SIN-CHN SCIENTIFIC PRESS PTE.LTD.

Molecular & Cellular Biomechanics 2024, 21(4), 353.
https://doi.org/10.62617/mcb353

Article

A qualitative study of the perioperative exercise experience in elderly colorectal cancer patients with sarcopenia

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CITATION

Yang J, Fu G, Zhang X, et al. A qualitative study of the perioperative exercise experience in elderly colorectal cancer patients with sarcopenia. Molecular & Cellular Biomechanics. 2024; 21(4): 353. https://doi.org/10.62617/mcb353

ARTICLE INFO

Received: 11 September 2024
Accepted: 23 September 2024
Available online: 31 December 2024

Abstract: Objective: To understand the needs and characteristics of elderly colorectal cancer patients with sarcopenia for perioperative exercise rehabilitation, to develop an interview outline, and to analyze the facilitators and barriers to perioperative exercise, feasibility, acceptability, and implementability of perioperative exercise in elderly colorectal cancer patients with sarcopenia by means of qualitative interview, with the aim of providing theoretical basis for the guidance of perioperative exercise for elderly colorectal cancer patients with sarcopenia. **Methods:** A phenomenological research method was used to conduct semi-structured interviews with 15 perioperative exercisers of elderly colorectal cancer patients with sarcopenia, and the results of the interviews were analyzed using the Colaizzi seven-step analysis method. **Results:** The perioperative exercise experience of elderly colorectal cancer patients with sarcopenia encompasses 4 core elements:(1) the presence of intricate negative physical and psychological experiences. (2) Fear of limiting physical activity. (3) Anticipation of regaining health. (4) Desire for effective social support. **Conclusion:** The 4 core factors of perioperative exercise in elderly colorectal cancer patients with sarcopenia are expected to provide new insights into the development of perioperative exercise programs for elderly colorectal cancer patients with sarcopenia. The relationship between elderly patients with colorectal cancer muscle atrophy and biology is mainly reflected in the following aspects: (1) Inflammatory response and muscle atrophy: Colorectal cancer patients often experience systemic inflammatory response, which can trigger a series of changes in anorexia, metabolism, and neuroendocrine system, thereby activating muscle protein breakdown and leading to the occurrence of muscle atrophy. High levels of pro-inflammatory cytokines such as TNF - α and IL-1 β are significantly correlated with the occurrence of sarcopenia, while IL-6 levels show a positive correlation with the occurrence of sarcopenia. (2) Imbalance between protein synthesis and breakdown: In the tumor state, the protein breakdown system in skeletal muscle cells is activated and closely related to the ubiquitin proteasome system (UPS) and calpain. The muscle specific E3 ubiquitin ligase expression of UPS in cancer patients' muscles increases, leading to muscle protein breakdown and promoting muscle atrophy. (3) Autophagy: Autophagy is a normal physiological process in which cells break down unnecessary or dysfunctional organelles. In cancer patients, tumor cells can utilize autophagy to survive in nutrient deficient environments. Autophagy plays an important role in the dynamic balance of muscles. The FOXO transcription factor family participates in immune related regulation such as cell cycle arrest and apoptosis through various signaling pathways, inducing increased gene expression for muscle autophagy degradation, leading to the occurrence of sarcopenia. (4) Gut microbiota and its metabolites: High levels of Clostridium difficile, Escherichia coli, and Streptococcus pyogenes can be detected in the tumor tissues of colorectal cancer patients, while the number of protective bacteria, including Roche, Clostridium, and Bifidobacterium, is significantly reduced. The changes in gut microbiota may affect muscle quality by influencing the

expression of genes related to muscle protein synthesis. (5) Individual differences and protein intake: The muscle mass changes of colorectal cancer patients show significant individual differences, indicating that the relationship between protein intake and muscle mass is not simply a linear correlation, but is influenced by multiple factors working together. The degree of inflammatory response plays a key role in this process, and CRC patients with high levels of chronic inflammatory markers (such as C-reactive protein, IL-6, etc.) have a poorer response to additional protein intake and are more prone to muscle atrophy. These biological factors work together to affect the muscle mass and function of elderly colorectal cancer patients, which is closely related to the occurrence and development of sarcopenia.

