $\pm$ 2.85	-0.076	31	0.940	-2.36 to 2.19
Cognitive subscale	0.31 $\pm$ 2.52	0.12 $\pm$ 3.12	0.197	31	0.845	-1.83 to 2.22
Quality of life (total)	1.44 $\pm$ 11.00	1.53 $\pm$ 10.14	-0.025	31	0.980	-7.60 to 7.42
Physical well-being	-0.19 $\pm$ 6.09	1.44 $\pm$ 4.52	0.126	31	0.900	-3.39 to 3.84
Social/Family well-being	-0.06 $\pm$ 2.86	-0.24 $\pm$ 4.72	0.126	31	0.900	-2.62 to 2.97
Emotional well-being	1.44 $\pm$ 4.52	2.88 $\pm$ 4.17	-0.956	31	0.346	-4.53 to 1.64
Functional well-being	0.25 $\pm$ 3.47	0.18 $\pm$ 4.20	0.055	31	0.957	-2.67 to 2.82
Anorexia/cachexia	0.25 $\pm$ 4.50	1.12 $\pm$ 5.94	-0.454	31	0.635	-4.76 to 3.03
Body composition						
SMM (kg)	Pre: 22.46 $\pm$ 3.30 Post: 22.73 $\pm$ 3.17 Mean rank: 16.66	Pre: 22.85 $\pm$ 5.14 Post: 23.68 $\pm$ 6.55 Mean rank: 17.32	-0.257/ -0.198	27.47	0.799 ^a / 0.843 ^b	-3.45 to 2.69
Physical function						
6MWT (m)	Pre: 395.81 $\pm$ 72.61 Post: 426.44 $\pm$ 64.80 Δ : 30.23 $\pm$ 30.63	Pre: 417.44 $\pm$ 59.78 Post: 411.79 $\pm$ 64.80 Δ : -5.65 $\pm$ 36.49	-0.937/ 3.099	31	0.356 ^a / 0.004 ^a	-68.73 to 25.47 12.40 to 60.15
Handgrip strength (kg)	Pre: 26.95(24.1–31.9) Post: 26.9(23.2–34.0) Δ : 3.12 $\pm$ 1.09	Pre: 27.0(19.3–32.0) Post: 26.3(17.8–29.6) Δ : -0.12 $\pm$ 2.51	1.23	31	0.227 ^a	-0.79 to 3.22

Note. Δ = Change/Difference value; ^a Independent t–test, SD = Standard deviation, IQR = Interquartile range, df = Degrees of freedom, CI = Confidence interval

Data are presented as mean $\pm$ SD, median (IQR), or frequency (%), as appropriate.

SMM (kg) = Skeletal muscle mass measured in kilograms; 6MWT (m) = 6–Minute Walk Test measured in meters

The overall mean compliance with the exercise was 85.9% (SD 18.7), with 13 out of 16 participants (81.3%) having compliance $\geq 70\%$. However, variability was observed, primarily due to a decrease in resistance training after the first month.

Within the intervention group, participants with exercise adherence $\geq 80\%$ demonstrated greater improvements in physical function than those with adherence $< 80\%$. The mean increase in 6MWT distance

was significantly greater among participants with higher adherence. No significant differences were observed between the two adherence groups in changes in fatigue, muscle strength, or SMM (all $p > 0.05$). Although participants with exercise adherence $\geq 80\%$ tended to show greater improvement in quality of life than those with adherence $< 80\%$, the difference did not reach statistical significance (Table 3).

Table 3. Comparison of changes in outcome variables by exercise adherence ($\geq 80\%$ vs. $< 80\%$) in the intervention group

Variable	Adherence	N	Mean ± SD/ Mean rank	Mean difference	95% CI (Lower, Upper)	p-value
Δ Fatigue score	≥ 80%	10	3.20 ± 8.59	+5.03	−3.83, 13.90	0.243
	< 80%	6	−1.83 ± 6.82			
Δ FAACT score	≥ 80%	10	5.50 ± 8.18	+10.83	−0.15, 21.82	0.053
	< 80%	6	−5.33 ± 12.45			
Body composition						
Δ SMM (kg)	≥ 80%	10	0.49 ± 1.10	+0.61	−0.72, 2.09	0.377
	< 80%	6	−0.12 ± 1.36			
Physical function						
Δ 6MWT (m)	≥ 80%	10	110.40 ± 20.92	+48.60	27.98, 69.22	< 0.001
	< 80%	6	61.00 ± 13.52			
Δ Handgrip strength (kg)	≥ 80%	10	1.25 ± 3.15	+0.42	−3.15, 3.99	0.806
	< 80%	6	0.83 ± 3.34			

Notes: Δ = Change/Difference value; FAACT = Functional Assessment of Anorexia/Cachexia Treatment); SMM (kg) = Skeletal muscle mass measured in kilograms; 6MWT (m) = 6-Minute Walk Test measured in meters;

^a Independent t-test for continuous variables with a normal distribution.

