

암생존자의 비만관리

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Introduction

- Many cancer survivors experience weight gain following the diagnosis of cancer and its treatment.
- The underlying mechanism of obesity causing cancer is complex and is incompletely understood.
- Obesity not only increases the risk of recurrence in some cancers but also increases the risk of diabetes mellitus, cardiovascular disease, and poor quality of life.



Exercise, Diet, and Weight Management During Cancer Treatment: ASCO Guideline

Ligibel et al.

Systematic review: Weight loss in cancer patients

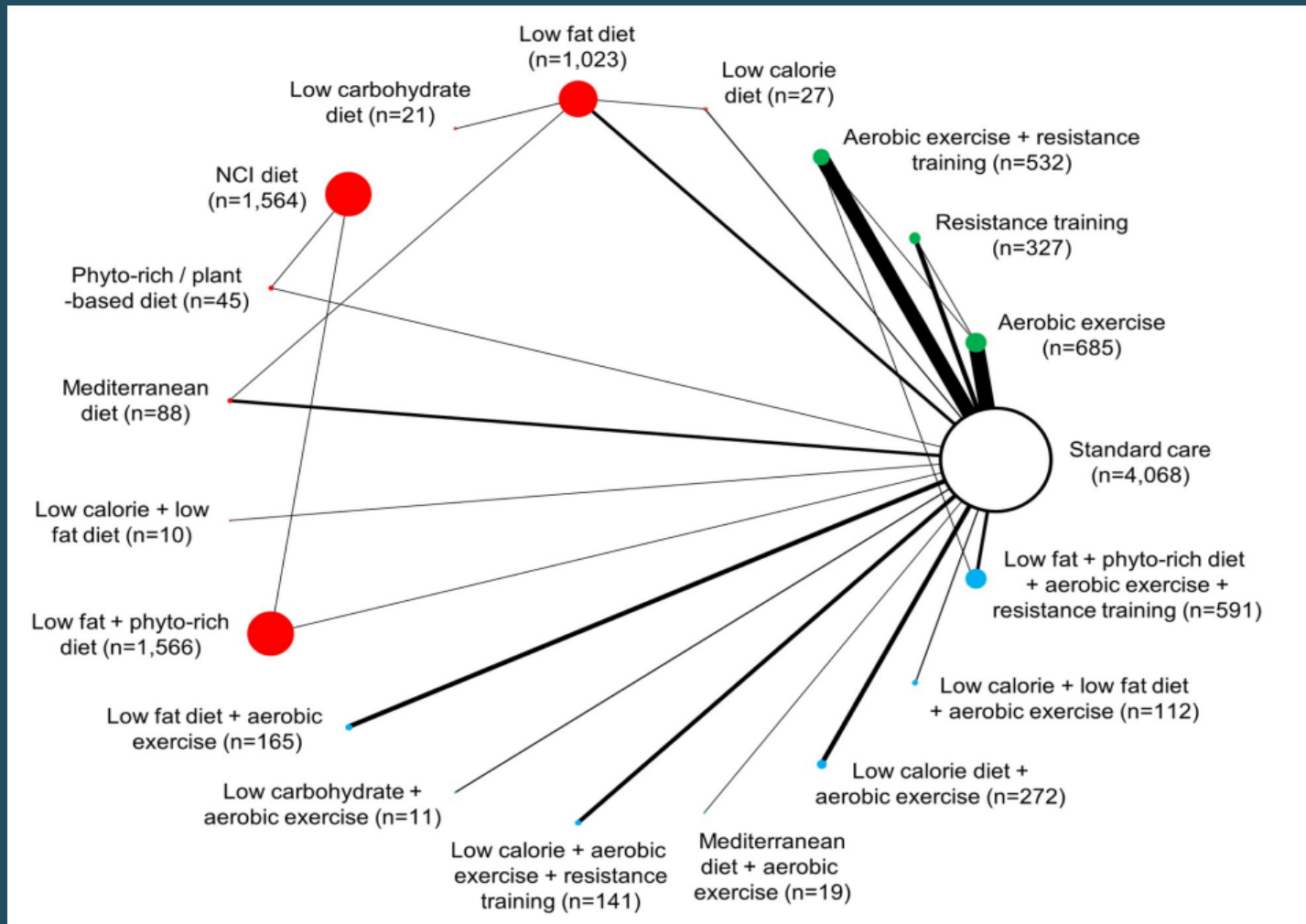
Optimising weight-loss interventions in cancer patients_A systematic review and network meta-analysis

- **Objective:** To conduct a systematic review and network meta-analysis (NMA) of randomized controlled trials (RCTs) comparing the effects of exercise and dietary interventions alone or in combination on anthropometric measures of adult cancer patients and survivors.

Table 1. Overview of study characteristics included in NMAs (n = 75).

Characteristic	Summary Measure
Year of publication	
2010>	59 (78.7%)
2001–2009	16 (21.3%)
1991–2000	0 (0%)
<1990	0 (0%)
Study sample size	
<50 patients	33 (44.0%)
51–100 patients	27 (36.0%)
101–500 patients	13 (17.3%)
501–1000 patients	0 (0%)
>1000 patients	2 (2.7%)
Time of Study Intervention	
Pre-operative	3 (4.0%)
During chemotherapy	9 (12.0%)
During adjuvant hormone therapy/androgen deprivation	9 (12.0%)
After treatment	54 (72.0%)
Type of cancer patients enrolled	
Breast	48 (64.0%)
Prostate	13 (17.3%)
Colorectal	3 (4.0%)
Mixed sites	8 (10.6%)
Other sites	3 (4.0%)
Median of average patient ages (range)	57 (42–73)
Median of average patient body weights (range kg)	80 (49–98)
Median of average patient BMI (range kg/m²)	29 (23–35)
Duration of study intervention	
<3 months	14 (18.7%)
3–6 months	44 (58.7%)
7–12 months	11 (14.7%)
>12 months	5 (6.7%)
Not reported	1 (1.3%)
# studies involving a treatment group of:	
Standard care	72 (96.0%)
Dietary Intervention	16 (21.3%)
Exercise Therapy	45 (60.0%)
Combination Intervention	26 (34.7%)

