Effect of Brisk Walking on Self-Care Agency or Care Dependency among Colorectal Cancer Patients with Permanent Stoma

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Abstract: *Objective:* The purpose of this study was to determine the effectiveness of brisk walking as an intervention for self-care agency and care dependency in patients with permanent colorectal cancer stoma. *Method:* This study adopted a quasi-experimental research design, specifically a non-equivalent control group pre-test and post-test design. Utilizing the Exercise of Self-Care Agency Scale (ESCA) and Care Dependency Scale (CDS), a survey was administered to 64 patients from a hospital in Shandong Province. The statistical methods used for analyzing data included frequency, mean, standard deviation (SD), independent *t*-test, *P*-value calculation, and dependent *t*-test. *Result:* After two months of a brisk walking exercise program, participants in the experimental group had a higher level of self-care agency than before the experiment ($P < 0.05$), and their level of care dependency was significantly reduced ($P < 0.05$). Participants in the control group also showed higher levels of self-care agency ($P < 0.05$) and lower levels of care dependency ($P < 0.05$) after two months compared to their levels before the two months. *Conclusion:* The brisk walking program had a positive impact on patients' self-care agency and reduced their care dependency.

Keywords: Permanent stoma; Colorectal cancer; Brisk walking; Self-care agency; Care dependency

1. Introduction

Colorectal cancer (CRC), a malignant tumor of the gastrointestinal tract that is becoming increasingly prevalent worldwide, is closely associated with a range of lifestyle factors. Poor lifestyle habits such as a sedentary lifestyle, obesity, smoking, and excessive alcohol consumption may all contribute to the development of colorectal cancer. However, as colorectal cancer often lacks obvious symptoms in its early stages, many patients tend to overlook the importance of screening, and as a result, it is often diagnosed in advanced stages where treatment options are relatively limited. This ultimately leads to colorectal cancer becoming the second leading cause of cancer deaths worldwide. According to the latest data released by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) on the global cancer burden in 2020, the

number of new cases of colorectal cancer (CRC) in the world in that year will be as high as about 1.9 million, and the number of deaths will be about 935,000, which is the third highest incidence rate in the world, and the second highest mortality rate [1].

Focusing on China, the number of new cases of CRC in 2020 will be about 560,000, resulting in about 290,000 unfortunate deaths. Colorectal cancer ranks second in the incidence of malignant tumors in China and fifth in mortality [2,3]. The situation is particularly serious in China, where the incidence and mortality rates remain high, making the management and prevention of colorectal cancer a major challenge [4,5]. Unfortunately, people over 50 years of age and the elderly constitute the main group of stoma patients. Due to age and health status limitations, these patients are often faced with the dilemma of having less self-care agency [6].

To effectively treat colorectal cancer, permanent colostomies are widely used in the field of surgery and hold an important place in the management of colorectal cancer. In this procedure, the surgeon makes an incision in the patient's abdominal wall, removes the patient's intestinal tube from where it normally sits, and sews it into the incision. This process alters the natural anatomy of the gastrointestinal tract, and the opening may take the role of the anus for feces [7]. According to a study [8], surgery is the main treatment for colorectal cancer, and despite the risks associated with surgery, most colorectal cancer patients choose to be treated with a permanent stoma. The procedure does play an important role in improving the survival rate of the patients, thus helping to reduce the mortality rate of the patients.

Brisk walking offers significant benefits for patients with a permanent stoma. It not only effectively promotes the contraction of intestinal muscles and helps patients form regular bowel habits, making it easier for them to change their stoma bags regularly, but also strengthens the coordination of the waist, hips, and limbs. This helps improve muscle strength, makes the body stronger, and enhances the ability to perform daily activities [9,10]. As patients' ability to perform daily activities gradually improves, their self-care agency also increases accordingly, reducing their dependence on nursing care [11,12].

Following a permanent colostomy, patients often develop a strong dependency on their caregivers in the early stages of recovery. Due to the significant physical impact of the surgery, the patient's self-care agency diminishes with increasing care dependency. A study suggests that patients with a stoma require significant caregiving support during the transitional phase of rehabilitation after discharge from the hospital [13].

Nurses and physicians have actively promoted patient self-management after surgery through preoperative instructions and training to reduce the risk of complications from permanent stoma surgery. However, according to the researcher's field observations in hospital-based stoma care clinics, patients often remained highly dependent on nursing care after surgery, especially among elderly stoma patients. Impaired physiological functions caused by surgery often make them feel overwhelmed by daily activities, and simple movements such as turning over and defecation become challenging.

However, there is still a dearth of research on how brisk walking specifically enhances self-care agency and reduces care dependency in stoma patients. Therefore, the researcher explored in detail the specific effects of brisk walking on the self-care agency and care dependency of colorectal cancer patients with permanent stoma. It is expected that the results of this study could be an effective guide to rehabilitative exercise for colorectal stoma patients, thus providing them with a more precise and efficient care plan and helping them to regain their self-care agency more quickly.

2. Materials and methods

2.1. Brisk walking intervention

A brisk walking intervention using a questionnaire was conducted with permanent stoma patients in a hospital

in Shandong Province to observe the patients' self-care agency and care dependence after brisk walking. This study utilized a quasi-experimental research methodology, accurately described as a pre-test-post-test non-equivalent group design. There were no randomly assigned groups in the quasi-experiment. Instead, the study included an experimental group and a control group [14]. Participants in both groups were assessed prior to intervention administration in the treatment group. Subsequently, one of the treatment groups received a two-month brisk walking intervention, during which participants in the experimental group engaged in 30 minutes of brisk walking exercise per day. In contrast, the control group did not receive the intervention, and participants in this group were only required to perform daily activities. After the treatment group completed the intervention, both groups underwent post-testing [15]. Therefore, the independent variables in this study consisted of two levels: brisk walking intervention and no intervention. The dependent variables were patients' levels of self-care competence and care dependency.

