

Effects of Exercise Programs on Cancer Patients:
 a Systematic Literature Review*

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ABSTRACT

This study examined exercise programs for the cancer patients, patient exercise time, and the data on exercise programs according to the type of cancer by systematically reviewing the results of the experimental studies on the application and effectiveness of the exercise programs for the cancer patients registered with the Korean Citation Index (KCI) and published between January 2010 and December 2016. The study result showed that exercise programs for the Korean cancer patients were found to have a positive effect. The most common cancer type and program time were ‘breast cancer patients’ and ‘after surgery’. Exercise programs were confirmed to be used in the recovery period. It was also confirmed that studies on the exercise programs for the cancer patients are very limited even though exercising has a positive effect on physical function and psychology during cancer treatment. Since the effectiveness of the exercises has been proven, it is necessary to develop various exercise programs based on the type of cancer and treatment period, and study the application of exercises in the field.

1. Introduction

With advancements in medical science and technology in recent years, early diagnosis and various new cancer therapies have been developed, and the management of cancer patients is entering a new phase. According to statistics (Data 1) from the National Cancer Center in 2009, the number of cancer patients in Korea has exceeded 800,000, and the number of patients diagnosed with cancer is increasing every year. In the recent years, despite the prolongation of the survival rate and the

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survival period due to the development of new cancer therapies, cancer ranks first in adult mortality in Korea and is regarded as the highest health risk for Koreans.

The majority of patients diagnosed with cancer undergo a series of treatments including surgery, chemotherapy, radiotherapy, and other alternative therapies, and they should also have an optimal living environment in which to recuperate and increase the rate of response and recovery and their quality of life before and after the treatment. Survivors who live a healthy life after successful treatment are also greatly interested in constructing a healthy living environment to prevent the recurrence of cancer and other chronic diseases. In response to the increasing demand, many studies have been conducted on healthy dietary habits, physical activity, and lifestyle. Studies of physical activity and exercise, in particular, have grown exponentially in recent years, and physical activity and exercise were reported to have a significant effect on the progression of various cancers and the prevention of some cancers (Kim & Yi, 2017). In other words, physical activity and exercise can play important clinical roles for patients, such as overcoming adverse effects of previous treatments, improving the health of long-term survivors, and reducing the cancer recurrence. This study aimed to analyze the current state of physical activity and exercise intervention by reviewing the results of domestic studies on physical activity and exercise intervention with cancer survivors and systematically reviewing the literatures regarding the cancer type, exercise type, exercise program participation, and the effect of exercise.

2. Research Method

2.1 Data Collection

In this study, we systematically reviewed the results of experimental studies on the application and effectiveness of exercise programs for cancer patients published between January 2010 and December 2016 to analyze the current status of such treatments in Korea.

Papers registered with the Korea Citation Index (KCI) were searched, and degree papers which were not published in academic journals were excluded because they did not undergo a formal verification process. The search terms used were a combination of ‘patient and exercise program’, and ‘cancer patient and exercise program’. A total of 220 papers were found across all fields. Eighteen papers analyzing the results of experimental studies that verified the application and effectiveness of exercise programs for cancer patients were finally selected for review.

2.2 Data Analysis

For accurate analysis, we analyzed the papers based on ‘year’, ‘cancer type’, ‘exercise program type’, ‘patient exercise time’, and ‘verification criteria for exercise effectiveness,’ respectively.

3. Results

3.1 General characteristics of literature

Table 1. General characteristics of literature

Year	Number of Papers	Cancer Type	Exercise Type		Verification Criteria	
			Exercise Type	Exercise Time		
	5/35	Breast cancer	Lymphatic massage + resistance (elastic band),	Post-surgical recovery (breast pre-resection, breast conservation)	Changes in upper limb function, such as physical fitness, shoulder tilt, circumference of arm edema, depending on the surgical procedure (breast pre-resection, breast conservation (Kim & Kim, 2010)	
			12 weeks	12 weeks		
			Shoulder stretching	After surgery		Lymphedema, shoulder joint movement, fatigue, social support (Moon et al., 2010)
			Upper body rehabilitation (strap exercise)	Surgery and chemotherapy recovery of breast cancer survivors, 12 weeks, 60 minutes, once or 3 times per week		Body composition, flexibility, grip strength, and blood lipids (Kim, 2010)
		Tai chi	Stage 1-2 cancer surgical patients, 12 weeks	Range of shoulder movement, heart rate measurement (Kim et al., 210)		
		General cancer	Physical activity level, fatigue, correlation	Cancer diagnosis within 3 months Hematology-oncology, cancer center, breast cancer, endocrine medicine	Physical activity: physical activity questionnaire (IPAQ) and fatigue questionnaire (RPFS) developed by international organizations (Chea et al., 2010)	
2011	1/30	Female cancer	Stretching to improve flexibility, muscle strength, line dancing	Cancer patients Less than 1 year - 7 years +	Case studies on the operation of and participation in the health clinic in the cancer center (Chung et al, 2011)	
2012	5/31	Breast cancer	BEHAS exercise	Patients who received radiation therapy	Shoulder external rotation, cancer coping, group cohesiveness (Kim et al., 2012)	
			Rehabilitation exercise	Patients who started radiation therapy after surgery (Stage 0-4)	Quality of life, cardiopulmonary function. fatigue (Do et al, 2012)	
			Self-exercise	Post-surgical patients	Range of shoulder joint movement, edema, pain (Kim et al., 2012)	