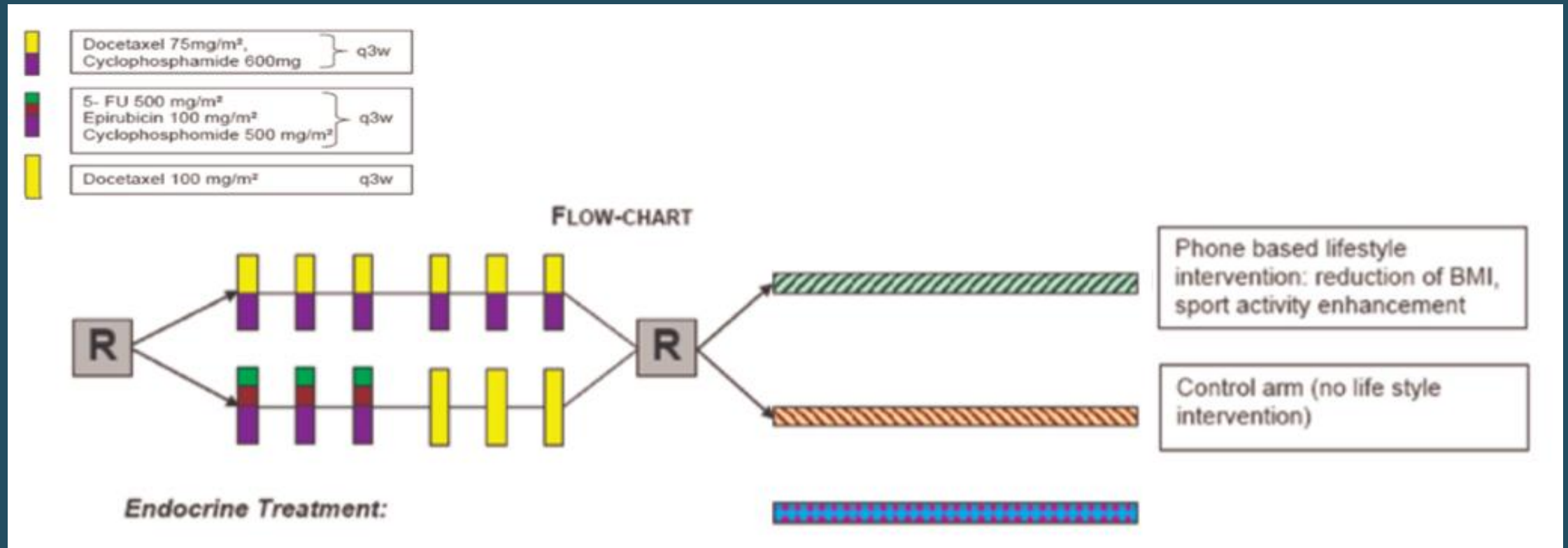
Systematic review: Weight loss in cancer patients



Change in Body Weight (Group level comparisons)

Combination [⊖]	0.631 [⊖]	0.993 [⊖]	1.000 [⊖]
-0.26 [↓] (-2.04 to 1.19) [⊖]	Diet [⊖]	0.965 [⊖]	0.998 [⊖]
-1.82 [↓] (-3.43 to -0.50) [⊖]	-1.56 [↓] (-3.12 to 0.17) [⊖]	Exercise [⊖]	0.914 [⊖]
-2.52 [↓] (-3.54 to -1.62) [⊖]	-2.25 [↓] (-3.43 to -0.91) [⊖]	-0.69 [↓] (-1.75 to 0.49) [⊖]	Standard Care [⊖]

SUCCESS C study_ open-label, multicenter, 2x2 factorial design, RCT phase III study



The Lifestyle Intervention Program within SUCCESS C

- Evaluate the efficacy of a lifestyle intervention program to improve disease free survival in early breast cancer.

Subjects

- BMI of 24–40 kg/m²
- Duration: 2 years
- Weight loss over the first 6 months followed by weight loss maintenance

Treatment Goal

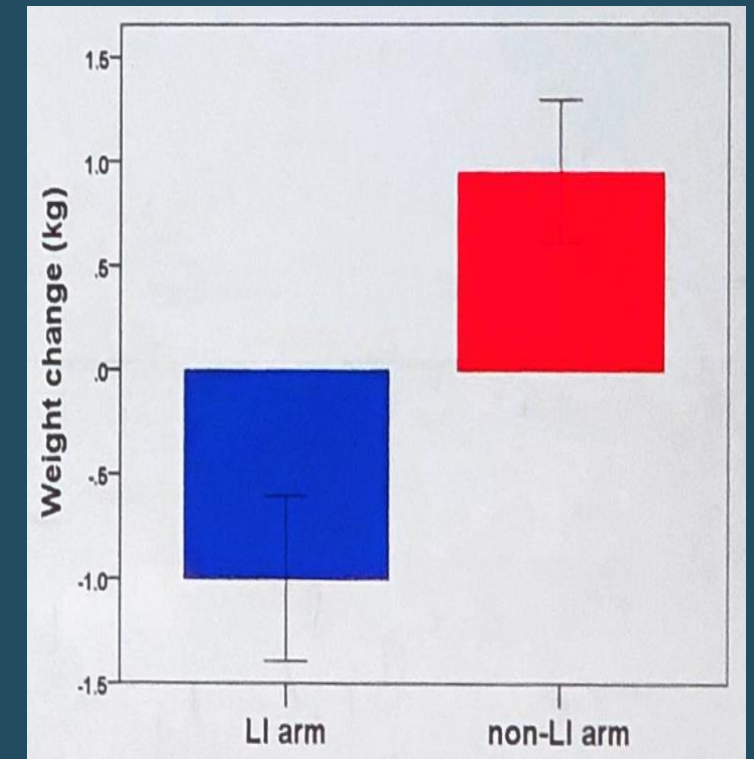
- **Weight loss of 5–10% of baseline weight** but not below a BMI of 22 kg/m²
 - at least 5% in those with a BMI between 24 and 30 kg/m²
 - 10% in those with a BMI \geq 30 kg/m²
- Caloric deficit of 500–1,000 kcal/day
- Fat intake of less than 20–25% of the total energy intake
- Progressive physical activity
 - gradual increase to 150–200 min of moderate physical activity per week
 - step-wise increase in physical activity.

The Lifestyle Intervention Program within SUCCESS C

- Weight change by lifestyle intervention arm-ITT analysis

LI arm (n=828): weight loss 1.0kg (95% CI -0.63 to -1.39)

non-LI arm (n=816): weight gain 0.95kg (95% CI 0.61 to -0.30)