In this study, the population comprised patients with permanent stomas who underwent stoma bag replacement at a hospital in Shandong Province. A total of 64 patients participated, ranging in age from 50 to 75 years old. The quasi-experimental quantitative study was divided into experimental and control groups, each consisting of 32 participants. According to the reference list of minimum total sample sizes for different hypothesis tests [15], considering a medium effect size, statistical power of 0.5, and α = 0.05, the total sample size for the study was calculated to be 64 [15].

2.2. Purposive sampling

Purposive sampling, also known as directed or purposive sampling, is a common method employed in social science research. Its primary objective is to select a representative sample from the overall population based on the research goals and objectives, aiming to better address the research questions and achieve the research objectives [16]. This approach allows researchers to choose a sample according to their research requirements, ensuring that the sample shares certain specific characteristics with the overall population. This helps in avoiding sampling bias and enhances the reliability and representativeness of the study results.

Characterized by integrating the sampling process into the study itself, purposive sampling closely aligns sampling operations with the study's purpose, enabling the determination of sample characteristics as per the actual needs of the research. This flexibility allows researchers to adjust sample selection according to the specific requirements, thereby optimizing research outcomes [17].

In this study, a total of 64 subjects were included, with 32 in each group. Participants were selected based on predetermined inclusion and exclusion criteria established by the researchers. The inclusion criteria were as follows:

(1) Patients who were more than 1 week postoperative and up to 1 year after colostomy surgery.

(2) Patients aged between 50 to 75 years.

(3) Patients or their family members who consented to participate after the investigator verbally explained the informed consent.

(4) Patients were expected to reside in the surrounding townships of the hospital in Shandong Province for one year after discharge.

Patients with the following conditions were excluded:

(1) Lack of independent living ability, history of mental illness, or cognitive impairment.

(2) Severe postoperative complications.

(3) Inability to communicate effectively to complete surveys or comprehend feedback.

(4) Individuals with severe cardiovascular disease, diabetes, or hypertension.

(5) Physical disability preventing them from completing brisk walking exercises.

2.3. Research instrument

The Exercise of Self-Care Agency Scale (ESCA) was utilized in this study to assess patients' self-care capacity, while the Care Dependency Scale (CDS) was employed to evaluate their level of dependence on others [18].

2.3.1. Exercise of Self-Care Agency Scale (ESCA)

The ESCA, developed in 1979 by Kearny and Fleischer based on Orem's self-care theory, is designed to measure a patient's self-care capacity [19]. It focuses on four main factors related to self-care: (1) the motivation of the individual, (2) the situation involving active and passive responses, (3) the individual's knowledge base, and (4) the individual's sense of self-worth [20].

2.3.2. Care Dependency Scale (CDS)

The CDS comprises 15 items covering various aspects such as diet, excretion, body position, activity capacity, circadian rhythm, dressing and undressing, body temperature, hygiene, risk prevention, communication, social interaction, values and norms, daily activities, leisure activities, and learning ability. The overall score ranges from 15 to 75, with the following grading categories: 25 indicating complete dependency, 25–44 indicating high dependency, 45–59 indicating partial dependency, 60–69 indicating moderate dependency, and 69–75 indicating virtually independence. The total CDS score serves as a comprehensive indicator of care dependency.

2.4. Data analysis

The researcher organized the recorded data and conducted a statistical analysis using the SPSS data analysis method. To ensure data security, it was stored on a computer and kept confidential, solely for use in this experimental study.

3. Results

In 2023-2024, 64 patients with permanent stoma from a hospital in Shandong, were selected, as the respondents of this study. Before and after the fast walking intervention, the following results were obtained from the modified study.

Table 1. The results of self-care agency and care dependency of pre-test and post-test between the experimental group and the control group

| | Pre-test | | | | | | Post-test | | | | | |
| | ESCA | | | CDS | | | ESCA | | | CDS | | |
	Mean	SD	%	Mean	SD	%	Mean	SD	%	Mean	SD	%
Control	110.31	12.55	64.13	48.94	6.24	65.25	127.75	8.87	74.27	58.34	6.83	77.79
Experimental	116.19	13.66	67.55	52.34	8.06	69.79	137.91	8.39	80.18	69.84	3.00	93.12

Abbreviation: ESCA, Exercise of Self-Care Agency Scale (total 172 scores, higher ESCA score indicated greater self-care agency); CDS, Care Dependency Scale (total 75 scores, higher CDS score indicated greater independence); SD, standard deviation.

Table 1 displays the mean scores of self-care agency and care dependency for both the experimental and control groups during the pre-test and post-test phases. Analyzing the ESCA data reveals that the mean scores of patients in the control group were 110.31 ± 12.55 during the pre-test and 127.75 ± 8.87 during the post-

test, indicating an improvement of 17.44 points from the pre-test to the post-test. The pre-test scores accounted for 64.13% of the total score, while the post-test scores increased to 74.27%, representing a 10.14% increase compared to the pre-test. Conversely, the mean scores of patients in the experimental group were 116.19 ± 13.66 during the pre-test and 137.91 ± 8.39 during the post-test, showing an improvement of 21.72 points. Pre-test results constituted 67.55% of the total score, while post-test results rose to 80.18%, indicating a 12.63% increase from pre-test to post-test. This comparison demonstrates that the experimental group exhibited a significantly greater improvement in scores between the pre-test and post-test compared to the control group.

