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A Comprehensive Fitness and Nutrition Plan for Cancer Survivors

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1. Introduction

The American Cancer Society recommends that exercise serve as an important part of an individual's cancer care plan, asserting that exercise will decrease feelings of fatigue both during and after treatment, and improve an individual's feeling of control and hope [5]. This is in light of more than two decades of research [6-9, 11, 19, 22], which support a link between a physically active lifestyle and positive physiological changes in cancer survivors. These include improvements in VO_{2max} , blood volume, and gas exchange [13], improvements in muscular strength and endurance [14], fatigue reduction [15 – 19], and improvements in quality of life [19; 20; 23], anxiety [21, 22] depression [21; 24] body image [25], immune function [26], and emotional well-being [22].

According to ACSM (Schmitz et al., 2010), the general objectives for exercise training among cancer survivors are as follows:

1. To regain and improve physical function, aerobic capacity, strength, and flexibility.
2. To improve body image and QOL.
3. To improve body composition.
4. To improve cardiorespiratory, endocrine, neurological, muscular, cognitive, and psychosocial outcomes.
5. Potentially, to reduce or delay recurrence or a second primary tumor.
6. To improve the ability to physically and psychologically withstand the on-going anxiety regarding recurrence or a second primary cancer.
7. To reduce, attenuate, and prevent long-term and late effects of cancer treatment.

8. To improve the physiologic and psychological ability to withstand any current or future cancer treatments.

With the right program, remaining physically active during and after cancer treatment will have a favorable effect on symptom management and quality of life. As such, we wish to present a step-by-step guide intended to assist an exercise trainer when working with a client who has been diagnosed with cancer. This guide will begin with pre-participation paperwork and will cover all pertinent information through exercise program development. Presented are guidelines for both facility-based settings and a home-based setting. These techniques have been employed by Maple Tree Cancer Alliance, a non-profit organization in southwest Ohio whose mission is to improve the physical and spiritual well-being of individuals battling cancer.

It is important to mention, however, that “cancer” is a broad term. No two cancer diagnoses are alike. Similarly, no two patients are alike. With so many different forms of cancer existing, each with its own treatment regimen, it is vital for the exercise trainer to remain in communication with the patient’s physician. Equally important, is the need to personalize each exercise program to the ever-changing needs of the patient. Therefore, the guidelines described in this book are just that – guidelines. Adjustments can and should be made accordingly, where appropriate.

2. Pre-participation paperwork

Obtaining information about the patient is vital to ensuring a safe and effective exercise program. Before any exercise is conducted, the exercise trainer must learn all they can about the patient’s medical and cancer history, treatment regimen, psychological well-being, exercise history, as well as any pertinent negative side effects related to cancer treatment. The exercise trainer will also want to have the patient’s physician sign a release form, and the patient sign a waiver prior to beginning any exercise program.

3. Fitness assessment procedures

After all necessary paperwork is complete and the physician’s clearance has been signed and returned, the exercise trainer may begin the exercise program development process. The first step in this process is a comprehensive fitness assessment. The purpose of the fitness assessment is to determine the patient’s current level of fitness. This will assist in goal setting and exercise program development. It is important to note, however, that cancer-specific norm charts have yet to be developed. Thus, any score received on the fitness assessment will be compared to a norm chart representative of a healthy population. Therefore, it would be wise to set goals that are relatively modest, particularly when working with a patient who is currently in treatment.

At Maple Tree Cancer Alliance, we recommend conducting one test for each component of fitness. To measure VO₂, we utilize the Bruce Treadmill Protocol, and have each patient

exercise to 75% of their estimated HRmax, or volitional fatigue. To measure body composition, we conduct the 7-site skinfold assessment. Muscular endurance is measured via the partial curl-up test. Muscular Strength is assessed via hand-grip dynamometer, and finally, flexibility is measured with the modified sit-and-reach. For patients who undergo breast cancer surgery, we also measure upperbody (flexion/extension) using the goniometer, and do upper extremity circumference measurements to check for lymphedema.

4. Exercise prescription

Once the fitness assessment has been completed and reviewed, the cancer exercise trainer designs an individualized exercise prescription for the patient, where recommendations pertaining to the frequency, intensity, duration, mode, and progression of exercise are addressed. Ideally, for an individual undergoing cancer treatment, the prescription will include a whole-body workout that targets all the major muscle groups. The overall goal of the exercise program should be to minimize the general de-conditioning that often results from cancer treatment so that the cancer treatments are better tolerated. In general, the exercise prescription should include a slow progression and demonstrate adaptability to changes in the patient's health status, which frequently will change from day-to-day during treatment.

At present, the optimal frequency, duration, and time course of adaptation to aerobic and resistance exercise training in cancer patients are not known, although research indicates that individuals undergoing cancer therapy benefit from low-to-moderate intensity aerobic and resistance exercise [13]. Based on available data, Table 1 presents some general guidelines a fitness professional may follow when designing an exercise program (Schmitz et al., 2010; Physical Activities Guidelines Advisory Committee, 2008; Haskell et al., 2007; Schneider & Carter, 2003).