The Lifestyle Intervention Program within SUCCESS C

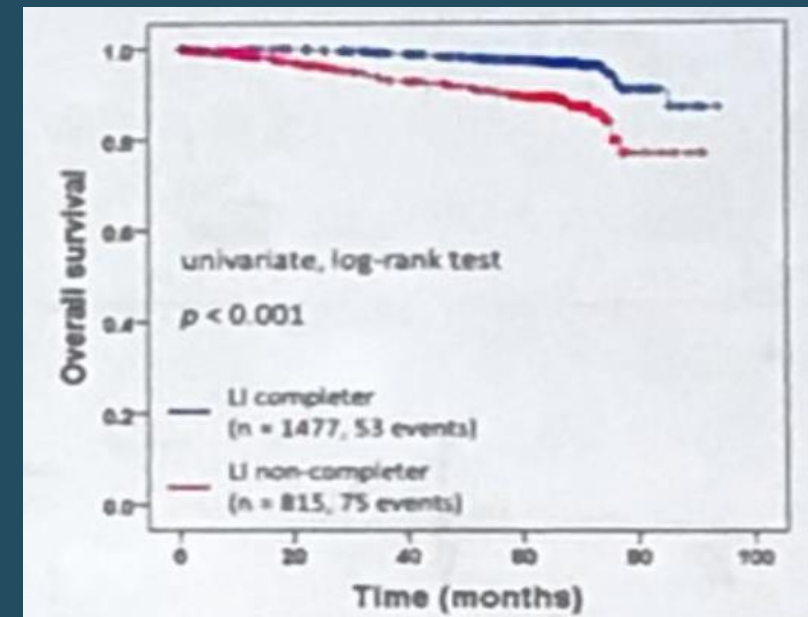
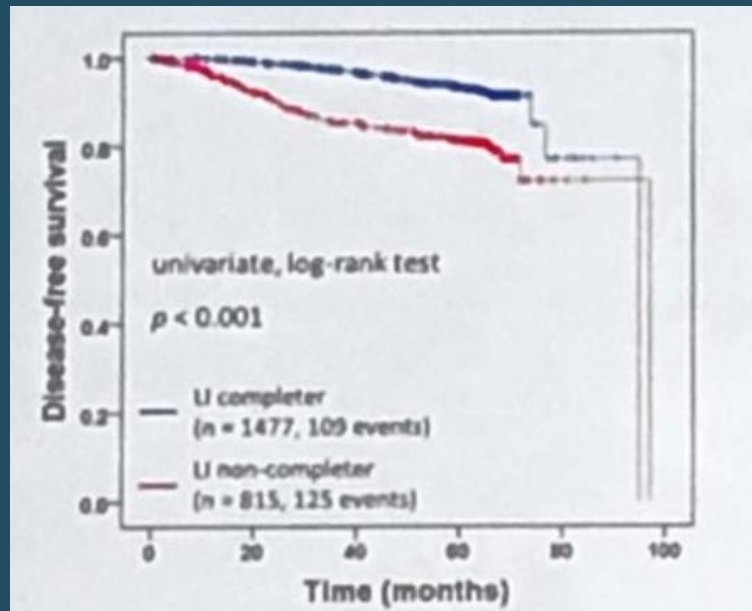
- Explorative subgroup analysis: Completion of 2 year of lifestyle intervention (yes/no)

Yes - Disease free survival: 64.4 month

No - Disease free survival: 58.9 month

Yes - Overall survival: 64.7 month

No - Overall survival: 63.3 month



Clinical Question 3

- Do interventions to promote intentional weight loss or avoidance of weight gain during cancer treatment safely improve outcomes related to quality of life, treatment toxicity, or cancer control?

Recommendation 3.

- There is currently insufficient evidence to recommend for or against intentional weight loss or prevention of weight gain interventions during active treatment to improve outcomes related to quality of life, treatment toxicity, or cancer control.

No recommendation

Evidence Quality	Strength of Recommendation
Insufficient	N/A

- *Note:* The Expert Panel felt strongly that the current lack of evidence regarding diet and weight management interventions during cancer treatment should be a call to conduct more research in these critical areas. Diet and weight management strategies that provide health benefits to the general population could also provide important benefits to people who are undergoing cancer treatment. The Expert Panel is not discouraging clinicians from discussing healthy diet and weight^{1,7} with their patients, but did refrain from making specific recommendations, given gaps in the evidence.

Cancer survivorship, excess body fatness and weight-loss intervention

—where are we in 2020?

- Of **early-stage breast-cancer patients receiving chemotherapy, 30–60% gain significant weight**. This weight gain involves **losing skeletal muscle while gaining adiposity** and adversely impacts quality of life and overall health.
- Young breast-cancer patients **can gain over 5% body weight in the first 12 months after diagnosis**, which is associated with **changes in eating habits** resulting from emotional stress as well as the side effects of treatments (e.g., steroids and chemotherapy-induced menopause, cancer-related fatigue and reduced physical activity).
- Clearly, interventions that provide the support needed to help patients **avoid or limit unintentional weight gain during treatment and/or facilitate excess body fatness loss following completion of treatment whilst maintaining adequate levels** of **physical activity** would be valuable adjuncts to curative cancer-care pathways.

Association among the Prevalence of Sarcopenia without Obesity, Nonsarcopenic Obesity, Sarcopenic Obesity, and Metabolic Syndrome in Cancer Survivors

: Based on Korea National Health and Nutrition Examination Survey

- Sarcopenic obesity group had the highest metabolic syndrome rate.

Table 2: The comparisons of metabolic syndrome factors among participants with sarcopenia without obesity, nonsarcopenic obesity and sarcopenic obesity (n=318)

Category	Mean ± SD			F or χ^2	P
	Sarcopenia without obesity (n=87)	Nonsarcopenic obesity (n=133)	Sarcopenic obesity (n=98)		
Waist circumference (cm)	80.93±5.22	91.07±4.73	92.97±6.00	13.832	0.000*
Triglyceride (mg/dL)	152.42±87.87	163.79±106.74	161.79±84.18	0.320	0.726
HDL cholesterol (mg/dL)	47.80±11.96	47.28±12.20	48.25±11.39	0.171	0.843
Blood pressure (mmHg)					
Systolic	127.11±18.84	126.17±17.12	127.47±16.67	0.171	0.843
Diastolic	77.03±9.42	78.10±9.94	78.77±10.23	0.714	0.491
Fasting glucose (mg/dL)	103.77±24.58	110.01±34.68	112.78±31.71	1.635	0.197
Metabolic syndrome, n (%)					
Yes	22 (25.3)	82 (61.7)	66 (67.3)	38.939	0.000*
No	65 (74.7)	51 (38.3)	32 (32.7)		

*P<0.005. HDL: High-density lipoproteins, SD: Standard deviation

Optimal weight for cancer survivor?



BMI is used to broadly define different weight groups in adults 20 years old or older.

- **Underweight:** BMI is less than 18.5
- **Normal weight:** BMI is 18.5 to 24.9
- **Overweight:** BMI is 25 to 29.9
- **Obese:** BMI is 30 or more

표 1. 한국인에서 체질량지수와 허리둘레에 따른 비만 동반 질환 위험도

분류*	체질량지수 (kg/m ²)	허리둘레에 따른 비만 동반 질환의 위험도	
		<90 cm(남자) <85 cm(여자)	≥90 cm(남자) ≥85 cm(여자)
저체중	<18.5	낮음	보통
정상	18.5~22.9	보통	약간 높음
비만전단계	23~24.9	약간 높음	높음
1단계 비만	25~29.9	높음	매우 높음
2단계 비만	30~34.9	매우 높음	가장 높음
3단계 비만	≥35	가장 높음	가장 높음

*비만전단계는 과체중 또는 위험체중으로, 3단계 비만은 고도비만으로 볼 수 있다.

Exercise

Weight Management and Exercise for the Cancer Survivor

- Another key component for **weight loss and especially maintenance of weight loss** is **physical activity**.
- Exercise recommendations for cancer survivors are to include
 - at least **150 minutes/week** of **aerobic exercise** and
 - at least **2 days/week** of **strength training**

Recommendation 1.1

- Oncology providers should recommend aerobic and resistance exercise during active treatment with curative intent to mitigate side effects of cancer treatment.