Furthermore, according to the ESCA grading scale for self-care levels, the control group's pre-test results indicated a medium level of self-care agency, which elevated to a high level in the post-test. In contrast, the experimental group demonstrated a high level of self-care agency in both the pre-test and post-test, indicating a higher baseline of self-care agency. It is noteworthy that while daily activities over two months enhanced self-care agency in the control group, the experimental group experienced a more substantial improvement through the intervention during the same timeframe. Therefore, it is evident that although both groups showed enhanced self-care agency during the intervention, the enhancement observed in the experimental group was significantly greater than that in the control group.

According to the data from the Care Dependency Scale, the mean scores of the control group during the pre-test and post-test were 48.94 ± 6.24 and 58.34 ± 6.83, respectively. Calculating the difference between the mean scores revealed an improvement of 9.40 points in the post-test compared to the pre-test. Pre-test results accounted for 65.25% of the total score, while post-test results increased to 77.79%. Overall, the post-test scores improved by 12.54% compared to the pre-test. Conversely, the mean scores of the experimental group were 52.34 ± 8.06 and 69.84 ± 3.00 during the pre-test and post-test, respectively, with the post-test scores improving by 17.50 points compared to the pre-test. Pre-test results constituted 69.79% of the total score, while post-test results significantly improved to 93.12%. Compared to the pre-test, the post-test showed an overall improvement of 23.33%, indicating a significant enhancement.

This comparison clearly demonstrates that the experimental group showed a significantly greater improvement in scores during the intervention period in terms of care dependency compared to the control group. Further analysis based on the Care Dependency Scale grading standards revealed that the pre-test results of the control group indicated partial dependency, and although there was an improvement in the post-test results, they still remained at the partial dependency stage. In contrast, the experimental group experienced a remarkable change from partial dependency to actual independence post-test after the intervention.

It is noteworthy that while participants in the control group exhibited reduced dependency on care over the two months of daily activities, their post-test results still indicated partial dependency. In contrast, the experimental group achieved a substantial transition from partial dependency to actual independence within the same timeframe through an effective brisk walking intervention. Therefore, it can be confidently concluded that care dependency was reduced in both groups of participants during the intervention, but the reduction observed in the experimental group was significantly greater than that in the control group, highlighting the significant effect of brisk walking as an intervention in reducing care dependency.

Based on the percentage data presented in **Table 1**, it can be observed that in the pre-test phase, the percentage of ESCA scores in the control group was 64.13%, while the percentage of CDS scores was 65.25%. ESCA scores reflect patients' self-care agency, while CDS scores represent the level of dependency on care. However, it is important to note that higher scores actually indicate greater independence of the patients. Thus, these data reveal that in the pre-test phase, patients in the control group possessed 64.13% self-care agency and 65.25% independence, indicating a high degree of congruence between the two in terms of levels. Similarly, in

the experimental group, 67.55% self-care agency and 69.79% independence were observed, demonstrating that self-care agency and independence were at the same level.

By the posttest stage, the control group's self-care agency increased to 74.27%, and correspondingly, the patients' independence increased to 77.79%, once again confirming the coherence between the two. In the experimental group, the patients' self-care agency reached as high as 80.18%, with their independence at 93.12%, indicating a high level of independence and self-care agency among the patients.

In conclusion, both in the pre-test and post-test stages, the patients' self-care agency and independence exhibited a high degree of consistency within the same group, fully demonstrating the complementary and coordinated nature of self-care agency and independence.

Upon careful analysis of the scores of all outcomes as a percentage of the total score, it was observed that even after two months of intervention, participants in both the control and experimental groups still did not reach 100% in terms of self-care agency. There may be multiple factors contributing to this. Firstly, the patient's own factors cannot be ignored, such as age and recovery time after surgery. According to the demographic data of this study, the average age of the control group was 64.41 years old, while that of the intervention group was 61.91 years old, with both groups belonging to the elderly population. Considering the relatively slower rate of physical recovery in the elderly, this may be an important reason why they did not achieve complete self-care even after the two-month intervention. Additionally, postoperative recovery time was also a key factor. The mean time from surgery to pre-test for participants in the control group was 5.59 months, compared to 5.91 months for the experimental group, and both groups had similar mean postoperative recovery times of less than six months before the intervention. Even with the addition of the two-month intervention period, the total recovery period was still less than eight months, which may still be insufficient for some patients to achieve complete self-care. Thus, the relatively short recovery time also contributed to the participant's failure to achieve 100% self-care status.

Table 2. The differences in pre-test and post-test brisk walking self-care agency and care dependency in the two groups group (mean ± SD)

	ESCA		Paired *t*-test		CDS		Paired *t*-test		Evaluation	Decision
	Pre-test	Post-test	*t*	*P*	Pre-test	Post-test	*t*	*P*		
Control	110.31 ± 12.55	127.75 ± 8.87	-10.11	< 0.05	48.94 ± 6.24	58.34 ± 6.83	-13.76	< 0.05	Significant	Reject H_0
Experimental	116.19 ± 13.66	137.91 ± 8.39	-12.03	< 0.05	52.34 ± 8.06	69.84 ± 3.00	-13.55	< 0.05	Significant	Reject H_0

Note: *P*-value ≤ 0.05 = Significant; *P*-value > 0.05 = Insignificant. Abbreviation: ESCA, Exercise Self-Care Agency Scale; CDS, Care Dependency Scale; H_0, null hypothesis.

Table 2 shows whether there are significant differences in pre-test and post-test results of self-care agency and care dependency in the control group and experimental group.