^b Mann-Whitney U test for continuous variables with a non-normal distribution.

Compliance values exceeding 100% were capped at 100%.

Overall compliance was calculated as the average of aerobic and resistance compliance.

Findings from Qualitative Phase

The qualitative component explored participants' challenges, experiences, adherence, and satisfaction with the combined exercise and dietary program. The sample consisted of 22 participants: 12 from the intervention group and 10 from the control group. The analysis resulted in two main themes, comprising a total of nine sub-themes:

Theme 1: Dietary Challenges in the Course of Cancer Treatment

This theme reflects participants' experiences of maintaining dietary intake during cancer treatment. Eating behaviors were influenced by physical changes, treatment-related side effects, personal values, and environmental support. Participants described reduced appetite and sensory changes that limited their food intake; however, they developed adaptive strategies to maintain nutrition and strength, with support from

family members and healthcare teams. Dietary management during chemotherapy was therefore an ongoing process of adjustment and resilience. Four subthemes arose describing factors that hindered or supported dietary intake during cancer treatment. Participants are identified below using anonymized study codes. “ID” denotes participant identification, the number indicates the interview sequence, and the final letter indicates group allocation (C = control; I = intervention).

Sub-theme 1.1: Treatment-related physiological and sensory disruptions: This subtheme focuses on how chemotherapy-related changes—particularly altered taste, oral discomfort, gastrointestinal symptoms, and other side effects—reduced appetite and enjoyment of food, thereby making it harder for participants to consume sufficient nutrition.

“I can’t eat very spicy food at all — it burns my tongue and makes eating less enjoyable.” (ID2C)

“I want to eat, but sometimes I can’t because I feel full.” (ID2C)

“And during chemotherapy, I feel like I’m completely bored. I feel like I don’t want to do anything. I want to sleep because I’m constantly nauseous, dizzy, and vomiting.” (ID10I)

“I feel pain in my jaw. It starts with the first few bites of food and improves afterward. However, if I stop eating for 1–2 hours and then try again, the pain returns with every meal. This symptom lasts for about a week.” (ID21I)

Sub-theme 1.2: Food avoidance, restrictions, and access limitations: Participants described limiting food choices due to infection concerns, beliefs about “unsafe” or processed foods, dependence on externally prepared meals, and dissatisfaction with nutritional supplements, all of which constrained dietary intake.

“We’re more selective about the foods we eat. For example, before, we could eat anything. Now, we’re more selective. We don’t eat grilled foods very often. We don’t eat processed foods, especially sausages.” (ID5C)

“We cannot cook our own food. We buy it from other places. Therefore, sometimes we cannot choose all the food.” (ID17I)

“The Ensure that my doctor prescribed for me was 2.5 kilograms, take eight spoons three times a day. I finished it before chemotherapy. But when I started chemotherapy, I started to dislike it because I found it had an unpleasant odor. Even when I tried changing it to coffee, I was really bored.” (ID15C)

Sub-theme 1.3: Motivation, beliefs, and personal adaptation: Eating behaviors were influenced by participants’ determination, their beliefs about the role of nutrition in recovery, attention to health-related cues, and individual coping styles. Participants described actively adjusting both food choices and eating patterns to match their physical tolerance while still trying to meet treatment and recovery goals.

“After surgery, I hardly ever touched buffets or grilled food. My appetite has decreased, and my desire for those foods has significantly diminished. This is due to changing my mindset, which tells me that if I can’t eat, I shouldn’t.” (ID22I)

“I don’t feel uncomfortable or unwilling to eat, even though I have to eat more. I want to improve my ability to eat more. To keep the body strong.” (ID11I)

“I truly believe eating regularly is so important. I’ve talked to many patients, and when they can’t eat and don’t try to keep eating, their bodies become weaker, and it’s harder for them to keep fighting.” (ID21I)

“I didn’t vomit. I still had a good appetite, and my food always felt delicious, even while taking medication.” (ID13I)

Sub-theme 1.4: Social, professional, and activity-related supports: Support from family caregivers and guidance from healthcare professionals

helped participants continue eating during treatment. Some participants also mentioned that being physically active helped stimulate their appetite and made eating feel easier. Overall, these sources of support helped them manage periods of poor appetite and reminded them of the importance of maintaining nutritional intake during chemotherapy.