Evidence-based
benefits outweigh harms

Evidence Quality
Moderate -
Low

Strength of
Recommendation
Strong

Note: Exercise interventions during active treatment reduce fatigue; preserve cardiorespiratory fitness, physical functioning, and strength; and in some populations, improve quality of life and reduce anxiety and depression. In addition, exercise interventions during treatment have low risk of adverse events. Evidence was not sufficient to recommend for or against exercise during treatment to improve cancer control outcomes (recurrence or survival) or treatment completion rates

Exercise Guidelines for Cancer Survivors

Consensus statement from International Multidisciplinary Roundtable

Effects of exercise for cancer survivors

ASCO Guidelines

EXERCISE, DIET, AND WEIGHT MANAGEMENT

EXERCISE RECOMMENDATION HIGHLIGHTS

Oncology providers should recommend aerobic and resistance exercise during active treatment with curative intent to mitigate side effects of cancer treatment

Exercise interventions during active treatment:

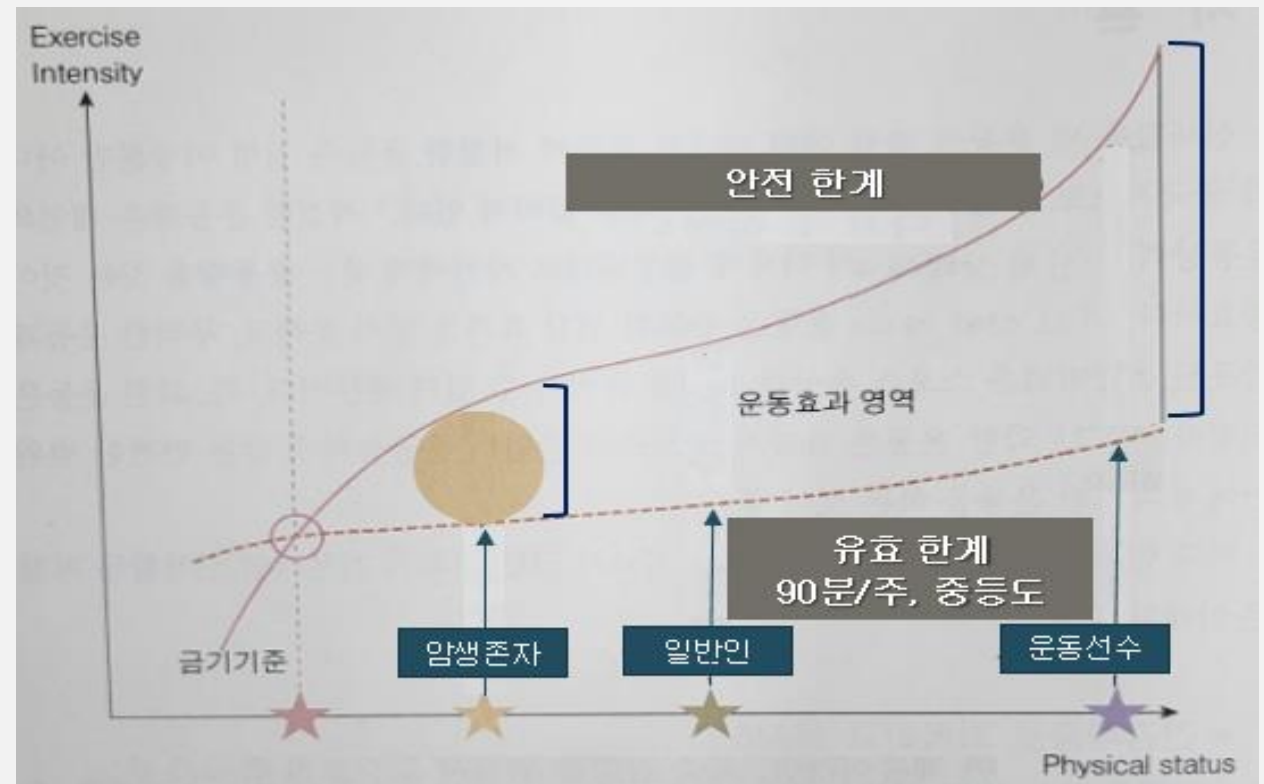
- Reduce fatigue
- Preserve cardiorespiratory fitness, physical functioning, and strength
- Improve quality of life & reduce anxiety and depression in some populations
- Have a low risk of adverse events

- | |
|--|
| • Anxiety |
| • Bone health |
| • Cardiotoxicity |
| • Chemotherapy-induced peripheral neuropathy |
| • Cognitive function |
| • Depressive symptoms |
| • Falls |
| • Fatigue |
| • Health-related quality of life |
| • Lymphedema |
| • Nausea |
| • Pain |
| • Physical function |
| • Sexual function |
| • Sleep |
| • Treatment tolerance |

Exercise Guidelines for Cancer Survivors

Exercise Efficacy Zone

- 적절한 운동의 강도
: '유효 한계'와 '안전 한계' 사이
- 유효 한계
: 운동 목적에 따라 다르다
physical state에 따라 다르다



Exercise Guidelines for Cancer Survivors

Consensus statement from International Multidisciplinary Roundtable

evidence-based FITT (frequency, intensity, time, type) prescriptions



Aerobic

- **Intensity: Moderate**
- **Time:** at least **30 minutes**
- **Frequency:** at least **3 times per week**
for at least 8–12 weeks



Resistance

- **Intensity:** at least **60% of one repetition maximum**
- **Time:** at least **2 sets of 8–15 repetitions**
- **Frequency:** at least **2 times per week**

Intensity of exercise

Moderate intensity

- 3~<6 METs
- RPE= 5~6
- 40~59% HRR
- 64~76% HRmax

- Walking briskly
- dancing
- Playing double tennis
- Raking the yard
- Slow swimming

Vigorous intensity

- >6 METs
- RPE= 7~8
- 60~84 HRR
- 77~93% HRmax

- Jogging
- Other loads upstairs
- Strenuous fitness class
- Fast swimming

Exercise Guidelines for Cancer Survivors

Consensus statement from International Multidisciplinary Roundtable

Exercise testing recommendations

- **Ideally,** cancer survivors should receive a comprehensive assessment of all components of health-related physical fitness (i.e., cardiorespiratory fitness, muscle strength and endurance, body composition and flexibility)
- However, **no assessments are required** to start
 - **Low intensity aerobic training** (i.e., walking or cycling)
 - **Resistance training with gradual progression**
 - **Flexibility program**in most survivors.

- Standard exercise testing methods are generally appropriate for patients with cancer who do not require medical clearance or who have been medically cleared for exercise with the following considerations:
- Be familiar with the most common toxicities associated with cancer treatments including increased risk for fractures and cardiovascular events, along with neuropathies or musculoskeletal morbidities related to specific types of treatment
- The evidence-based literature indicates 1-RM testing is safe among survivors of breast and prostate cancer without bony metastases(6)
- Among patients with bony metastases or known or suspected osteoporosis routine assessments of muscle strength and/or endurance involving musculature that attaches to and/or acts on a skeletal site that contains bone lesions should be avoided(107).
- Older survivors and/or survivors treated with neurotoxic chemotherapy (typical for breast, colon, lung, ovarian cancers) may especially benefit from a standard assessment of balance and mobility to assess fall risk(108)
- CVD has become a competing cause of morbidity and mortality for survivors of cancer with a favorable prognosis(109). Given the potential for underlying CVD, cancer survivors should be screened for evident or underlying CVD using the ACSM pre-participation guidelines (see below) and if implicated have a cardiopulmonary exercise test prior to beginning an exercise program(110).