According to the data on the subjects' self-care agency, the mean ± SD of the control group's scores on the pre-test and post-test are 110.31 ± 12.55 and 127.75 ± 8.87, respectively. The *t*-value is -10.11, and since the *P*-value is less than the set level of significance of 0.05, the null hypothesis is rejected; that is, there is a significant difference between the pre-test and post-test. Therefore, it can be concluded that there is a significant difference in the self-care agency of the participants in the control group between the pre-test and post-test. Similarly, for the experimental group, the mean ± SD of the subjects' scores on the pre-test and post-test are 116.19 ± 13.66 and 137.91 ± 8.39, respectively. The *t*-value is -12.03, and again, the null hypothesis is rejected as the *P*-value is less than the 0.05 level of significance. This indicates that there is also a significant difference

in the self-care agency of the participants in the experimental group between the pre-test and post-test.

In addition, according to the ESCA self-care level grading, the control group's self-care agency was moderate in the pre-test and elevated to a high level in the post-test. However, the experimental group demonstrated a high level of self-care in both the pre-test and post-test, showing a high base of self-care. Comparing the results of the control and experimental groups, it is easy to see that both groups showed varying degrees of significant self-care improvement during the intervention period. This suggests that both groups demonstrated significant self-care improvement after the test compared to the pre-test.

However, in an in-depth comparison of the differences between the control and experimental groups in the ESCA scores on the post-test and pre-test, it is found that the control group's post-test scores improved significantly compared to the pre-test scores, with a specific value of 17.44 points. In contrast, the experimental group shows an even more significant improvement, with a 21.72-point increase in their post-test score compared to their pre-test score.

On the other hand, in the ESCA results, according to the percentage of scores, the control group's pre-test results accounted for 64.13% of the total scores, and the post-test results accounted for 74.27% of the scores, with the scores increasing by 10.14% of the total scores. In the experimental group, the pre-test results accounted for 69.79% of the total scores, and the post-test results accounted for 93.12% of the total scores, with an overall increase of 23.33%. This data clearly demonstrates the different levels of improvement in self-care agency between the two groups.

Table 2 demonstrates in detail the differences between the pre-test and post-test results for the control and experimental group participants in terms of care dependency. Specifically, the pre-test mean ± SD of the control group is 48.94 ± 6.24, while the post-test is 58.34 ± 6.83. After statistical analysis, the *t*-value is -13.76, and the null hypothesis that there is no significant difference between the pre-test and the post-test is rejected because the *P*-value is less than the set significance level of 0.05. This result indicates that the level of care dependency in the control group significantly decreased after the intervention.

Similarly, for the experimental group, the pre-test mean ± SD is 52.34 ± 8.06, which improves to 69.84 ± 3.00 in the post-test. After statistical analysis, the *t*-value is -13.55, and the null hypothesis is again rejected because the *P*-value is less than 0.05. This indicates that there is a significant difference in the level of care dependency of the participants in the experimental group between the pre-test and post-test.

In conclusion, both the control and experimental groups showed significant improvements in their care dependency levels in the post-test, demonstrating the effectiveness of the intervention. According to the CDS care dependency level grading scale, the control group showed partial dependency in the pre-test, and although care dependency decreased in the post-test, it remained in the category of partial dependency. Comparatively, the experimental group was also in a state of partial dependency in the pre-test, but after the intervention, it reached a state of actual independence in the post-test.

By comparing the results of the control group with those of the experimental group, it is clear that both groups showed a trend of decreasing care dependency during the intervention. However, the experimental group achieved a shift to a state of complete independence, unlike the control group, which remained partially dependent in the post-test. Further analysis of the differences between the post-test and pre-test data of the two groups showed that the control group's care dependency score improved by 9.40 points, while the experimental group's score improved by 17.50 points. This significant difference highlights the more substantial results of the experimental group in reducing care dependency.

In the CDS results, the control group had 65.25% of the total scores in the pre-test and 77.79% in the post-test, an overall improvement of 12.54%. In contrast, the experimental group had 69.79% of the total scores

in the pre-test and 93.12% in the post-test, an overall improvement of 23.33%. These data clearly reflect the different degrees of improvement in care dependency between the two groups, emphasizing the positive effects of the brisk walking intervention in reducing care dependency.

From the above analysis, it is evident that after two months of intervention, participants in both the experimental and control groups made progress in their self-care agency. This progress can be attributed to the combined effects of time and the intervention. With the passage of time and the participants' adaptation to their stoma, the control group showed a slight improvement in self-care agency. This indicates that time and daily activities positively impact self-care to some extent, and the longer the postoperative period, the better the adaptation to the stoma. However, the relatively small improvement in the control group compared to the experimental group suggests that the two-month intervention had a more significant effect on the experimental group.

For the experimental group, participants' knowledge of self-care agency significantly improved after the two-month brisk walking intervention. Brisk walking, as a simple and effective form of exercise, not only helps improve patients' limb strength and function but also boosts their self-confidence and motivation. Through the brisk walking intervention, patients in the experimental group focused more on physical activity and health care in their daily lives, thus enhancing their self-care agency. In summary, the two-month intervention resulted in more significant progress in the self-care agency for the experimental group, highlighting the relevance and effectiveness of the brisk walking intervention.

Regarding care dependency, the CDS data analysis showed a reassuring trend toward lower care dependency in the post-test for both the control and experimental groups. Higher care dependency scores in this context reflect greater independence, indicating that patients are less dependent on external care. The experimental group showed significantly greater reductions in care dependency compared to the control group, a truly impressive difference.

Overall, the intervention led to a reduction in care dependency, which is a natural consequence of time, patient self-adaptation, and the positive effects of the intervention. While the control group showed reduced care dependency over the two-month adaptation period, they may still require considerable external support and assistance. In contrast, participants in the experimental group achieved almost complete independence through brisk walking exercises. The two months of brisk walking not only improved their physical mobility but also helped them reduce their care dependency, enabling them to be more independent in their daily activities.