Year	Number of Papers	Cancer Type	Exercise Type		Verification Criteria
			Exercise Type	Exercise Time	
		Colon cancer	Video exercise for 10 minutes (upper body stretching, muscle strength)	Patients undergoing chemotherapy	Physical function: step box (cardiopulmonary function), grip strength (upper body strength), degree of bone marrow suppression, WBC, hemoglobin, hematocrit, platelets Emotions: anxiety, confusion, depression, energy, anger (Cho et al., 2012)
		Breast cancer, prostate cancer, stomach cancer	Combined exercise	Patients within 6 months to 5 years after surgery, 12 weeks	Body composition, cardiovascular endurance, strength, muscle endurance, flexibility, fatigue questionnaire (Kim et al., 2012)
2013	1/32	Breast cancer	Rehabilitation exercise	Breast cancer survivor	Grip strength (affected site, non-affected site), immune response, physical well-being, emotional well-being, depression, coping with cancer, self-esteem (Kim et al, 2013)
2014	3/32	Breast cancer	Combined exercise	Breast cancer survivors	Estradiol, IGF-I and CA15-3 (Kim & Chio, 2014)
			Yoga	Post surgical patients, 12-week exercise	Depression, catecholamine (Oh & Song, 2014)
		Prostate cancer	Kegel exercises for 12 weeks	Post-surgical patients	Functional physical fitness over time, isokinetic muscle function, dysuria (Yang et al, 2014)
2015	1/29	Breast cancer	Acupressure	Patients undergoing chemotherapy	Questionnaire on the patients' fatigue and sleep pattern (Kang et al., 2015)
2016	2/29	Colon cancer	Participation in exercise (e.g. walking, etc.)	Patients undergoing chemotherapy	Exercise awareness and constraints Explaining the need for exercise to cancer patients (Park et al., 2016)
		Stomach cancer, colon cancer	Participation in physical activity	Outpatients 4 years after the diagnosis of cancer	Body composition, physical activity investigation (Lee et al., 2016)

There were a total of 220 papers related to the search terms of 'cancer patients' and 'exercise program' for over 6 years from 2010 to 2016. Of these, a total of 18 papers (10.00%) related to the experimental studies conducted on the application and effectiveness of the exercise programs

for cancer patients.

There were 5/35 papers (14.28%) published in 2010, 1/30 (3.33%) in 2011, 5/31 (16.13%) in 2012, 1/32 papers (3.21%) in 2013, 3/32 (9.37%) in 2014, 1/29 (3.45%) in 2015, and 2/29 (13.79%) in 2016, respectively.

3.2 Cancer type of the patients participating in the exercise programs

Of the 18 papers in this study, 11 papers (61.11%) discussed exercise programs for the breast cancer patients, followed by 3 papers (16.66%) on the exercise programs for the cancer patients in general (all cancer patients, and not patients with any specific type of cancer), 3 papers (16.66%) on the colon cancer patients, and 1 paper (5.55%) on the prostate cancer patients (5.55%), respectively.

3.3 Exercise program types and times

Of the 18 papers reviewed in this study, the majority of 11 papers (61.11%) discussed the shoulder joint exercise for the cancer patients, including the shoulder joint exercise, shoulder stretching, BEHAS exercise, Tai chi, rehabilitation exercise, qigong exercise, combined exercise, yoga, and the respiratory exercise. These papers also reported on the degree of participation in combined exercises and walking and exercise level according to the physical activity surveys conducted with physical activity questionnaires.

Of the 18 papers, 4 papers (22.22%) related to the patients undergoing chemotherapy, 1 paper (5.55%) on the patients undergoing radiation therapy, and 2 papers (11.11%) on the patients recovering from surgery. Of the papers reviewed, 11 papers (61.11%) discussed patients who completed their treatment, patients who experienced cancer, and patients who underwent surgeries.

3.4 Effectiveness of the Exercises

To verify the effectiveness of the exercises, we have conducted a physical function evaluation, a psychological evaluation for the quality of life, social support, and fatigue, and a combined functional and psychological evaluation. We found that 9 (50.00%) out of 18 papers verified the effectiveness of the exercises through the functional evaluation, 2 (11.11%) papers verified psychological effectiveness, and 7 papers (39.88%) verified combined effectiveness.

4. Discussion

During this study, we have examined exercise programs for the cancer patients, patient exercise time, and the data on exercise programs according to the type of cancer by systematically reviewing the results of the experimental studies on the application and effectiveness of the exercise programs for the cancer patients registered with the Korean Citation Index (KCI) and published between January 2010 and December 2016.