Keywords: elderly; colorectal cancer; sarcopenia; perioperative period; exercise experience; qualitative study; biomechanics

1. Current status of sarcopenia in elderly patients with colorectal cancer

Colorectal cancer is one of the common malignant tumors, and its incidence and mortality rates rank the 3rd and 2nd among malignant tumors, respectively [1], causing nearly 900,000 deaths each year [2]. Surgery is one of the main treatment modalities for colorectal cancer patients, but patients often have decreased physiological and/or psychological reserve capacity before surgery due to various reasons, such as digestive and absorption disorders, tumor consumption, and psychological shock caused by the disease, etc. When coping with surgery, which is a strong source of stress, the adaptive capacity of the body is weakened, and it is prone to severe and persistent stress reaction, which in turn affects the clinical prognosis [3]. Compared with younger patients, elderly colorectal cancer patients have an increased risk of complications after surgery, which may be related to factors such as the decline in the functional reserve of vital organs in elderly patients [4]. Current status of sarcopenia in elderly colorectal cancer patients.

Sarcopenia (referred to as sarcopenia) is a syndrome of generalized progressive, widespread reduction in skeletal muscle mass or muscle strength and reduced physiological function, which is associated with an increased risk of falls, fractures and death [5]. Findings have shown that sarcopenia is not only associated with aging, but also with diseases such as tumors [6]. Patients with colorectal cancer have a high prevalence of sarcopenia, and their preoperative prevalence of sarcopenia ranges from 15% to 60% [7,8]. Myasthenia gravis reduces an individual's quality of life while imposing a heavy medical burden on society [9]. Elderly patients with sarcopenia have five times the medical cost of non-sarcopenic patients and require long-term care, which will consume a large amount of medical resources and increase the burden on families and society, and has become a health problem that cannot be ignored. In an aging population, sarcopenia has become an important threat and burden [10,11]. And studies have shown that exercise combined with high protein nutrition improves muscle strength, muscle mass and somatic function and reduces the incidence of sarcopenia in colorectal cancer patients. Physical activity is negatively associated with the risk of sarcopenia, and substantial and more significant sarcopenia prevention benefits can be obtained by increasing the amount of physical activity [1]. Improvement of sarcopenia has an advantageous role in perioperative exercise rehabilitation for elderly colorectal cancer patients Perioperative nursing refers to the

provision of whole, holistic care for patients in the process that begins when surgical treatment is determined and ends basically when post-surgical treatment is completed [12], which, as an essential element in the medical and healthcare system, is closely related to patients' postoperative recovery [13]. Studies have pointed out [14] that quality perioperative care is beneficial to increase the cure rate of patients' diseases, reduce complications, and improve their hospitalization experience [15]. Therefore, perioperative care should also keep pace with the times and dare to break through the traditional nursing model in order to adapt to the new test under the change of medical model and fully demonstrate the professional value of the nursing discipline in formulating the movement model, and based on the fact that perioperative exercise rehabilitation for elderly patients with colorectal cancer has an advantageous role, it is one of the hot issues to be explored by clinical caregivers.

2. Objects and methods

2.1 Research object

In this study, the purposive sampling method was used to select elderly patients with colorectal sarcopenia from a tertiary hospital in the Guangxi Zhuang Autonomous Region. The inclusion criteria were as follows:(1) Age ≥ 60 years old, (2) Colorectal cancer confirmed by pathological examination, (3) Compliance with the diagnostic criteria of sarcopenia: ① Grip strength: male < 28 kg, female < 18 kg; ② 6m walking speed > 1.0 m/s; ③ L3-SMI: male < 50 cm^2/cm^2, female < 39 cm^2/cm^2; Compliance with the condition (3) and fulfillment of the condition ① and/or condition ②; (4) The patients do not have a regular exercise habit; (5) The patients have no regular exercise habit; (6) The patients are willing to participate in this study. The patients voluntarily participated in this study and signed the informed consent; (7) They were conscious and had the ability to express themselves verbally. The exclusion criteria were as follows: those who suffered from mental, physical, psychological and other diseases could not cooperate with the interview. The sample size was based on information saturation. Fifteen elderly patients with colorectal cancer myasthenia gravis were finally included. The general information is shown in **Table 1**.

Table 1. General information about the study population.