However, despite the two months of brisk walking intervention and adaptation, participants in both groups did not achieve full self-care and independence. This is mainly attributed to the age of the participants and the length of recovery after stoma surgery. The demographic information indicates that the majority of patients in both groups were elderly, with a relatively slow rate of recovery. Additionally, the average postoperative recovery time for both groups was just under six months, making it difficult to achieve full independence in such a short period. Therefore, participants in both groups did not achieve 100% independence and self-care after the intervention.

Table 3. The differences in self-care agency and care dependency among stoma participants between the two groups in terms of pre-test and post-test

	Pre-test		Independent t-test		Evaluation	Decision	Post-test		Independent t-test		Evaluation	Decision
	Control	Experimental					Control	Experimental				
	M±SD		t	P			M ± SD		t	P		
ESCA	110.31 ± 12.55	116.19 ± 13.66	1.79	> 0.05	Insignificant	Accept H_0	127.75 ± 8.87	137.91 ± 8.39	4.71	< 0.05	Significant	Reject H_0
CDS	48.94 ± 6.24	52.34 ± 8.06	1.89	> 0.05	Insignificant	Accept H_0	58.34 ± 6.83	69.84 ± 3.00	8.73	< 0.05	Significant	Reject H_0

Note: P-value ≤ 0.05 = Significant; P-value > 0.05 = Insignificant. Abbreviation: ESCA, Exercise Self-Care Agency Scale; CDS, Care Dependency Scale; H_0, null hypothesis.

Table 3 shows the results of self-care agency and care dependency for the experimental and control groups in the pre-test and post-test, respectively.

Regarding self-care agency, an independent *t*-test conducted at the pre-test stage showed no significant difference between the self-care agency of patients in the control group and the experimental group. Specifically, the null hypothesis is accepted as the *P*-value is greater than the set significance level of 0.05, and the *t*-value is 1.79. This data suggests that the level of self-care in the control group and the experimental group is roughly equivalent before the intervention is implemented, and there is no significant difference. Further observations reveal that participants in the control group had a moderate level of self-care on the pre-test, while the experimental group had a high level of self-care. Although the two groups differed in their pre-test levels of self-care agency, the difference is only 5.88, and statistical analyses show that this difference is not significant.

Furthermore, based on the detailed calculation of the percentage of scores, we found that the ESCA control group's results in the pre-test accounted for 64.13% of the total score, while the experimental group's results accounted for 67.55%. The difference between the two is not significant at 3.42%. This suggests that the baseline levels of the two groups were relatively close to each other before the start of the intervention. This result is most likely due to the fact that the mean age of the patients in the control and experimental groups was extremely similar, reaching 64.41 and 61.91 years, respectively, and also that the postoperative recovery time was approximately the same for both groups, 5.59 and 5.91 months, respectively. These similarities may have allowed them to demonstrate similar levels of self-care agency in the pre-test phase. Therefore, it can be assumed that the control and experimental groups had essentially the same level of self-care agency before the intervention.

However, in the post-test, the post-intervention scores were analyzed in depth again using the independent *t*-test. This time, the result shows that there is a significant difference between the self-care agency of the patients in the control and experimental groups. Specifically, the null hypothesis is rejected as the *P*-value is less than the set significance level of 0.05, and the *t*-value is 4.71. Further analysis reveals that according to the level of self-care agency, both the control group and the experimental group showed a high level of self-care agency in the post-test, but the difference between the two groups reached 10.16. Similarly, according to the exact calculation of the percentage of scores, the results of the ESCA control group in the post-test accounted for 74.27% of the total scores, while the percentage of the experimental group increased to 80.18%. The gap between the two groups widened to 5.91% when compared to the pre-test. This indicates that after the intervention, the experimental group's self-care agency was more significantly improved.

This difference mainly stems from the fact that in the post-test, the control group only performed normal activities, while the experimental group additionally performed brisk walking exercises, resulting in a relatively greater increase in self-care agency in the experimental group. This data clearly demonstrates that the post-test results indicate a significant difference between the control group's and the experimental group's self-care agency. This change fully demonstrates the positive effect of the intervention in improving patients' self-care agency, especially since the effectiveness of the brisk walking intervention in the experimental group in improving patients' self-care agency has been verified.

Table 3 also shows the differences between the experimental and control groups of stoma patients in terms of care dependency in the pre-test and post-test results. In the pre-test, the mean CDS scores of the patients' experimental and control groups are statistically analyzed by an independent *t*-test. Specifically, as the *P*-value is greater than the set significance level of 0.05, the null hypothesis is accepted, with a *t*-value of 1.89. This suggests that the level of care dependency between the control group and the experimental group is roughly comparable before the intervention is implemented, with no significant difference. Further observations reveal

that the pre-test care dependency of the participants in the control group is at the level of partial dependency, as well as the experimental group, and the difference is only 3.40 points.

By comparing the percentage data, we observed that the percentage of nursing dependence at pre-test was 65.25% and 69.79% for the control and experimental groups, respectively. The difference between the two groups is only 4.54%, indicating that the level of nursing dependency was relatively close for both groups before the start of the intervention. Therefore, it can be assumed that there is no significant difference between the two groups. This may be because both groups were roughly the same age and postoperative time. Since the statistical analyses reveal that the difference is not significant and the level of care dependency is at a partial dependency level in both groups, it can be firmly concluded that the control and experimental groups had essentially the same level of care dependency before the intervention.