“Sometimes at night, when I’m sleeping, my daughter will ask, ‘Mom, what are you going to eat tomorrow?’ I imagine it, and then she’ll find it for me. I’m happy to eat it.” (ID15C)

“I gained knowledge about eating. After participating in this project, I tried to eat according to my goals, even though I didn’t want to eat, because I knew I wouldn’t have the energy if I didn’t.” (ID16I)

“At first, I ate very little. Just seeing it, just thinking about it, made me want to walk away. All the nausea I was already feeling was gone. But later, there were many things. But I have to admit that walking helped me feel hungrier.” (ID17I)

Theme 2: Navigating Exercise Challenges in Cachexia During Illness and Treatment

This theme reflects participants’ experiences of engaging in exercise during cachexia and cancer treatment. Physical symptoms, treatment-related side effects, psychological factors, and situational barriers limited participants’ ability to maintain physical activity. However, motivation, social and professional support, perceived benefits, and coping strategies facilitated exercise participation. Exercise engagement was an ongoing process of adaptation and decision-making in response to changing physical abilities and environmental conditions. The findings are presented in five subthemes describing barriers and facilitators influencing exercise participation.

Sub-theme 2.1: Physical and treatment-related constraints: This subtheme describes how tiredness, muscle weakness, pain, numbness, and other treatment-related

side effects physically constrained participants’ capacity to exercise, especially on the day following chemotherapy.

“During the first week after receiving the medication, I was unable to exercise at all. I felt tired. I was able to start exercising around the following week.” (ID21I)

“I don’t pull the rubber bands when the numbness is severe. Now, I only do it once a week. The soles of my feet are painful when I walk, even in soft shoes.” (ID11I) [The rubber band is a resistance band, provided in the intervention to facilitate the resistance exercise].

Sub-theme 2.2: Psychological beliefs, motivation, and confidence: Participants’ exercise behaviors were shaped by motivation, self-discipline, confidence in performing exercises, and beliefs about the safety or benefits of exercise during treatment. Misunderstandings and fear would lead to inactivity, but determination and a positive attitude would lead to action.

“Pulling resistance bands is actually... a very easy exercise. We can do it every day. But sometimes... I have to admit that I’m lazy. It’s not as fun as walking.” (ID17I)

“People with normal health should exercise, but people with illnesses should exercise even more.” (ID16I)

“Rest helps build blood cells, which helps my blood test results pass, so I don’t have to waste energy exercising.” (ID15C)

Sub-theme 2.3: Resources, time, and environmental context: There were enabling and impeding factors in exercise engagement due to access to equipment, physical space, time constraints, time conveniences [such as work schedules], and barriers to tomorrow activities; weather conditions [barriers], low temptation proximity; neighborhood safety barrier/enabler that inhibits/facilitates routine activity.

“But now I’m not as flexible as I used to be because I wake up with abdominal bags. Sometimes they’re very heavy. I have to wash them, clean them, and then do something neat. It takes time.” (ID17I)

“I hardly find time to walk. Sometimes it rains every day. During winter, my legs become numb, and I feel cold, which makes my legs walk slowly.” (ID17I)

“Shift work schedules make it difficult to exercise consistently.” (ID16I)

Sub-theme 2.4: Social and professional support systems: Support from family, peers, and healthcare professionals was a key motivator to exercise, giving reassurance, routine, and confidence in staying active during treatment.

“My child said, ‘Mom, you have to be patient with me for another ten years.’”

“My parents said, ‘You can’t do anything, you’re still young,’ and that I need to be patient and strong.” (ID21I)

“I want to be with my children and worry about my older child, who is taking care of him. My child said, ‘Since it can happen, I must be able to treat it.’” (ID11I)

“After participating in the program, following a set schedule is better than doing it without direction. For example, before, I would run and walk, but with a schedule, I know the correct pattern to follow.” (ID16I)

“The doctor recommended exercise to recover and prepare for medication. My nurse friend also emphasized that I must do it.” (ID22I)

“Participating in this program was very beneficial. If I hadn’t participated in the program, I wouldn’t have known how to exercise.” (ID11I)

Sub-theme 2.5: Adaptation, perceived benefits, and prior experience: Participants reported modifying the degree of exercise and exercise schedules daily according to their own physical condition. Positive changes in strength, appetite, and sleep were contributing factors that kept participants engaged.