No.	Sex	Age	Education	profession	exercise habit or not	chemotherapy or not	typology	calf circumference (cm)	debilitation scale score	myasthenia gravis scale score
1	Male	60	Primary	retirement	Yes	Not	pT4aN2bM0IIIC	31	3	3
2	Female	84	Primary	retirement	Yes	Not	Colon Cancer T3	30	4	5
3	Male	62	junior high school	farmer	Yes	Yes	CT4Bn2Mx	32	4	1
4	Male	63	Primary	retirement	Yes	Yes	CT4Bn2Mx	33	3	3
5	Female	73	high school	retirement	Yes	Yes	T3Bn2Mx	30	4	3
6	Female	68	junior high school	retirement	Not	Yes	pT4bNxM1cIV	30	3	2
7	Male	62	junior high school	retirement	Yes	Not	pT3N0M0IIA	32	3	2

Table 1. (*Continued*).

No.	Sex	Age	Education	profession	exercise habit or not	chemotherapy or not	typology	calf circumference (cm)	debilitation scale score	myasthenia gravis scale score
8	Male	73	Primary	retirement	Yes	Not	CT4Bn2Mx	33	4	2
9	Male	71	junior high school	retirement	Yes	Not	T3Bn2Mx	31	3	2
10	Male	60	junior high school	retirement	Yes	Not	Pt2N0M0I	32	2	2
11	Male	78	junior high school	retirement	Yes	Yes	PT4N0M1 IV	33	4	3
12	Female	60	Primary	farmer	Yes	Yes	CT4N2Mx	33	3	2
13	Male	73	Primary	retirement	Yes	Not	ypT3N1bM1aIVa	33	3	0
14	Male	68	Primary	retirement	Yes	Yes	PT4N0M1 IV	32	5	4
15	Male	67	junior high school	retirement	Not	Not	pT4bNxM1cIV	33	4	3

2.2. Research methods

One-to-one semi-structured interviews were used to collect data. The interviews were conducted by the researcher based on the interview outline. The duration of the interviews with the study participants was controlled to be about 20–40 min each time. Before the interview, the researcher distributed the exercise intervention program to the subjects and explained its content, informed the subjects of the main content of the interview, explained the purpose of the study to the subjects before the interview to understand the subjects' exercise compliance and the content of the intervention that needed to be adjusted, and promised to keep all the content of the interview confidential, and carried out the interview after the subjects had given informed consent.

2.2.1. Developing an interview outline

Interview outlines were developed through literature review and research team discussion The research team included experts in colorectal cancer nursing, geriatric nursing, and rehabilitation nursing to ensure that the interview outlines were as comprehensive and easy to understand as possible. After the interview outline was determined, two elderly colorectal cancer patients with sarcopenia were first pre-interviewed, and the interview outline was revised according to the pre-interview, and the finalized interview outline is as follows:

① What is your understanding of debilitation and sarcopenia?

② What changes have occurred in you physically and psychologically after your illness?

③ What changes have occurred in your life as you have gotten older and sicker?

④ Can you describe what you experienced about immediate surgery? What are your experiences with debilitation and sarcopenia in relation to immediate surgery?

⑤ What are your thoughts on exercise prior to surgery? How will sarcopenia affect you? Why?

⑥ What is your opinion about how exercise before surgery affects you? Why?

⑦ What do you think are the factors that promote your exercise? What are the factors that prevent you from exercising?

⑧ How do you solve these problems when faced with them? What kind of help do you need?

2.2.2. Methods of data collection

This study was conducted in a tertiary hospital in the Guangxi Zhuang Autonomous Region from July to September 2024. The researcher established contact with the patients who met the inclusion criteria, and after obtaining the informed consent of the research subjects, the researcher conducted face-to-face in-depth interviews with the interviewees, and agreed on the time of the interviews with the interviewees prior to the interviews, and chose a place with a quiet environment and no external disturbances as the location of the interviews. Before the formal interview, after obtaining the consent of the interviewee, the whole interview process was recorded, supplemented by notes, and the interview lasted 20~40 min.

2.2.3. Methods of data analysis

After the interviews were completed, they were transcribed verbatim by the researcher on the same day and analyzed using the Colaizzi seven-step analysis method. Themes and subthemes distilled.

2.3. Quality control

Before the formal interview, the researcher systematically studied the qualitative research course to master the content and methods of qualitative research. During the interview, in order to ensure the authenticity of the collected information, the researcher should avoid exerting any inducement and pressure on the research subject to mix the researcher's opinion with the subject's viewpoint. Reflect and record at the end of the interview, collect the confusion that arises in the notebook and then seek better interview techniques by reading and thinking many times. Data analysis stage, the researcher retains the information of the interviewees' language, movement, and demeanor while organizing and analyzing the data and recording it in the text data.