However, in the post-test, the post-intervention scores are analyzed in depth by applying the independent samples t-test again. This time, the results show that there is a significant difference in care dependency between the control and experimental group of patients. Specifically, the original hypothesis is rejected as the P-value is less than the set significance level of 0.05 and the t-value is 4.71. By comparing the percentage data, we found that the percentage of nursing dependence at the post-test was 77.79% and 93.12% for the control and experimental groups, respectively. The difference between the two groups reached 15.33%, indicating that after the intervention, the experimental group made more significant progress in reducing nursing dependence compared to the control group. Therefore, it can be assumed that there is a significant difference between the two groups.

Further analysis reveals that according to the level of care dependency, both the control and experimental groups showed higher scores in the post-test implying lower care dependency, and the difference between the two groups amounted to 10.50. This data clearly indicates that in the post-test results, there was a significant difference in care dependency between the control group and the experimental group. This change shows the positive effect of the intervention in reducing patients' nursing care dependence and particularly verifies the effectiveness of the brisk walking intervention in the experimental group in reducing patients' nursing care dependence.

After an in-depth analysis of the data, it was found that in the pre-test, the two groups of patients had comparable levels of self-care competence with no significant differences. However, in the post-test results, the two groups demonstrated a significant difference in self-care agency. The key to this change is that the patients in the experimental group received a two-month intervention of brisk walking activity. As a form of aerobic exercise, brisk walking not only enhances muscle strength and body coordination but also promotes metabolism, which has a significant positive effect on the rehabilitation of stoma patients. Therefore, in the post-test, the physical condition of the patients in the experimental group was significantly improved. They became more comfortable coping with the demands of daily life and were able to independently complete more activities necessary for daily living. In conclusion, the brisk walking intervention, as an efficient means of enhancing self-care agency, had a positive effect on the rehabilitation process of stoma patients.

Additionally, when comparing the care dependency data of the experimental and control groups, it was found that although the level of care dependency in the control group was slightly lower than that in the experimental group in the pre-test, data analysis showed that this difference was not significant. However, in the post-test, the experimental group's care dependency score was significantly higher than that of the control group, indicating that a significant difference in the level of care dependency between the two groups emerged. The results on self-care agency and care dependency further corroborate this view: before the intervention, the self-care agency and care dependency levels of the control group and the experimental group were roughly

equal; however, after the intervention, the experimental group not only achieved a significant improvement in self-care agency but also a significant reduction in care dependency through the brisk walking activity. This fully indicates that the brisk walking intervention has a significant and beneficial effect on reducing patients' nursing dependence and improving their self-care agency.

4. Discussion

The effectiveness of brisk walking on patients' self-care competence and dependence on care was evident. Through brisk walking exercise, patients not only improved their physical fitness and endurance but also enhanced their self-confidence and self-efficacy, leading to more active participation in self-care practices. This accumulation of practical experience further enhanced patients' self-care agency, creating a virtuous cycle that ultimately reduced dependence on external care.

The results of this study are highly compatible with Orem's self-care theory. Orem's theory emphasizes the autonomy and responsibility of the individual in the nursing process and advocates achieving optimal health through the enhancement of self-care agency. The brisk walking intervention, as an effective self-care modality, is a concrete practice under this theoretical framework. Through brisk walking, patients can actively manage their health, reduce their dependence on others, and achieve the goals of personal independence and self-actualization.

Additionally, according to the core requirements of the self-care theory, this study not only focuses on the improvement of patients' self-care agency but also the effect of its application in real life. For example, this study primarily assessed participants' universal self-care requisites, particularly those critical to maintaining basic life activities. By assessing the change in patients' nursing care dependence level after the brisk walking intervention, this study verified the strong link between self-care agency and actual nursing care needs. This result provides empirical support for self-care theory and a useful reference for future nursing practice.

The purpose of this study was to provide a comprehensive and intensive assessment of participants' performance in three areas: self-care theory, self-care deficit theory, and systems of care theory. Using the ESCA and CDS scales, this study systematically examined participants' specifics in universal self-care requirements, developmental self-care requirements, and self-care requirements in a state of health deviation.

More notably, this study validated the important role that self-care agency plays in reducing care dependency through the implementation of a brisk walking intervention. This finding is highly compatible with Orem's self-care theory, further demonstrating the validity and usefulness of self-care theory in guiding nursing practice.

The results of this study not only enrich the connotation of self-care theory and provide new perspectives and ideas for future theoretical research, but they also provide practical guidance for improving patients' self-care agency and reducing care dependence.

According to a study [20], patients' physical and mental health tends to deteriorate most rapidly in the month following discharge from the hospital. However, this gradually improves over the next six months. The reason for this change is that patients need time to adapt to new physiological functions and cope with the difficulties associated with the transitional phase of stoma surgery, a time when they are at a physical, social, and emotional low. Further analysis revealed that patients' marital status, income, and level of education play decisive roles in their physical and mental health. In addition, patients with colorectal cancer and stoma who have a shorter recovery time from surgery are at risk of reduced physical activity, which also deserves attention and focus [21]. When patients and families first encounter a stoma, they often view it as a disorder that compromises the body's

integrity, making it difficult to accept initially. This psychological stress is often more severe than the actual impact of the disease itself. As a result, the postoperative stoma becomes a major challenge for the patient. However, over time, patients become less dependent on their body's function and more tolerant of their stoma. They are more willing to take ownership of their self-care responsibilities with the support of their families, doctors, and nurses. The longer the postoperative recovery time, the more adaptable the patients become, and their ability to take care of themselves gradually improves. Similarly, patients in the control group demonstrated better self-care abilities [22].