“I feel more refreshed, energetic, and strong.” (ID11I)

“Exercise, especially walking, helps increase my appetite and improves my appetite.” (ID17I)

“Adapt your exercise routines to your physical condition each day, as fatigue after each chemotherapy cycle varies. Move as much as you can and feel comfortable.” (ID16I)

“Being sick made me realize that my previous lifestyle was wrong. The thought of “knowing but not doing” has returned to my mind, forcing me to make changes.” (ID22I)

“After listening to the doctor talk and seeing others exercise, seeing others exercise makes me want to exercise.” (ID13I)

“I used to ride a bicycle. The furthest distance was from Loei Province to Bangkok, taking four days and four nights. I cycled with a team of forty people, who had a car, food, and accommodation provided.” (ID19C)

“Before I got sick, I cycled every day. I started around five a.m., usually in small groups of two to three people on weekdays, and expanded to larger groups of six to ten people on weekends.” (ID20I)

“I usually use the treadmill and do some weight training. Sometimes I walk in the park for about thirty minutes a day, four days a week.” (ID4I)

Integration of Quantitative and Qualitative Findings⁴⁸

Quantitative and qualitative findings were integrated during the interpretation phase through a side-by-side comparison. Areas of convergence, complementarity, and discrepancy were systematically examined. No substantial discrepancies were identified; instead, the qualitative findings largely complemented and provided deeper explanations for the quantitative

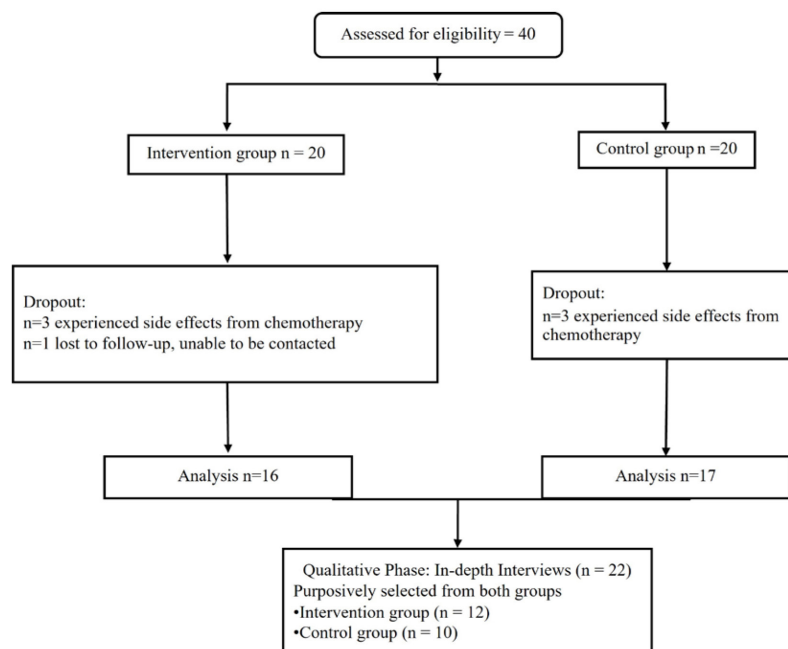
results. Both quantitative and qualitative evidence showed a positive impact on functional capacity. While no differences in body composition, grip strength, fatigue, or quality of life were found, qualitative data provided essential context regarding issues such as treatment side effects, neuropathy, fatigue, and obstacles to exercise. On the other hand, qualitative information indicated that patients perceived positive changes in their energy levels, appetite, and physical functioning through walking exercises, which may explain the improvement in 6MWT performance (Table 4).