Exercise Guidelines for Cancer Survivors

암환자 운동 전 확인 및 조치

관상동맥질환, 부정맥, 빈맥(HR>100), 흉통, 심장질환 있는 경우

현재 감염성 질환이 있거나 열(BT>37.8°C)이 있는 경우

호흡곤란 발생

운동 1~2일 전에 발생한 구토, 설사

다리 통증 및 경련

최근 발생한 허리 및 목 통증 시

혈액검사 이상

- 빈혈 (Hb <10g/dL)
- 절대호중구 수 감소 (ANC <500)

어지러움, 균형감각 이상

심한 림프부종

24시간 이내에 항암치료 받은 경우

카테터가 있는 경우

방사선 치료 중

조절되지 않는 당뇨

심한 피곤함



운동 보류

운동 보류

운동 보류

운동 보류

운동 보류

뼈 전이 및 골절의 위험성 먼저 평가

- 가벼운 스트레칭 가능
- 공공장소 운동 피함

걷기 보다는 정지상태 자전거 타기가 안전

증상 있는 팔의 사용을 주의

운동 보류 / 스트레칭 정도

카테터 부위 근력 운동을 피함

치료 부위 자극을 피함 (수영장 염소 성분, 땀이 많이 나는 운동)

운동 보류

10분 정도의 스트레칭은 가능

Obesity in adults

a clinical practice guideline

Table 1 (part 2 of 5): Recommendations on

Physical activity in obesity management

- 26 Aerobic physical activity (30–60 minutes of moderate intensity) should be encouraged in adults who want to:
- Achieve small amounts of body weight and fat loss
 - Achieve reduction in abdominal visceral fat (level 1a, grade B) even in the absence of weight loss
 - Favour weight maintenance after weight loss
 - Favour the maintenance of fat-free mass during weight loss
 - Increase cardiorespiratory fitness (level 2a, grade B)
- 27 For adults living with overweight or obesity, regular physical activity can improve muscle mass or fat-free mass and mobility.
- 28 Increasing exercise intensity, including high-intensity interval training, can reduce the amount of time required to achieve weight loss.
- 29 Regular physical activity, with and without weight loss, can improve glycaemic control in adults who have overweight or obesity, including hyperglycaemia (level 1a, grade B) and dyslipidemia (level 2a, grade B).
- 30 Regular physical activity can improve health-related quality of life in adults living with overweight or obesity.

4. 운동치료

지침

1. 운동치료 전 심혈관, 대사성, 신장 질환의 증상이 있거나, 증상이 없더라도 심혈관, 대사성, 신장 질환이 있으면서 규칙적인 운동을 하고 있지 않은 경우에는 의사 상담 후에 운동을 시작하고, 그 외에는 의학적 허가없이 저-중강도부터 운동을 시행할 것을 권고한다. (A, Class I)
2. 체중 감량을 위해서 유산소운동은 최소 주당 150분 이상, 주당 3~5회 실시하고 근력운동은 대근육군을 이용하여 주 2~3회 실시하는 것을 권고한다. (A, Class I)
3. 체중 감량 효과상 유산소운동과 근력운동을 병행한 운동이 유산소운동 단독 및 근력운동 단독에 비해 효과적이므로 체중 감량을 위해서는 유산소운동과 근력운동을 병행하는 것을 권고한다. (A, Class I)
4. 효과적인 체중 감량을 위해서는 운동 외에 식사치료를 병행할 것을 권고한다. (A, Class I)

Management Guidelines for Obesity Management in Adults

Management

...tion
...ce energy intake by 500–1,000 kcal/day
...cal activity
...lly at least 150 min/week moderate aerobic
...ise combined with 1–3 sessions/week
...ance exercise
...itive behaviour therapy
...macotherapy
... ≥ 30 kg/m² or BMI ≥ 27 kg/m² with co-
...idities
...nct to lifestyle modification
...tric/metabolic surgery
...40 kg/m² or BMI between 35.0–39.9 kg/m² +
...orbidities or BMI between 30.0–34.9 kg/m²
...type 2 diabetes on individual basis. Consider
...er weight loss attempts fail; requires lifelong
...cal monitoring
...ention and treatment of co-morbidities

2020 August 4;192:E875-91. doi: 10.1503/cmaj.191707

Obes Facts 2015;8:402–424

Exercise, Diet, and Weight management during cancer treatment

TO REDUCE SYMPTOMS DURING AND SOON AFTER ANY TYPE OF CANCER TREATMENT:



- Build up to 30 minutes, 3x per week of aerobic activity like walking, cycling, water exercise, dancing or jogging at a level that increases your breathing rate and heart rate. AND/OR
- Do exercises that use and strengthen the muscles of your whole body at least two days per week.

TO IMPROVE ANXIETY:



- 3x weekly aerobic activity 30-60 minutes
- The combination of 3x weekly aerobic activity 30-60 minutes plus twice weekly muscle-strengthening (resistance) exercise 2 sets/8-15 reps

TO IMPROVE HEALTH-RELATED QUALITY OF LIFE



- 3x weekly aerobic activity 30-60 minutes
- Muscle-strengthening (resistance) exercise 2x per week, 2 sets/8-15 reps
- The combination of these.

TO IMPROVE CANCER RELATED FATIGUE:



- 3x weekly aerobic activity 30-60 minutes
- Muscle-strengthening (resistance) exercise 2x per week, 2 sets/8-15 reps
- The combination of these.

TO IMPROVE PHYSICAL FUNCTION:



- 3x weekly aerobic activity 30-60 minutes
- Muscle-strengthening (resistance) exercise 2x per week, 2 sets/8-15 reps
- The combination of these.

ASCO Guideline

Exercise, Diet, and Weight management during cancer treatment

TO IMPROVE SLEEP:



- 3 times weekly aerobic activity 30-60 minutes

TO IMPROVE DEPRESSION:



- 3 times weekly aerobic activity 30-60 minutes
- The combination of 3x weekly aerobic activity 30-60 minutes plus twice weekly muscle-strengthening (resistance) exercise 2 sets/8-15 reps

TO IMPROVE BONE HEALTH:



- Muscle-strengthening exercise 2x per week, 2 sets/8-15 reps

Diet

Clinical Question 2

- Does consuming a particular dietary pattern or food(s) during cancer treatment safely improve outcomes related to quality of life, treatment toxicity, or cancer control?

Recommendation 2.1

- There is currently insufficient evidence to recommend for or against dietary interventions such as ketogenic or low carbohydrate diets, low fat diets, functional foods, or fasting to improve outcomes related to quality of life, treatment toxicity, or cancer control.