There was a negative correlation between self-care agency and nursing dependence. Some patients rapidly acquired self-care agency after surgery, significantly reducing their nursing dependence. Other patients, for various reasons, were slower to improve their self-care agency, making them more dependent on care and needing more external support and help [23]. For stoma patients, nursing dependence is essential in the early postoperative period. However, over time, patients should gradually learn to care for themselves and become less dependent on external care. In the early postoperative period, patients with persistent colorectal stoma face multiple pressures. They not only have to cope with physical discomfort but also face psychological challenges such as anxiety and depression [24]. These stresses affect the recovery process and may also aggravate their nursing dependence. Therefore, the psychological state of patients also affects nursing dependence. In addition, family members play an important role in the recovery process. They are not only the main caregivers but also an important source of psychological support for patients [25].

In China's newly released stoma family life guidelines, it is specifically recommended that permanent stoma patients try to adopt brisk walking as a means of rehabilitation [26]. The rationale behind this recommendation is based on the remarkable effectiveness of outdoor exercises such as brisk walking in providing mindfulness and stress relief. The results of another study showed that aerobic exercise, especially brisk walking, is widely recognized as one of the most effective ways to improve physical endurance and flexibility [9]. Through brisk walking, patients can not only enhance their physical fitness but also gradually adapt to living with a stoma in a relaxing and pleasant atmosphere. By maintaining brisk walking, patients can maintain a good state of health, prevent chronic diseases and their complications, and thus reduce their dependence on nursing care. For those suffering from colorectal cancer in particular, moderate aerobic activity can be pivotal to their recovery process. According to a study, engaging in more recreational physical activity, receiving longer, light to moderate-intensity aerobic workouts, and any high-intensity aerobic physical activity were strongly associated with improved survival rates [27]. Therefore, brisk walking is not only a form of exercise but also an important way to improve the quality of survival and accelerate the recovery process of colorectal cancer patients.

Brisk walking can contribute to a patient's reduced dependency on outside care providers by boosting their immunity, physical health, and body endurance and flexibility. Patients who walk actively can minimize their need for medical care because they can avoid some chronic illnesses and their consequences, maintain good physical health, and lessen their physical dependency [28]. According to a study [25], the level of care dependency is higher during the transition period from hospital to home in elderly stoma patients. Effective health interventions by nurses during patients' transitional periods will help reduce dependency on care. Additionally, according to another research report [29], brisk walking can effectively reduce the care dependency of patients after colorectal cancer surgery. The reasons may be: First, brisk walking can accelerate intestinal peristalsis and promote smooth defecation, thereby reducing the occurrence of postoperative constipation and other problems. Secondly, it helps improve the patient's mental health and alleviate negative emotions such as anxiety and depression, thereby improving the patient's self-care agency. In addition, walking can also enhance the patient's

resistance. Through walking, patients can gradually recover their bodies in a relaxed and pleasant atmosphere, enhance their self-confidence, and thus reduce their dependency on nursing care.

The effectiveness of brisk walking on patients' self-care competence and dependence on care was evident. Through brisk walking exercises, patients not only improved their physical fitness and endurance but also enhanced their self-confidence and self-efficacy, which led to more active participation in self-care practices. This accumulation of practical experience further enhanced patients' self-care agency, creating a virtuous cycle that ultimately reduced dependence on external care.

The results of this study are highly compatible with Orem's self-care theory. Orem's theory emphasizes the autonomy and responsibility of the individual in the nursing process and advocates achieving optimal health through the enhancement of self-care agency. The brisk walking intervention, as an effective self-care modality, is a concrete practice under this theoretical framework. Through brisk walking, patients can actively manage their health, reduce their dependence on others, and achieve the goals of personal independence and self-actualization.

Additionally, according to the core requirements of the self-care theory, this study not only focuses on the improvement of patients' self-care agency but also its application in real life. By assessing the change in patients' nursing care dependence level after the brisk walking intervention, this study verified the strong link between self-care agency and actual nursing care needs. This result provides empirical support for self-care theory and a useful reference for future nursing practice.

In summary, this study verified the important role of self-care competence in reducing nursing dependence through the brisk walking intervention and fit with Orem's self-care theory. The results of this study not only enriched the connotation of self-care theory but also provided practical guidance for improving patients' self-care agency and reducing nursing dependence.

5. Conclusion

Through the results of this study, it was found that brisk walking can help stoma patients improve self-care and reduce care dependency. A daily 30-minute brisk walking program not only helps patients increase their physical fitness and endurance but also promotes self-care. During brisk walking, patients learn how to take better care of their bodies and how to recognize and respond to health problems that may arise. In addition, the 30-minute daily brisk walking program is highly feasible and sustainable. It does not require special equipment or venues, and patients can flexibly adjust the brisk walking program according to their physical condition and schedule. This simple and easy-to-use exercise makes it easier for patients to stick to it, thus benefiting them in the long run. Furthermore, daily activities such as slow walking and bathing also help patients improve their self-care agency and reduce care dependency. This study also concluded that the age of the patient and the time after surgery were related to the patient's self-care agency and care dependency. For older adults with a shorter postoperative time, self-care agency was lower, and care dependency was higher.

Disclosure statement

The authors declare that they have no conflict of interest.

References

[1]   Karlsson E, Farahnak P, Franzén E, et al., 2019, Feasibility of Preoperative Supervised Home-Based Exercise

in Older Adults Undergoing Colorectal Cancer Surgery – A Randomized Controlled Design. PLoS One, 14(7): e0219158. https://doi.org/10.1371/journal.pone.0219158

[2] Liu Z, Li Z, Zhang Y, et al., 2021, Interpretation on the Report of Global Cancer Statistics 2020. Journal of Multidisciplinary Cancer Management (Electronic Version), 7(2): 1–14.

[3] Jia S, 2022, Mortality Trend Analysis and Prediction of Gastrointestinal Cancer in China from 2005 to 2020, thesis, Zhengzhou University.