3. Results

3.1. Theme 1 Presence of intricate negative physical and mental experiences.

The patient said that due to factors such as disease consumption and age, he gradually lost weight and developed anxiety. The specific interview content is shown in **Table 2**.

Table 2. Presence of intricate negative physical and mental experiences.

Subtheme 1: Anxiety triggered by somatic changes
Patients reported gradual physical wasting and anxiety due to disease wasting and age.
Patient 2: Physical loss of appetite after illness, affecting life, unable to cook for himself, psychologically unhappy, blaming his lack of attention to food for his current illness.
Patient 3: Physical weight loss, psychological fear and despair.

Table 2. (*Continued*).

Sub-theme 2: Lack of self-acceptance A number of patients reported a lack of self-acceptance and low self-esteem in the wake of their illness, as they needed to be cared for by their families and were worried about involving their families.
Patient 6: I can still help my daughter with the kids, I can help her cook, and when I am sick it feels like she is the one taking care of me. Patient 7: I often feel lonely, irritable, and lack self-esteem. Patient 10: The psychological burden has become heavier, and I cannot take care of my children instead of dragging them down.
Subtheme 3: Concerns about Surgical Recovery Several patients expressed concern about postoperative recovery due to the unknown prognosis of the surgery.
Patient 11: Immediate surgery makes me feel fearful, afraid of poor recovery after surgery, afraid of lying in the hospital bed and suffering after surgery. Patient 15: The psychological burden is heavier than before I got sick, fearing that I will lose my money and drag my family down.

3.2. Theme 2 fear of limiting physical activity

Patients generally believe that their current muscle mass, muscle strength and muscle function have been reduced and they are unable to support exercise, thus avoiding rehabilitation exercises. The specific interview content is shown in **Table 3**.

Table 3. Fear of limiting physical activity.

Subtheme 1: Lack of strength for independent activities Patients commonly avoid rehabilitation exercises because they perceive a current reduction in muscle mass, muscle strength and muscle function and an inability to support movement.
Patient 14: Age and illness have weakened my body, which has led to a reduction in all my social event activities.
Sub-theme 2: Worry about falling Some patients avoid rehabilitation exercises for fear of falling, which appears not only physically debilitating but also psychologically worrisome.
Patient 14: Being sick and becoming weak, exercise workouts may cause me to have accidents during exercise workouts. Patient 15: Myasthenia gravis increases my likelihood of falling.
Subtheme 3: Disease deterioration Due to a lack of knowledge about the disease, patients appear to have a one-sided understanding of the disease.
Patient 13: I'm afraid that the surgery will make the sarcopenia worse. Patient 5: I'm afraid to move, I'm afraid the disease will get worse.

3.3. Theme 3 expectations of regaining health

Table 4. Expectations of regaining health.

Subtheme 1: Surgery to regain hope Patients are hopeful about the outcome of the surgery, and despite their fears, they go into the surgery with greater confidence and goodwill.
Patient 8: I will be having surgery soon and I will feel fearful that it will fail, but I want to have it sooner rather than later in case I recover well from the surgery. Patient 11: Exercise before surgery should make the muscles around my joints strong and firm and lessen the effects of sarcopenia.
Subtheme 2: Active exercise for recovery An attitude of actively performing exercise exists in some patients, with confidence in performing rehabilitation exercises in the perioperative period to recover.
Patient 7: Exercise is good for health and can prevent cancer recurrence. Patient 10: Exercise before surgery can promote the body's metabolism, improve my immunity, and also help exercise my lung function, which can help reduce postoperative respiratory infections and facilitate my recovery after surgery.

The patient is full of hope for the effect of the surgery. Despite the fear, he has greater confidence and wishes to undergo the surgery. The specific

interview content is shown in **Table 4**.

3.4. Theme 4 desire for effective social support

This interview found that medical staff have insufficient awareness and support for the disease of sarcopenia in the elderly with colorectal cancer, and most patients have not received support strategies on how to prevent and reduce sarcopenia. The specific interview content is shown in **Table 5**.

Table 5. Esire for effective social support.