Recommendation 2.2

- Neutropenic diets (specifically diets that exclude raw fruits and vegetables) are not recommended to prevent infection in cancer patients during active treatment.

No recommendation

Evidence Quality	Strength of Recommendation
Insufficient	N/A

Evidence-based
harms likely to outweigh benefits

Evidence Quality	Strength of Recommendation
Low	Weak

ASCO Guideline

Exercise, Diet, and Weight management during cancer treatment

Broad range of dietary interventions

- Changes in **timing** of food intake (eg, intermittent fasting)
- Changes in dietary **patterns**
- Changes in **macronutrient** composition (eg, low-fat or low-carbohydrate diets)
- Changes in **intake or omission** of particular foods



Failed to show consistent effects of dietary change on patient-reported or other outcomes in patients with cancer

Main findings: Studies of food intake and cancer-related outcomes.

- Evidence for or against specific foods or dietary patterns during cancer treatment is slim.
- Limited evidence suggests that dietary interventions during treatment may prevent weight gain for those at risk.
- Adequate nutritional status during treatment is associated with overall survival, although causation has not been demonstrated.

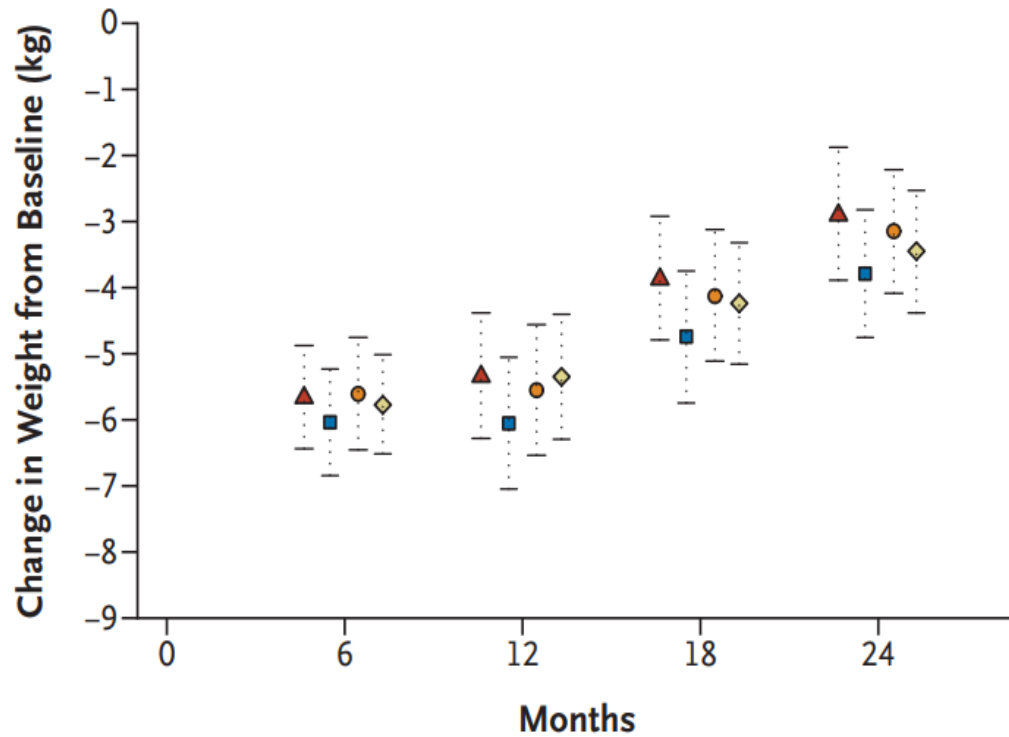
2-year POUNDS LOST (Preventing Overweight Using Novel Dietary Strategies) trial

- **Participants:** age 30~70 years, BMI 25~40 kg/m²
- Four diets: fat, protein, carbohydrates 20, 15, 65% / 20, 25, 55% / 40, 15, 45% / 40, 25, 35%
- Weight loss intervention: include 8% or less of saturated fat
at least 20 g of dietary fiber per day
150 mg or less of cholesterol per 1000 kcal.
Carbohydrate-rich foods with a low glycemic index
Each participant's caloric prescription represented a **deficit of 750 kcal per day**
- **Results:** At 6 months, **each diet** had lost an average of 6 kg, (- **7%** of their **initial weight**)
weight loss remained similar in those who were assigned to a diet
- **Conclusion:** **Reduced-calorie diets** result in clinically meaningful weight loss regardless of which macronutrients they emphasize.