	Aerobic Training	Strength Training	Flexibility Training
Frequency	3-5 days/wk	2-3 days/wk	2-7 days/wk
Intensity	40-60% HRR*	40-60% HRR*	Stretch to the point of mild discomfort
Duration	20-60 min/session	1-3 sets, 8-12 reps per exercise	10-30 seconds per stretch
Mode	Walking, cycling, cross trainers, swimming	Free weights, machines, resistance bands, resistance balls	Static stretching

Table 1. Guidelines for Designing an Exercise Prescription for Individuals Undergoing Cancer Treatment.

Initially, intensity will depend on the patient's functional status and exercise history prior to cancer diagnosis. Typically, previously active cancer patients may continue their exercise

regimen, although intensity may need to be decreased during treatment. Progression should consist of increases in frequency and duration rather than in intensity (Physical Activities Guidelines Committee, 2008; Schneider & Carter, 2003).

5. Exercise program

5.1. Pre-exercise guidelines

Prior to each exercise session, the cancer exercise trainer must assess the patient’s readiness to exercise. Resting heart rate and blood pressure should be measured, and general information regarding the patient’s overall health status should be obtained. Contraindications to exercise are listed in Table 2. Depending on the information attained from the patient, the exercise intervention may need to be adjusted for that day.

Onset of nausea following exercise initiation
Vomiting within the last 24 hours
Leg pain
Decreased heart rate and blood pressure with increased workload
Chest pain
Difficult or shallow breathing
Unusual muscle weakness
Numbness in the extremities
Chemotherapy treatment within the last 24-hours
Irregular pulse during exertion
Disorientation and confusion
Dizziness

Table 2. Contraindications to exercise in cancer patients.

5.2. Supervised exercise training session

- **Warm up:** Each session should begin with a 5- to 10-minute warm-up that stimulates blood flow to the working muscles. The warm-up should involve some mild stretching and light aerobic activity.
- **Aerobic Component:** During the aerobic component of exercise, it is important to frequently monitor blood pressure and heart rate. If the patient is on a medication that affects heart rate, the Borg Scale of Exertion (Borg, 1973) (Figure 1) may be used to monitor intensity. Based on this scale, a light-to-moderate intensity (RPE of 11 to 14) should be encouraged. If

dizziness, nausea, or chest pain occurs, all exercise should be stopped. Frequent short breaks are sometimes encouraged to accommodate therapy-related fatigue.

- **Resistance Training:** The type of resistance exercise performed will depend on the patient's range of motion, tissue removal, and wound healing. ACSM recommends at least 48 hours of rest between each resistance training session (Schneider & Carter, 2003). Therefore, it may be advisable to plan a whole body approach to resistance training, where all major muscle groups are targeted in one day. If the patient is unwilling or unable to participate in traditional modes of strength training, Yoga, or Pilates may serve as an alternative form of strength exercise.
- **Cool Down:** Aerobic exercise should be followed up by static stretching and range of motion exercises for all major muscle groups.

6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

Figure 1. The Borg Scale Rating Perception of Effort (RPE).

6. Follow up

To assist in progression, patients should be reassessed approximately every 6 months (Schneider & Carter, 2003). In addition, it is advisable to maintain communication with the patient's

primary oncologist. The following form, used by Maple Tree Cancer Alliance, is sent to the physician every 3-6 months, and is a simple way to keep the doctor abreast of the patient's progress.

7. Nutrition guidelines during cancer

Nutritional guidance during cancer treatments is very important, since cancer treatments typically result in side effects that lead to eating problems. Such side effects include trouble swallowing, sore mouth, dry mouth, thick saliva, altered taste and smell, nausea and vomiting, decreased appetite and constipation. Nutritional interventions specific to these side effects have been shown to contribute shorter hospital stays, decreased healthcare costs, faster healing, increased tolerance to treatment duration and higher treatment dosages, as well as decreased complications during their cancer treatment.

A registered dietitian may provide nutritional counseling, develop meal plans, and monitor the body weight, caloric, and dietary needs of a person diagnosed with and being treated for cancer. Ideally, each individual would be given a personalized dietary plan according to their specific needs and goals. Dietary plans should be closely monitored and changed according to the client's changing nutritional health requirements throughout their battle with cancer. The purpose of nutritional guidance is to help the patient:

- Improve quality of life
- Maintain a healthy weight
- Improve treatment tolerance
- Manage treatment-related side effects
- Improve eating habits

Sound nutrition practices include eating a variety of foods that will give the body the nutrients needed to help fight cancer. Included in these nutrients are protein, fats, and carbohydrates, as well as water, vitamins, and minerals.