Subtheme 1: Professional support from healthcare professionals This interview found that healthcare professionals are not sufficiently aware of and supportive of the disease of sarcopenia in older adults with colorectal cancer, and that the majority of patients are not provided with support strategies on how to prevent and mitigate sarcopenia.
Patient 12: It is usually a matter of reducing the amount and intensity of exercise, and I would like to have a specialized set of exercise regimens that are appropriate for the patient. Patient 14: I wish I had a professional to guide me in exercising, and I could have a set of exercise patterns that are appropriate for my condition.
Sub-theme 2: Family understanding and companionship Understanding and support from the patient's family is crucial to the patient's confidence in treatment and relief of anxiety.
Patient 7: Feeling that he has no strength in his arms and legs, which affects his normal activities and socialization, and he becomes more dependent on his family in his life. Patient 8: The older you get and the weaker you get, the more dependent you become on your family.
Subtheme 3: Reliable information platform support Some patients are relatively unaware of this disease, and some have not even heard of it. In order to carry out the prevention and treatment of sarcopenia in the department, it is necessary to first let patients and healthcare workers know that there is this disease and provide effective channels to understand and pay attention to it.
Patient 4: I wish healthcare professionals provided better medical resources and more appropriate exercise instruction programs. Patient 9: I wish there was expertise available to help me.

4. Perioperative exercise program for elderly patients with colorectal cancer with sarcopenia

This is the perioperative exercise program for elderly patients with colorectal cancer sarcopenia summarized through this qualitative interview, literature review, and literature analysis. The specific content is shown in **Table 6**.

Table 6. Perioperative exercise program for elderly patients with colorectal cancer with sarcopenia.

Time	Content of the intervention	interventionist
Official Admission–Pre-Operative	① Explain the definition, diagnostic criteria, risk factors, incidence, and proper methods of exercise management of colorectal cancer and sarcopenia, so as to make them aware of their sarcopenia status and knowledge of exercise management. ② Analyze the hazards faced by elderly patients with colorectal cancer in the presence of sarcopenia who do not exercise, such as falls, fractures, and even death, to draw attention to the patient's concerns about the dangers of not performing exercise. ③ Discuss the problems and obstacles in the process of behavioral change with the individual, help the patient to make a behavioral change plan, shape the image of the exerciser, and guide the individual to make a commitment, such as announcing to family members and friends that they will start the behavioral change, asking them to supervise, and signing a commitment to exercise. ④ Pre-adaptation: preoperative (pre-rehabilitation) Analyze the specific functional status of the patient, gradually increase the number of sets and repetitions based on the patient's own condition, and formulate a personalized exercise program, in order to enhance the patient's motor function, preoperative exercise rehabilitation. Exercise prescription: it can be adjusted according to age and other specific conditions, and the intensity can be reduced for those with radiotherapy, loss of appetite and poor sleep. ⑤ It is recommended to increase nutrition before surgery to avoid nutritional deficiencies in surgical patients before and during surgery and to reduce the incidence of postoperative malnutrition. ⑥ Aerobic training: walking for 15–30 min, 1 time/d; climbing stairs, 15–30 min, 1 time/d; Resistance exercise: 8–12/set, 2–3 sets/times, 2–4 times/week. Balance training: single-leg upright, 5-10pcs/time, 2–3 times/d. Taijiquan exercise: 15–30 min/time, 1 time/d, 2–4 times/week. Note: Generally the heart rate after exercise is controlled at 65%–80% of the maximum heart rate, and the heart rate of the elderly in this study is basically controlled at 104–139 beats/min. Advise patients to stop exercise immediately if they have chest pain, unbearable dyspnea, lower limb cramps, profuse sweating, and pallor.	Graduate students, charge nurses, primary care physicians, dietitians
Post-operative day	① Resistance training: active and passive exercises assisted by family members, including gradual transition from upper limb elevation to over-shoulder, alternating flexion and extension and elevation of lower limbs, 6–8 groups/time, 1–2 times/d. ② Give psychological counseling to patients and encourage them to perform exercise rehabilitation with positive cases. ③ Provide nutritional supplementation according to the patient's characteristics.	Graduate students, dietitians, rehabilitation therapists
Post-operative day 1	① Resistance training: active and passive exercises assisted by family members, including gradual transition from upper limb elevation to over-shoulder, alternating with lower limb flexion, extension and elevation, 8–12 sets/times, 2–3 times/d	Graduate students, rehabilitation therapists
Post-operative day 2	① Resistance training: active and passive exercises assisted by family members, including gradual transition from upper limb elevation to over-the-shoulder, lower limb flexion, extension and elevation alternately, 8–12 groups/times, 2–3 times/d. ② Balance training: single-leg upright, 2–5/time, 1–2 times/d.	Graduate students, rehabilitation therapists
Post-operative day 3	① Resistance training: active and passive exercises assisted by family members, including gradual transition from upper limb elevation to over-the-shoulder, lower limb flexion, extension and elevation alternately, 8–12 groups/times, 2–3 times/d. ② Balance training: single-leg upright, 2–5/time, 1–2 times/d. ③ Aerobic training: walking for 5–10 min.	Graduate students, rehabilitation therapists
Postoperative day4 until postoperative day 8–12	After the patient's drainage tube was removed: Aerobic training: walking 5–10 min gradually transitioned to 15–30 min, 1 time/d; stair climbing, 5–10 min, 1–2 times/d. Resistance exercise: 8–12/set, 2–3 sets/times, 2–4 times/week. Balance training: single leg upright, 2–5/repetition gradually transitioning to 5–10/repetition, 2–3 times/d. Taijiquan exercise: 5–10 min gradual transition to 15–30 min/time, 1 time/d, 2–4 times/week. Adjust the exercise parameters of aerobic training, balance training, resistance training, and tai chi according to the patient's condition.	Graduate students, rehabilitation therapists