Table 4. Joint display of quantitative and qualitative findings and integration of the same

Outcome	Quantitative findings	Qualitative findings	Mixed methods inferences
1. Body composition	No significant difference between groups ($p > 0.05$).	Participants reported barriers to adequate nutritional intake, including treatment-related side effects and fatigue. One participant stated: <i>"The soles of my feet hurt when walking, even when wearing soft shoes."</i>	Expansion: Although exercise was implemented, qualitative findings suggest that treatment side effects and inadequate dietary intake may have limited the anabolic response required for muscle growth. These findings help explain why no significant improvement in muscle mass was observed within the study period.
2. Functional capacity (Grip strength)	No significant difference between groups ($p > 0.05$).	Some participants experienced hand numbness or pain that limited resistance exercise performance. Others disliked resistance bands. One participant reported: <i>"When the numbness is severe, I don't use the band. Sometimes I only exercise once a week."</i>	Expansion: Quantitative findings showed no improvement in grip strength, while qualitative findings revealed that chemotherapy-induced neuropathy and discomfort during resistance training reduced exercise adherence and training intensity. These barriers may have limited the effectiveness of the strength-training component.
3. Functional capacity (6-Minute Walk Test)	A significant difference was observed in 6MWT performance ($p < 0.05$).	Participants in the intervention group reported feeling more energetic, stronger, and having better appetite. Examples included: <i>"I feel more refreshed, energetic, and stronger."</i> and <i>"Walking exercise helps improve my appetite and allows me to eat better."</i>	Confirmation: The intervention was found to be beneficial in both quantitative and qualitative study results. Participants showed improved functional ability and perceived physical benefits, though muscle mass did not increase significantly. Walking exercise is effective in improving daily living functions within 12 weeks.

Table 4. Joint display of quantitative and qualitative findings and integration of the same (Cont.)

Outcome	Quantitative findings	Qualitative findings	Mixed methods inferences
4. Fatigue and quality of life (QoL)	No significant difference in fatigue or overall QoL scores between groups ($p > 0.05$).	Participants still felt tired during chemotherapy. However, some noted that they felt physically better and had a greater sense of well-being.	Expansion: There was no significant effect seen through quantitative measurements, but perceived effects were observed through interviews. These results reveal that the outcomes of fatigue and QoL are affected by many variables, and the 12-week program was not sufficient for any measurable changes to take place.
5. Adherence/ Actual activity dose	In the intervention group ($n = 16$), 10 participants (62.5%) achieved exercise adherence $> 80\%$.	Barriers reported by participants were fatigue, peripheral neuropathy, adverse weather conditions, and discomfort with equipment. Factors that acted as facilitators were family support and perception of gains resulting from the exercise.	Expansion: Adherence was quite high despite the presence of barriers. Insights derived from qualitative data will help elucidate how factors such as family support and gains from exercise facilitated adherence. High adherence could have been the reason for increased functional capacity (6MWT).



Note. Flow diagram illustrating the sequential mixed-methods design, including the quasi-experimental phase ($N = 33$) and the subsequent qualitative follow-up ($n = 22$)

Figure 2. Study flow diagram

Discussion

This mixed-methods study evaluated an advanced practice nurse-led, 12-week Self-Care Support Program among 33 participants with gastrointestinal cancer receiving chemotherapy to mitigate cancer cachexia. The Program focused on body composition, physical function, fatigue, quality of life, and qualitative experiences with diet and exercise. Participants in the experimental group achieved a high mean exercise compliance rate of 85.9%, with 81.3% sustaining compliance at or above 70%. Rather than strictly evaluating physical outcomes, these findings validate the feasibility and real-world applicability of the Self-Care Support Program combined with exercise and nutritional guidance during active oncology treatment.^{49,50} Nevertheless, the wide variability in compliance highlights the confounding influence of heterogeneous physical function, treatment-related complications, and individual patient lifestyles.

While body composition, fatigue, and quality of life remained comparable between the two groups, the intervention group demonstrated significantly greater improvements in physical function. This finding may be explained by the systemic physiological effects of exercise during chemotherapy, which promote neuromuscular adaptation, enhance muscle contractile efficiency, and increase capillary density, thereby improving oxygen delivery and exchange in the lungs.⁵¹ It stimulates the autonomic nervous system, adjusts balance, and reduces heart rate. The volume of blood pumped by the left ventricle per heartbeat (stroke volume) increases, improving oxygen-delivery capacity; the VO₂max value increases.^{51,52} Exercise enhances lung capacity and cardiovascular function, leading to improved physical performance. Consistent with these physiological benefits, physical function, as measured by the 6MWT, improved by 30.63 meters in the intervention group. This finding is consistent with a previous review reporting a minimal clinically important difference of 43 meters on the 6MWT in adults with chronic diseases.⁵³