Proteins are important for growth, immune system function, and building and repairing body tissue. When protein is lacking in the diet, the body breaks down its muscle, which lowers resistance to infection and makes it harder for the body to recover from illness. Good sources of protein include lean meats, fish, poultry, eggs, dairy, nuts, beans, peas, and lentils.

Carbohydrates are a major source of energy for the body, giving it the energy it needs for activity and proper function. Most of all carbohydrates turn into glucose after it is digested. Glucose is used by the body to create adenosine triphosphate, the energy currency of the cells. Glucose can also be stored, in the form of glycogen, in the liver and skeletal muscle. During times of starvation or exercise, glycogen is broken down into glucose to be used to make energy.

When selecting dietary sources of carbohydrates, it is important to choose foods that don't have a dramatic effect on blood sugar. This can be done by examining the glycemic index of

the food. Glycemic index is a number between 50-100 associated with food, that indicates its effect on blood sugar. A lower glycemic index suggests slower rates of digestion and absorption of the foods' carbohydrates, and may also indicate greater extraction from the liver and periphery of the products of carbohydrate digestion. A lower glycemic response usually equates to a lower insulin demand but not always, and may improve long-term blood glucose control. Therefore, the best sources of carbohydrates are those that have a low glycemic index (whole grains, peaches, strawberries, mushrooms, chillis, most vegetables, and seeds), compared to high glycemic index foods (white breads and pastas, most commercial cereals, bagels, white rice, and white potatoes).

Fats are a rich source of energy for the body. There are different types of dietary fat, and some are better for the cancer patient than others. In general, monounsaturated and polyunsaturated fats are better choices than saturated or trans fats. Monounsaturated fats are mainly in vegetables, including olive, canola, and peanut oils. Polyunsaturated fats are the main fats found in seafood, as well as safflower, sunflower, corn, and flaxseed oils. Saturated fats are primarily found in animal sources, like meat, poultry, milk, cheese, and butter. Because saturated fats can raise cholesterol, the American Cancer Society recommends that less than 10% of an individual's calories come from saturated fat. (ACS, 2006). Trans fats are found in foods made with partially hydrogenated vegetable oils, margarine, or shortening. They have a negative effect on cholesterol and are not recommended in the diet.

8. Sound nutrition during treatment

Sound nutrition practices are very important during cancer treatment to help the body maintain strength, prevent tissue break down, manage side effects, and maintain immunity. The healthier an individual's diet, the better they can tolerate treatments and the more effective cancer treatments are in their body.

In general, a plant-based diet is ideal. At least 5 servings of fruits and vegetables are recommended each day, in a variety of colors. Colorful fruits and vegetables contain phytochemicals, which have preventative or disease-protective properties. High-fat foods, especially those from animal sources, should be avoided, as well as salt-cured, smoked, and pickled foods. Small snacks may be ingested during the day, as caloric needs often increase during cancer treatment. It may be helpful to keep a variety of protein-rich snacks on hand, including yogurt, soup, cheese, and crackers.

It is also very important to ensure that the patient is getting enough fluids each day. These can be in the form of water, juices, or other clear liquids that are sipped throughout the day. Fluids are lost through vomiting or diarrhea, and may lead to dehydration if not replenished.

During treatment, there will most likely be days when side effects make eating difficult or undesirable. On those days, it might be helpful to eat several small snacks throughout the day, rather than three large meals. Liquid supplements or high-protein beverages might be helpful to increase calories. Also, the patient should not be limited to food choices. In other words, if

they want to eat breakfast for dinner, or vice versa, it is okay. When eating is difficult, it is more important to get calories in so that the patient can maintain strength. Then, on days when appetite is good, the patient should be encouraged to eat as healthy as possible.

9. Food safety

Because cancer and its associated treatments can weaken the immune system, food safety is essential. It is very important to avoid being exposed to germs when food is not handled or prepared properly. Hand washing is very important anytime food is going to be handled or eaten. Keeping food at the proper temperature and defrosting frozen foods correctly is also very important. Fruits and vegetables should be washed thoroughly under running water before peeling or cutting. Food that has been cut at the grocery store (i.e. melon or squash) should be avoided. Use a clean knife and cutting board to cut different foods, and clean counter tops with hot, soapy water. Foods should be cooked well, but not charred.

Once treatment ends, most eating-related side effects of cancer treatments go away. It is still very important for the patient to continue to eat a healthy diet, in order to regain strength, build tissue, and improve quality of life. Patients will want to continue to eat at least 5-7 fruits and vegetables each day, especially those that are dark-green, deep-yellow, and citrus fruits. Foods high in fiber, including whole-grain breads, should also be consumed. Red meat intake should be limited to no more than 3-4 servings each week. Alcohol consumption should also be limited. Salt-cured, smoked, and pickled foods, such as bacon, sausage, and deli meats, should be avoided. Low-fat milk and dairy products should be selected, and food should be prepared in such a way to reduce the total amount of fat (i.e. bake or broil over fry).

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