5. Discussion

5.1. Patient perspective on disease prognosis

Patients have a positive view of the prognosis of the disease**,** including active exercise to strengthen the movement, improve strength, reduce sarcopenia, gain self-confidence, etc. [16], showing a high degree of cooperation in treatment, but there is a lack of knowledge and a lack of exercise skills, so it is necessary to improve the patient's knowledge of the disease of colorectal cancer sarcopenia and the skills of rehabilitation exercise [17], and personalized rehabilitation exercise is particularly important [18].

5.2. Obstacles to exercise

Due to the change of disease cognition and physical condition, patients worry about falling, disease deterioration and poor surgical condition, and then avoid exercise and interpret rehabilitation exercise in a negative perspective, which has an impediment effect on patients' rehabilitation in the later stage, and such patients should be strengthened with knowledge education and the confidence and benefits of exercise should be promoted [19]. According to the needs and characteristics of patients, we should formulate a plan to meet the needs of perioperative exercise for elderly colorectal cancer patients with sarcopenia, and help them recover faster and better under the premise of patient safety.

5.3. Lack of support from professional medical staff

Lack of professional support for healthcare personnel and professional skills to guide patients in preventing and mitigating sarcopenia need to be strengthened. Sarcopenia, as a new type of chronic disease, mainly manifests itself as age-related loss of muscle mass, with concomitant declines in muscle strength and/or somatic function, which can lead to an increased risk of falls, incapacitation, and loss of self-care in older adults, and the disease is associated with cognitive decline, hospitalization, and the disease is associated with cognitive decline, hospitalization, and death [20]. Healthcare professionals should learn about the disease and first acquire and utilize screening tools for sarcopenia. Screening methods for sarcopenia should be simple, quick, and effective. Therefore, early intervention and health education for sarcopenia is crucial [21].

5.4. Provide an effective support platform

Provide an effective support platform: health care personnel should increase the publicity and education of the knowledge of colorectal cancer oligometastatic disease in the elderly under the premise of improving their own business knowledge, and can implement effective health education through special lectures, consultations, thematic publicity, electronic screens, posters, popular science, and WeChat public number, to improve the patient's cognition of the disease of oligometastatic disease in the elderly, to enhance the awareness of the self-management of the disease, and to enhance the elderly's understanding of the disease of oligometastatic disease. In order to improve the awareness of sarcopenia among the elderly and their ability of self-health

management, we can effectively prevent and detect sarcopenia at an early stage, reduce the incidence of falls among the elderly, and improve their ability of self-care and quality of life.