In people with cancer, chemotherapy has been found to reduce mitochondrial markers, including citrate synthase, which is abnormal in mitochondrial synthesis.⁵⁴ Animal studies have shown that exercise reduces oxidative stress and protease activity from chemotherapy, which causes muscle breakdown.^{51,55} It also effectively stimulates anabolic signaling, thereby increasing protein synthesis.⁵⁶ However, this study did not find a statistically significant difference in body composition between the two groups. This is explained by the emphasis on “doing as much as you can” rather than increasing exercise intensity. Participants indicated that the best time to exercise was associated with days when chemotherapy side effects were minimal.

Engaging in exercise appropriate to an individual's physical condition may promote muscle hypertrophy. Regular moderate-to-vigorous aerobic exercise improves cardiopulmonary capacity, enhances muscle oxygenation, and increases mitochondrial volume but not muscle size.^{49,52,53} In non-cancer volunteers or the general population, it takes about 2–8 weeks to improve cardiopulmonary function, and muscle growth is stimulated after 8 weeks or more when aerobic exercise is combined with resistance training.⁵⁷ In people with cancer, it takes longer due to side effects from treatment, as cardiopulmonary function takes about 6–24 weeks.⁵⁵ Studies have reported increased VO₂ max or VO₂ peak in breast cancer and colon cancer patients with or without resistance training.⁵⁸ Aerobic exercise combined with resistance training and dietary advice improves cardiopulmonary function and increases muscle mass over approximately 12–20 weeks.⁵¹ This is consistent with a meta-analysis reporting that resistance training can induce muscle hypertrophy in cancer patients, although the increase was only modest, approximately 1–2%, especially in those undergoing treatment.⁵⁹

Fatigue from this study did not differ statistically between groups. Cancer-related fatigue is multifactorial, resulting from central and peripheral mechanisms, chemotherapy, and cytokine-mediated inflammation

that alters neurotransmitter function, leading to increased fatigue perception and reduced energy.⁵⁷ The participants provided qualitative data that they were tired even before exercising, especially that symptoms would be worse after receiving chemotherapy for one week, wanting to sleep all the time, and peripheral fatigue that occurs in skeletal muscle due to chemotherapy–induced mitochondrial damage, resulting in reduced adenosine triphosphate (ATP) production, so the body is tired after activities.⁵⁸ A meta–analysis compiled data from 113 randomized clinical trials involving over 11,500 people with cancer to compare the effectiveness of four main treatment modalities for reducing fatigue: exercise, psychotherapy, psychotherapy combined with exercise, and medication. The study found that exercise yielded the highest results, but key factors included walking or running.⁵⁹ A combination of aerobic and resistance training was effective but depended on adherence to the Program, as well as on implementation, intensity, frequency, and duration. Short– or low–frequency exercise (< 2 days/week) yielded lower outcomes than the control group.⁶⁰ Consistent with our study, no differences were found between groups. In the intervention group, 10 of 16 participants achieved 80% adherence to the program, a small number that may not have led to significant differences between the groups. Furthermore, exercise records indicated that volunteers' intensity was low to moderate, which may not have led to clinically meaningful changes in fatigue.

Quality of life was another important factor that did not differ significantly between the two groups. This is because quality of life is a multidimensional outcome comprising physical, social/family, emotional, mental, and activity–related factors that impact daily functioning. This is more complex than a comprehensive care program can provide. Fatigue was found to be a significant negative factor affecting the quality of life in patients with gastrointestinal cancer.⁶¹ This is consistent with the data in this study, which showed no statistically significant difference in fatigue. Therefore,

a larger sample size was recommended to enhance statistical power.

The primary investigator played a key role in supporting health behavior change among people with cancer cachexia through comprehensive assessment, identification of individual barriers, personalized nutrition and exercise planning, and continuous support, consistent with advanced nursing practice. Qualitative findings supported quantitative outcomes, indicating improved symptom coping, behavioral changes, and greater engagement in care. Participants became active partners rather than passive recipients, highlighting the importance of individualized support from advanced practice nurses, families, and healthcare providers. Intervention flexibility, including adaptation of exercise and nutrition plans to patients' functional status and preferences, contributed to adherence and demonstrated the value of personalized APN interventions in bridging theory and clinical practice.