Domestic and foreign papers reported that regular exercise not only prevents cancer and lowers the incidence of cancer but also has a positive effect on the patients undergoing treatment (McNeely et al., 2006; Choi, 2014). However, chemotherapy is accompanied by numerous adverse physical and psychological effects. Adverse physical effects include nausea and vomiting, edema, loss of appetite, loss of strength, decreased mobility of the shoulder joint, muscle weakness, and decreased cardiovascular endurance (Pickett et al., 2002), and adverse psychological effects include anxiety, irritability, fear, despair, anger, sadness, and depression (Byar et al., 2006). It was reported that these adverse effects could be alleviated by exercising, and exercising has had a positive effect on the quality of life and psychology. Even though many studies have demonstrated the effectiveness of the exercises, there have not been many studies conducted on surgical cancer patients during hospitalization, patients in the recovery period, or patients undergoing chemotherapy (Kim & Yi, 2017). Even though the incidence of cancer has increased, and the importance of recovery and physical activity has recently been emphasized, there have not been many experimental studies conducted on the exercise programs for the cancer patients: 5/35 papers (14.28%) in 2010, 1/30 (3.33%) in 2011, 5/31 (16.13%) in 2012, 1/32 (3.21%) in 2013, 3/32 (9.37%) in 2014, 1/29 (3.45%) in 2015, and 2/29 (13.79%) in 2016, respectively.

In addition, breast cancer was among the most common types of cancer among the patients involved in the exercise programs (11 papers, 61.11%). Patients complained about the difficulty with moving the upper limbs around the surgical areas as far as shoulder joint movements and inconvenience in daily activities are concerned following mastectomy. Therefore, the upper body exercise is considered necessary to help improve the function of the shoulder joints, and the studies have focused on the upper body for the lack of restriction on other physical movements and it is rather easy to find female participants. In addition, since the effect of the upper body exercise was clearly recognized in the breast cancer resection and the adverse effects of lymphadenectomy, many studies attempted to apply adverse exercise programs. The upper body exercise accounted for the largest portion of the exercise programs for the breast cancer patients, while band, BEHAS, Tai chi, rehabilitation exercise, qigong exercise, combined exercise, yoga, and respiratory exercise were commonly used to improve the shoulder joint flexibility and movement range. Kim, Yong-Woo and Kim (2010) performed lymphatic massage, exercises to improve upper limb flexibility, and elastic band exercises by dividing the patients into mastectomy and breast conservation surgery patients to examine the changes in the upper limbs' functional fitness, shoulder tilt, and the circumference of arm edema. Their results showed a significant improvement in grip strength and flexibility and shoulder tilt in the upper limb function after 12 weeks of exercise in the breast mastectomy patients, and there was a significant increase in flexibility among the breast conservation surgery patients.

Park et al. (2016) reported that the patients who received chemotherapy following cancer surgery suffered from adverse physical and emotional effects, and had difficulty in pursuing physical and other activities since their cancer diagnosis. As such, a considerable number of mental and physical constraints are manifested in the process of diagnosing and treating cancer. Studies are conducted not only on the recovery of physical function but also on the psychological effects to verify the effectiveness of the exercises, and many studies are also being conducted on these two areas in

combination. This study found that 9 (50.00%) out of 18 papers verified the physical function recovery, (11.11%) papers verified the psychological effectiveness, and 7 papers (39.88%) verified the combined effectiveness. A study by Do, Jeong-Hwa et al. showed improvement of the quality of life and improvement of the cardiopulmonary function after a 6-week Behas intervention for the patients who started radiation therapy for breast cancer. If the patients with chronic diseases, including cancer, avoid excessive physical activities due to fatigue, it may not only deteriorate their cardiovascular function and muscular strength but also cause depression, anxiety, cognitive deficits, decreased self-esteem, and fear of recurrence (Zabora et al., 2001); however, it has been reported that the exercise intervention can help patients to overcome such symptoms and improve their quality of life. The variables used in this study for the combined verification were physical functions such as body composition, flexibility, grip strength, heart rate, and muscle strength, and psychological variables such as depression, fatigue, sleep, self-esteem, social support, and quality of life. Emotional variables included anxiety, confusion, energy, and anger. Kim (2012) applied a combined exercise program of muscle strength, flexibility, and aerobic exercise to prostate cancer patients. As a result, muscle strength, flexibility, and endurance were improved, and fatigue declined. (Kim et al., 2013).

Exercise programs for the Korean cancer patients were found to have a positive effect. The most common cancer type and program time were 'breast cancer patients' and 'after surgery'. Exercise programs were confirmed to be used in the recovery period. It was also confirmed that studies on the exercise programs for the cancer patients are very limited even though exercising has a positive effect on physical function and psychology during cancer treatment. Since the effectiveness of the exercises has been proven, it is necessary to develop various exercise programs based on the type of cancer and treatment period, and study the application of exercises in the field.

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