[4] Sung H, Ferlay J, Siegel RL, et al., 2021, Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA: A Cancer Journal for Clinicians, 71(3): 209–249. https://doi.org/10.3322/caac.21660

[5] Hong Z, Zhao X, Wang C, 2022, Current Status of Colorectal Cancer Screening. Journal of Dalian Medical University, 44(6): 534–538.

[6] Zhao T, Wang Z, Cui X, et al., 2023, Nursing Care of a Patient with Anastomotic Leakage and Distal Stoma Retraction After Rectal Cancer Surgery. Chinese General Practice Nursing, 21(29): 4169–4170.

[7] Beeken RJ, Haviland JS, Taylor C, et al., 2019, Smoking, Alcohol Consumption, Diet and Physical Activity Following Stoma Formation Surgery, Stoma-Related Concerns, and Desire for Lifestyle Advice: A United Kingdom Survey. BMC Public Health, 19: 574. https://doi.org/10.1186/s12889-019-6913-z

[8] Lei W, Yue Y, 2024, Analysis of Influencing Factors of Cancer-Related Fatigue in Patients with Enterostomy. Tianjin Journal of Nursing, 32(1): 27–31.

[9] Xu H, 2019, The Current Status of Physical Activity in Colorectal Cancer Patients with Stoma and the Analysis of Impact Factors, thesis, Henan University.

[10] Yang X, Feng F, Zhu M, et al., 2023, A Cross-Lagged Analysis of Daily Activity Ability and Cognition in the Elderly. Journal of Jinzhou Medical University, 44(3): 93–96.

[11] Saunders S, Brunet J, 2019, A Qualitative Study Exploring What It Takes to be Physically Active with a Stoma After Surgery for Rectal Cancer. Supportive Care in Cancer, 27(4): 1481–1489. https://doi.org/10.1007/s00520-018-4516-3

[12] Chen C, 2022, Application Effect of Five Element Music Therapy Combined with 6 Minute Walking Test in Perioperative Accelerated Rehabilitation Surgical Nursing of Rectal Cancer Patients. Journal of General Surgery for Clinicians (Electronic Version), 10(2): 81–83.

[13] Shi H, Jia F, Fang F, 2022, Nursing-Dependent Present Status of Senior Patients with Stoma in Catagen for Discharged, and the Fators Influencing the Status. Chinese Journal of Coloproctology, 42(11): 61–63.

[14] Krishnan P, 2019, A Review of the Non-Equivalent Control Group Post-Test-Only Design. Nurse Researcher, 26(2): 37–40. https://doi.org/10.7748/nr.2018.e1582

[15] Ball M, 2021, Mental Health Delivery Method Outcomes for the Postsecondary Student: A Quantitative Quasi-Experimental, Non-Equivalent Control Group Pretest-Posttest Study, thesis, Liberty University.

[16] Yang H, Wang X, Chen D, 2023, Qualitative Study on Stigma Among Patients with Rectal Cancer and Permanent Enterostomy. Modern Nurse, 30(11): 114–118.

[17] Ma Q, Shan S, 2024, Qualitative Study on the Home Care Needs of Elderly Colorectal Cancer Patients with Permanent Enterostomy. Modern Nurse, 31(1): 131–134.

[18] Lee L, 2021, Utility of the Care Dependency Scale in Predicting Care Needs of Elderly Patients Admitted to A Geriatric Unit, thesis, Soochow University.

[19] Carter E, 2020, The Impact of the Exercise of Self-Care Agency and Compassion Satisfaction on the Professional Social Worker, thesis, Walden University.

[20] Han J, 2022, Care Dependency Development Trajectory and Intervention of Elderly Patients with Comorbidities Undergoing Elective Surgery, thesis, Jiangsu University.

[21] Lin J, Chen Q, Chen J, et al., 2021, Analysis of the Correlation between Stoma Self-Care Ability and Physical Activity Status of Patients After Radical Resection of Colorectal Cancer. Journal of Qilu Nursing, 27(16): 28–31.

[22] Yu Z, Zhu X, Wei D, et al., 2023, Meta-Analysis of Factors Influencing Discharge Readiness of Enterostomy Patients. Nursing Practice and Research, 20(23): 3542–3550.

[23] Zheng X, Zhang X, Gao J, et al., 2020, The Status of Care Dependency in Patients with Enterostomy during the Post-discharge Transition Period and Its Influencing Factors. Nursing Journal of Chinese People's Liberation Army, 37(6): 24–27.

[24] Zhang L, Hu K, Pu Y, et al., 2023, Research Progress of Nursing Dependence Related Scale in Chronic Diseases. Modern Nurse, 30(1): 21–25.

[25] Du S, Zheng W, Zhai Q, et al., 2022, Construction and Application of Transitional Care Plan for Elderly Patients with Permanent Enterostomy. Journal of Nursing, 37(18): 25–28.

[26] Bai B, 2023, How to Minimize the Impact of an Ostomy on Your Daily Life [Personal Communication]. Family Living Guide, 2023(11): 183–184.

[27] Brown JC, Ma C, Shi Q, et al., 2022, Physical Activity in Stage III Colon Cancer: CALGB/SWOG 80702 (Alliance). Journal of Clinical Oncology, 41(2): 243–254. https://doi.org/10.1200/JCO.22.00171.

[28] Lee HS, Park JH, 2015, Effects of Nordic Walking on Physical Functions and Depression in Frail People Aged 70 Years and Above. Journal of Physical Therapy Science, 27(8): 2453–2456. https://doi.org/10.1589/jpts.27.2453

[29] Wang J, 2021, Influence of Aerobic Exercise on the Cancer-Related Fatigue and Quality of Life in Colorectal Cancer Patients Undergoing Postoperative Adjuvant Chemotherapy. Chinese Journal of Coloproctology, 41(8): 57–59.