Limitations

This study had several limitations. The small sample size may have limited the statistical power to detect between–group differences. Participants were clinically frail, and disease–related symptoms and treatment effects may have affected their ability to fully engage with the intervention. Exercise equipment and strategies may require further adaptation to accommodate treatment–related limitations and improve feasibility. The non–randomized allocation based on clinic day may have introduced selection bias, although baseline characteristics were comparable between groups. Additionally, qualitative interviews included only participants with high intervention adherence, which may have influenced the reported experiences. As this was a single–center study, generalizability is limited. Future multicenter studies with larger samples and randomized designs are needed to confirm these findings.

Mixed–methods research has limitations such as resource intensiveness, complexity in design and

integration, difficulty in synthesizing qualitative and quantitative data, and advanced methodological knowledge.⁶²

Conclusion and Implications for

Clinical Nursing Practice and Research

This study provides feasibility data supporting the design, efficacy, and broader implementation of this multimodal intervention. The results will inform treatment guidelines for vulnerable patients with chronic diseases or other cancers, with or without cachexia. Improving the ability to effectively use exercise and nutrition to maintain muscle mass and enhance functional performance may be a cost-effective approach to reducing hospital length of stay and healthcare costs, and improving patients' overall quality of life. This trial demonstrates that a twelve-week chemotherapy intervention combining nutritional support with structured exercise training and relaxation strategies is feasible for patients with gastrointestinal cancer. The findings support the launch of a larger clinical trial, with the ultimate goal of improving patients' quality of life while receiving chemotherapy.

Developing a holistic care plan: This study highlights the important role of the APN in promoting self-care among people with gastrointestinal cancer receiving chemotherapy. APN-led support addressing self-care barriers, nutrition, and physical activity may enhance physical functioning, symptom management, and quality of life.

Policy recommendations: The findings support the development of multidisciplinary care for cancer cachexia, involving oncology, nutrition, physical activity, and nursing support. Healthcare institutions should consider integrating supportive care programs led by APNs into routine oncology services.

Acknowledgments and Declarations

The authors gratefully acknowledge all participants in this study and the scholarship support from the Faculty

of Medicine Ramathibodi Hospital, Mahidol University. Also, the authors sincerely thank the oncology outpatient department nurses and the nurse administrators of the Nursing Service Division for their support and encouragement during the study and data collection.

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Investigation: NB, SC

Formal analysis: NB, SC, PC

Data curation: NB

Writing – original draft: NB, SC

Writing – review & editing: NB, SC, PC

Supervision: SC, PC

All authors have read and approved the final version of the manuscript.

Funding

The authors received research funding from the Board-Certified Training Program in Nursing, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University.

Declaration of Generative AI in Scientific Writing

The authors used Grammarly, ChatGPT, and Gemini to verify grammar and improve English language clarity. After this, the authors reviewed and edited the content as needed and take full responsibility for the content and integrity of the final published work.

Declaration of Conflict of Interest

We declare that we have no conflict of interest related to this study or publication.

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ผลลัพธ์ของโปรแกรมการสนับสนุนการดูแลตนเองโดยผู้ปฏิบัติการพยาบาล ชั้นสูงในผู้ป่วยมะเร็งระบบทางเดินอาหารที่มีภาวะผอมแห้งหุ้มกระดูก : การศึกษาวิจัยแบบผสมผสาน