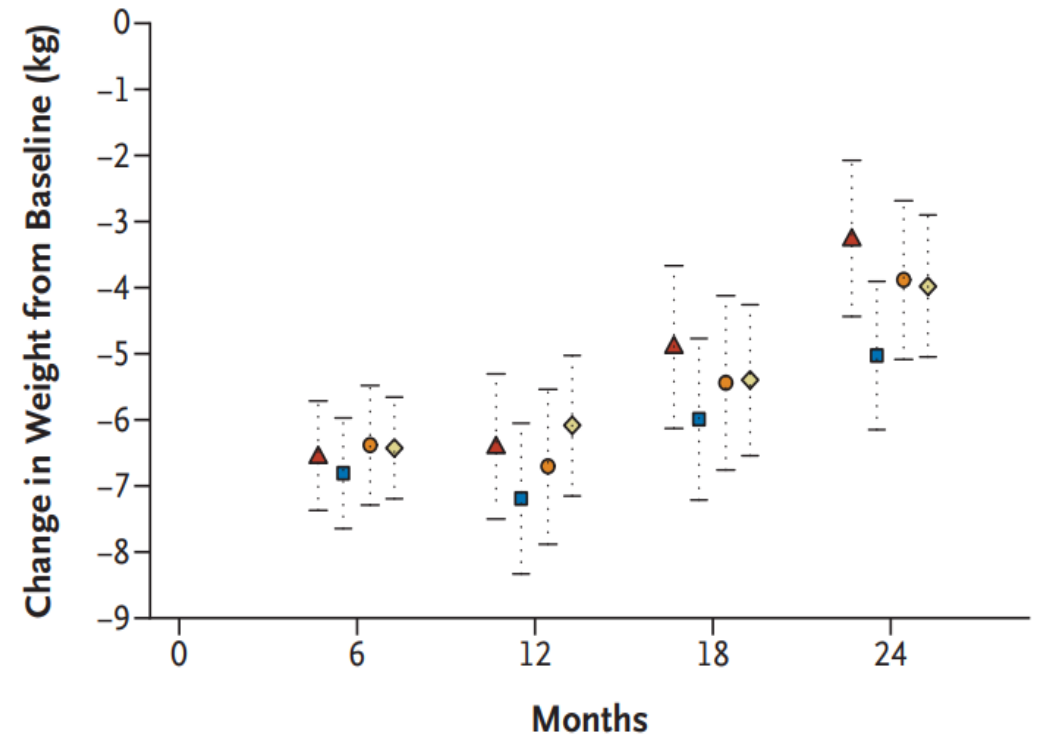
Diet and Cancer survivors

Carbohydrate/Protein/Fat: ▲ 65/15/20% ■ 55/25/20% ● 45/15/40% ◆ 35/25/40%

A All Participants



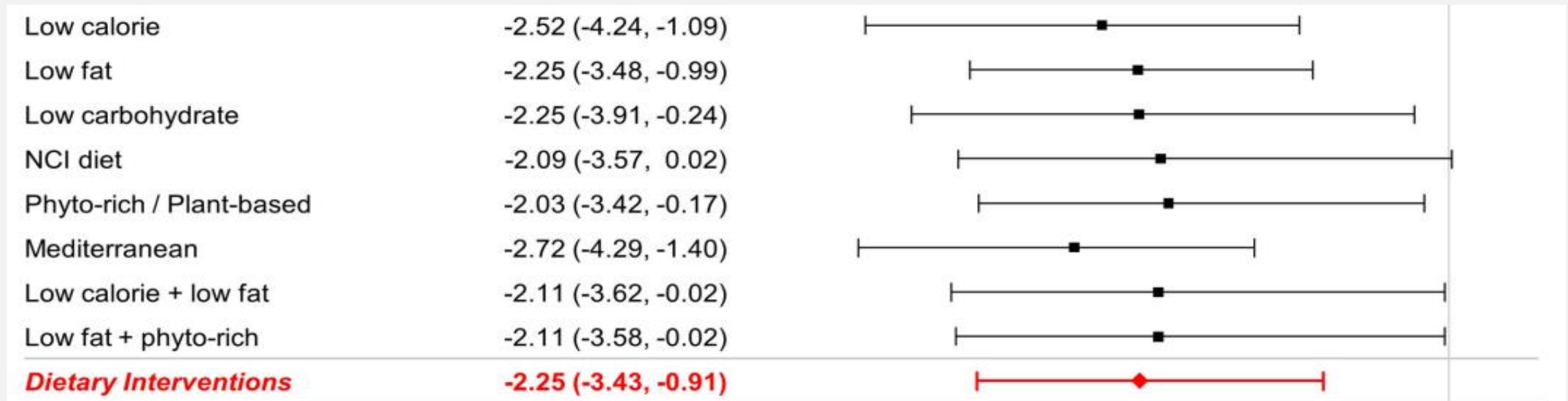
B Participants Who Provided Measurements at Various Time Points



Systematic review: Weight loss in cancer patients

Optimising weight-loss interventions in cancer patients_A systematic review and network meta-analysis

- **Objective:** To conduct a systematic review and network meta-analysis (NMA) of randomized controlled trials (RCTs) comparing the effects of exercise and dietary interventions alone or in combination on anthropometric measures of adult cancer patients and survivors.



All dietary interventions achieved a similar magnitude of weight loss
(MD range from -2.03kg to -2.52kg)

Effect of a Remotely Delivered Weight Loss Intervention in Early-Stage Breast Cancer : Randomized Controlled Trial

- **Participants:** Breast cancer survivors (stage I–III; body mass index 25–45 kg/m²)
Intervention arm (diet and physical activity, n=79) Vs Usual care (n = 80).
- **Intervention:** Aimed for weight loss of 5–10%
 - Reduce energy intake: 1200–1500 kcal/day
 - Reduce saturated fat (<7% total energy)
 - Increase vegetables and fruit (5 and 2 servings/day, respectively)
 - Limiting alcohol (≤1 serving/day)
 - Moderate-to-vigorous intensity aerobic activity to 210 in/week
 - Resistance exercise 2–3 sessions/week

Assessed at baseline, 6 months, 12 months, 18 months

Breast cancer survivors

Outcome	Timepoint	Intervention		Usual Care		Intervention Effect (Intervention—Usual Care)		
		<i>n</i>	Mean Change (95% CI)	<i>n</i>	Mean Change (95% CI)	Mean Difference (95% CI)	<i>p</i>	<i>d</i> ^a
Weight (% of baseline value)	Baseline M (SD)	79	83.9 (14.2)	80	83.6 (13.6)			
	6 months	73	−4.61 (−5.77, −3.44)	70	−0.52 (−1.70, 0.67)	−4.09 (−5.75, −2.43)	<0.001	−0.30
	12 months ^b	70	−5.06 (−6.46, −3.66)	60	−0.58 (−2.02, 0.85)	−4.48 (−6.48, −2.47)	<0.001	−0.32
	18 months	68	−3.69 (−5.23, −2.16)	60	−0.62 (−2.22, 0.97)	−3.07 (−5.28, −0.86)	0.007	−0.22
Weight (kg)	Baseline M (SD)	79	83.9 (14.2)	80	83.6 (13.6)			
	6 months	73	−3.74 (−4.71, −2.76)	70	−0.43 (−1.42, 0.56)	−3.31 (−4.70, −1.92)	<0.001	−0.24
	12 months ^b	70	−4.12 (−5.28, −2.96)	60	−0.52 (−1.71, 0.67)	−3.60 (−5.26, −1.94)	<0.001	−0.26
	18 months	68	−3.03 (−4.34, −1.73)	60	−0.56 (−1.91, 0.80)	−2.48 (−4.36, −0.59)	0.010	−0.18
Total fat mass (kg)	Baseline M (SD)	73	38.8 (10.4)	70	37.5 (10.2)			
	6 months	67	−3.13 (−3.97, −2.30)	62	0.13 (−0.73, 1.00)	−3.26 (−4.47, −2.06)	<0.001	−0.32
	12 months ^b	64	−3.27 (−4.26, −2.29)	54	0.05 (−0.98, 1.08)	−3.32 (−4.75, −1.90)	<0.001	−0.32
Total lean mass (kg)	Baseline M (SD)	73	42.8 (5.0)	70	43.6 (5.2)			
	6 months	67	−0.96 (−1.28, −0.63)	62	−0.24 (−0.57, 0.09)	−0.71 (−1.18, −0.25)	0.002	−0.14
	12 months ^b	64	−1.07 (−1.46, −0.68)	54	−0.52 (−0.93, −0.10)	−0.55 (−1.12, 0.02)	0.059	−0.11
Metabolic syndrome risk score	Baseline M (SD)	78	0.65 (0.60)	77	0.63 (0.59)			
	6 months	69	−0.19 (−0.27, −0.11)	65	0.03 (−0.05, 0.12)	−0.22 (−0.34, −0.10)	<0.001	−0.37
	12 months ^b	67	−0.18 (−0.27, −0.08)	56	0.01 (−0.09, 0.11)	−0.19 (−0.32, −0.05)	0.006	−0.32
Waist circumference (cm)	Baseline M (SD)	79	106.7 (11.7)	80	104.9 (10.4)			
	6 months	73	−3.47 (−4.95, −1.99)	70	−0.64 (−2.14, 0.87)	−2.83 (−4.94, −0.71)	0.009	−0.26
	12 months ^b	70	−5.50 (−7.11, −3.89)	60	−2.30 (−3.98, −0.62)	−3.20 (−5.53, −0.87)	0.007	−0.29
	18 months	68	−5.29 (−6.81, −3.78)	60	−2.50 (−4.08, −0.91)	−2.80 (−4.99, −0.61)	0.012	−0.25