6. Deficiency

In this study, there was a lack of older adults with other medical conditions, which did not adequately reflect the facilitating and hindering factors for the implementation of the intervention program among older adults with sarcopenia with different medical conditions, and further analysis is needed to incorporate the facilitating and hindering factors of multiple stakeholders such as family members, medical personnel, and so forth, which can be re-examined by enlarging the sample size in subsequent studies to obtain more accurate and reliable research results, as well as facilitating the long-term maintenance of the program. Maintenance. With the change of the intervention cycle, there is still a need to further explore the facilitating and hindering factors of the perioperative exercise intervention program for elderly colorectal cancer patients with sarcopenia in the process of long-term maintenance. In addition, this paper adopts qualitative research, and quantitative research can be done in the follow-up study, such as muscle measurements or quality of life assessment of the research subjects, in order to more comprehensively understand the effects of perioperative exercise on elderly colorectal cancer patients with sarcopenia, and to increase the control group as a benchmark for effect comparison, which can be used to compare the differences in the effects of perioperative exercise on elderly colorectal patients with sarcopenia, so as to ascertain the scientific validity and reliability of the research results, and to ensure that the research is scientifically sound and reliable, so as to ensure that the research is scientifically sound and reliable. Reliability, to ensure the scientific and accurate conclusions of the study.

7. Conclusion

The biomechanical effects of perioperative exercise on elderly colorectal cancer patients with muscle atrophy are mainly reflected in the following aspects:

(1) The relationship between physical activity and muscle mass: Reduced physical activity is one of the influencing factors of sarcopenia. Colorectal cancer patients have significantly lower physical activity compared to normal individuals due to the consumption of tumors. Research has shown that vigorous physical activity can increase muscle mass. Resistance exercise is a form of exercise that can significantly improve muscle mass and strength, and progressive resistance training can effectively enhance muscle mass and strength in older adults.

(2) The impact of exercise intervention on muscle strength and quality: Exercise intervention can significantly improve patients' muscle strength and quality, including aerobic exercise and resistance exercise. Aerobic exercise can maintain muscle mass, while resistance exercise can effectively delay the development of sarcopenia. For example, a study showed that after 12 weeks of preoperative and postoperative resistance exercise programs, patients' muscle strength was significantly improved.

(3) Scientificity and safety of perioperative exercise plan: A study constructed a goal-directed theory based perioperative exercise plan for elderly patients with

weakened colorectal cancer and verified its effectiveness. The program includes preoperative exercise, postoperative bed rest, sitting and standing exercises, and other stages. The results show that the program has been preliminarily validated in improving patients' postoperative physical function, daily living activity ability, and early postoperative recovery quality.

(4) The role of exercise in muscle remodeling: Mitochondrial mediated skeletal muscle remodeling plays an important role in the resistance of exercise against cancer cachexia. Exercise can regulate mitochondrial function in muscles, thereby affecting muscle mass and strength.

(5) The impact of exercise on functional ability and quality of life: A study shows that developing personalized aerobic exercise, resistance exercise, and other programs for different patients is an important factor in comprehensively improving their functional status, ensuring the effectiveness of pre rehabilitation, and improving their exercise compliance. In summary, perioperative exercise has a positive impact on elderly colorectal cancer patients with muscle atrophy, improving muscle function and quality of life, and promoting recovery at the molecular and cellular levels.

The development of population aging has made sarcopenia one of the major public health problems in the elderly colorectal population. Currently, the prevention and treatment of sarcopenia is mainly based on non-pharmacological treatment to improve lifestyle, and exercise intervention based on resistance exercise is one of the effective measures to prevent and treat sarcopenia, which can significantly prevent and treat sarcopenia in the elderly. In recent years, more and more scholars have developed an exercise program combining resistance training and traditional sports. In recent years, more and more scholars have developed exercise programs combining resistance training and traditional sports [22]. However, there are still many obstacles to the implementation of the program, such as low awareness of resistance exercise, low self-efficacy, and low knowledge of the exercise program for sarcopenia treatment among healthcare workers. In clinical work, medical personnel should pay attention to the screening and severity assessment of elderly colorectal cancer patients with sarcopenia, pay attention to the interventional guidance on controllable influencing factors, and encourage elderly colorectal cancer patients with sarcopenia to adhere to reasonable exercise during the perioperative period, so as to reduce the incidence and severity of sarcopenia in elderly colorectal cancer patients.

Author contributions: Conceptualization, JY and GF; methodology, JY; software, XZ; validation, JY, XZ and MW; formal analysis, RM; investigation, YZ; resources, XZ; data curation, JY; writing—original draft preparation, MW; writing—review and editing, RM; visualization, JY; supervision, XZ; project administration, YZ; funding acquisition, JY. All authors have read and agreed to the published version of the manuscript.

Ethical approval: Not applicable.

Conflict of interest: The authors declare no conflict of interest.

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