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บทคัดย่อ: ภาวะผอมแห้งหุ้มกระดูกจากมะเร็งเป็นภาวะที่พบได้บ่อยในผู้ป่วยมะเร็งระบบทางเดินอาหาร ส่งผลให้เกิดภาวะทุพโภชนาการ สมรรถภาพทางกาย และคุณภาพชีวิตลดลง ในประเทศไทยหลักฐานเชิงประจักษ์เกี่ยวกับโปรแกรมสนับสนุนการดูแลตนเองที่ดำเนินการโดยพยาบาลผู้ปฏิบัติการพยาบาลชั้นสูง ซึ่งออกแบบเฉพาะสำหรับผู้ป่วยกลุ่มนี้ยังมีอยู่จำกัด การศึกษานี้เป็นงานวิจัยแบบผสมผสานตามลำดับ มีวัตถุประสงค์เพื่อประเมินผลของโปรแกรมสนับสนุนการดูแลตนเองที่นำโดยผู้ปฏิบัติการพยาบาลชั้นสูง และสำรวจประสบการณ์ของผู้เข้าร่วมโครงการในผู้ป่วยมะเร็งระบบทางเดินอาหารที่มีภาวะผอมแห้งหุ้มกระดูก ณ โรงพยาบาลสังกัดมหาวิทยาลัยแห่งหนึ่งในกรุงเทพมหานคร ประเทศไทย ระหว่าง สิงหาคม พ.ศ. 2567 ถึง กุมภาพันธ์ พ.ศ. 2568 ผู้เข้าร่วมการวิจัยจำนวน 33 คน แบ่งเป็นกลุ่มทดลอง ($n = 16$) และกลุ่มควบคุม ($n = 17$) กลุ่มทดลองได้รับโปรแกรมการดูแลตนเองเป็นเวลา 12 สัปดาห์ร่วมกับการดูแลตามมาตรฐาน ส่วนกลุ่มควบคุมได้รับการดูแลตามมาตรฐาน ผลลัพธ์ที่วัด ได้แก่ องค์ประกอบของร่างกาย ความเหนื่อยล้า สมรรถภาพทางกาย (การทดสอบเดิน 6 นาที และการวัดแรงบีบมือ) และคุณภาพชีวิต วิเคราะห์ข้อมูลเชิงปริมาณด้วยสถิติเชิงพรรณนา สถิติทดสอบที่แบบอิสระ และ สถิติทดสอบแมนวิทนีซียู จากนั้นผู้เข้าร่วม 22 คน (กลุ่มทดลอง 12 คน กลุ่มควบคุม 10 คน) เข้ารับการสัมภาษณ์เชิงลึก ข้อมูลเชิงคุณภาพวิเคราะห์ด้วยการวิเคราะห์เชิงประเด็น (thematic analysis)

ผลการศึกษาไม่พบความแตกต่างอย่างมีนัยสำคัญระหว่างกลุ่มด้านองค์ประกอบของร่างกาย ความเหนื่อยล้า และคุณภาพชีวิต อย่างไรก็ตาม กลุ่มทดลองมีการพัฒนาขึ้นอย่างมีนัยสำคัญในการทดสอบการเดิน 6 นาที ขณะที่กลุ่มควบคุมมีระยะทางการเดินลดลง ข้อมูลเชิงคุณภาพสะท้อนประสบการณ์ของผู้ป่วยเป็น 2 ประเด็น ดังนี้ 1) ปัญหาการรับประทานอาหารที่เป็นผลจากการรักษาโรคมะเร็ง และ 2) ข้อจำกัดในการออกกำลังกายจากภาวะมะเร็งผอมแห้งหุ้มกระดูกในระหว่างการเจ็บป่วยและการรักษา ผู้เข้าร่วมสะท้อนว่าอาการไม่พึงประสงค์จากการรักษาและความอ่อนล้าเป็นอุปสรรคสำคัญต่อการปฏิบัติตามโปรแกรม ขณะที่การช่วยเหลือที่ปรับให้เหมาะกับแต่ละบุคคลช่วยส่งเสริมการปฏิบัติตามคำแนะนำด้านโภชนาการและการออกกำลังกาย ผลการวิจัยชี้ให้เห็นว่าโปรแกรมที่นำโดยผู้ปฏิบัติการพยาบาลชั้นสูงนี้อาจช่วยรักษาหรือปรับปรุงการทำงานของร่างกายในผู้ป่วยมะเร็งทางเดินอาหารที่มีภาวะผอมแห้งหุ้มกระดูก จำเป็นต้องมีการประเมินเพิ่มเติมโดยใช้กลุ่มตัวอย่างที่ใหญ่ขึ้นและมีความหลากหลายมากขึ้นในหลายสภาพแวดล้อม ก่อนนำโปรแกรมไปบูรณาการสู่การปฏิบัติทางคลินิก

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คำสำคัญ: ผู้ปฏิบัติการพยาบาลชั้นสูง ภาวะผอมแห้งหุ้มกระดูกจากมะเร็ง มะเร็งทางเดินอาหาร การวิจัยแบบผสมผสาน การพัฒนาโปรแกรม การดูแลตนเอง ประเทศไทย

ณัฐพิมพ์ ภิรมย์เมือง ผู้เข้าฝึกอบรมหลักสูตรฝึกอบรมพยาบาลชั้นสูงระดับบัณฑิต สาขาการพยาบาลผู้ใหญ่และผู้สูงอายุ โรงเรียนพยาบาลรามาธิบดี คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล
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