American Cancer Society Guideline for Diet and Physical Activity for Cancer Prevention

TABLE 2. Evidence for the Role of Weight Management, Physical Activity, and Diet for the Prevention of Cancer by Site^a

CANCER SITE	WEIGHT MANAGEMENT	PHYSICAL ACTIVITY	DIET	ALCOHOL
Breast	<ul style="list-style-type: none"> Weight gain during adult life and/or excess body fatness increases risk after menopause (WCRF/AICR 2018⁴) Weight loss may lower risk (Chlebowski 2019⁹) 	<ul style="list-style-type: none"> Physical activity, especially moderate to vigorous, lowers risk for postmenopausal disease and also may lower risk for premenopausal disease; regular vigorous physical activity lowers risk for premenopausal disease (WCRF/AICR 2018,⁴ USDHSS 2019⁶) 	<ul style="list-style-type: none"> Dietary patterns rich in plant foods and low in animal products and refined carbohydrates lower risk (US Dietary Guidelines Advisory Committee 2015⁷); the Mediterranean diet pattern lowers risk (Toledo 2015⁸) Consumption of nonstarchy vegetables and/or vegetables rich in carotenoids may lower risk for estrogen receptor–negative breast tumors (WCRF/AICR 2018⁴); diets higher in calcium/calcium-rich dairy may reduce risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Alcohol consumption may increase risk of premenopausal breast cancer and increases risk of postmenopausal breast cancer (WCRF/AICR 2018⁴)
Colorectal	<ul style="list-style-type: none"> Excess body fatness increases risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Regular, moderate to vigorous physical activity lowers the risk of colon cancer, but not the risk of rectal cancer (WCRF/AICR 2018,⁴ USDHSS 2019⁶) Reducing sedentary behavior may lower risk of colon cancer, but not the risk of rectal cancer. (USDHSS 2019⁶) 	<ul style="list-style-type: none"> A healthy eating pattern with whole grains, higher fiber, and less added sugar lowers risk (WCRF/AICR 2018,⁴ US Dietary Guidelines Advisory Committee 2015⁷); consuming nonstarchy vegetables and whole fruits probably lowers risk (WCRF/AICR 2018⁴) Processed meat intake, even in small amounts, and red meat in moderate to high amounts, increases risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Alcohol consumption increases risk (WCRF/AICR 2018⁴)
Endometrial	<ul style="list-style-type: none"> Excess body fatness increases risk (WCRF/AICR 2018⁴) Weight loss may lower risk (WCRF/AICR 2018,⁴ Luo 2017¹²) 	<ul style="list-style-type: none"> Regular, moderate to vigorous physical activity lowers risk (WCRF/AICR 2018,⁴ USDHSS 2019⁶) Reducing sedentary time may lower risk (WCRF/AICR 2018,⁴ USDHSS 2019^{6,13}) 	<ul style="list-style-type: none"> Consuming nonstarchy vegetables and whole fruits probably lowers risk (WCRF/AICR 2018⁴) Consume diets higher in calcium/calcium-rich dairy foods (WCRF/AICR 2018⁴); supplemental calcium may lower risk (WCRF/AICR 2018⁴) Low circulating levels of vitamin D (<30 nmol/L) may increase risk (McCullough 2019¹⁰) Eating a diet with low glycemic load (avoiding sweets, high-sugar/low-fiber foods, and sweetened beverages) may reduce risk (WCRF/AICR 2018⁴) 	
Gallbladder	<ul style="list-style-type: none"> Excess body fatness may increase risk (WCRF/AICR 2018⁴) Adult weight gain may increase risk (Campbell 2017¹⁴) 			
Kidney	<ul style="list-style-type: none"> Excess body fatness increases risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Regular, moderate to vigorous physical activity lowers risk (USDHSS 2019⁶) 		
Liver	<ul style="list-style-type: none"> Excess body fatness increases risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Regular physical activity may lower risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Consumption of fish may lower risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Alcohol consumption increases risk (WCRF/AICR 2018⁴)

American Cancer Society Guideline for Diet and Physical Activity for Cancer Prevention

CANCER SITE	WEIGHT MANAGEMENT	PHYSICAL ACTIVITY	DIET	ALCOHOL
Lung		<ul style="list-style-type: none"> Regular moderate to vigorous physical activity may lower risk (WCRF/AICR 2018,⁴ USDHSS 2019⁶) Reducing sedentary behavior may lower risk (USDHSS 2019⁶) 	<ul style="list-style-type: none"> Consuming nonstarchy vegetables and whole fruits, including those high in vitamin C (especially for smokers), probably lowers risk (WCRF/AICR 2018⁴) Processed and red meat may increase risk (WCRF/AICR 2018⁴) High-dose β-carotene supplementation increases risk, particularly among smokers and those exposed to asbestos (WCRF/AICR 2018⁴) 	
Ovary	<ul style="list-style-type: none"> Excess body fatness may increase risk (WCRF/AICR 2018⁴) Adult weight gain increases risk (Keum 2015¹⁵) 	<ul style="list-style-type: none"> Regular moderate to vigorous physical activity may lower risk (USDHSS 2019⁶) 		
Pancreas	<ul style="list-style-type: none"> Excess body fatness increases risk (WCRF/AICR 2018⁴) Adult weight gain increases risk (Genkinger 2015¹⁶) 	<ul style="list-style-type: none"> Regular moderate to vigorous physical activity may lower risk (USDHSS 2019⁶) 	<ul style="list-style-type: none"> Processed and red meats as well as saturated fats in general may increase risk (WCRF/AICR 2018⁴) Sugar-sweetened beverages may increase risk (WCRF/AICR 2018⁴) 	
Prostate	<ul style="list-style-type: none"> Excess body fatness increases risk of advanced prostate cancer (WCRF/AICR 2018⁴) 		<ul style="list-style-type: none"> Higher consumption of dairy products and calcium (>2000 mg/d) may increase risk (WCRF/AICR 2018,⁴ Wilson 2015¹⁷) 	
Thyroid	<ul style="list-style-type: none"> Excess body fatness may increase risk (Steele 2017¹⁸) Adult weight gain increases risk (Kitahara 2016¹⁹) 			
Stomach/ gastric	<ul style="list-style-type: none"> Excess body fat increases risk for gastric cardia cancer (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Regular moderate to vigorous physical activity may lower risk (USDHSS 2019⁶) 	<ul style="list-style-type: none"> Regular intake of processed, grilled, or charcoaled meats increases risk for noncardia gastric cancer (WCRF/AICR 2018⁴) Intake of nonstarchy vegetables and whole fruits, especially citrus fruits, probably lowers risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Alcohol consumption may increase risk (WCRF/AICR 2018⁴)
Upper aerodigestive	<ul style="list-style-type: none"> Excess body fatness increases risk of esophageal adenocarcinoma (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Regular moderate to vigorous physical activity may lower risk of esophageal adenocarcinoma (WCRF/AICR 2018,⁴ USDHSS 2019⁶) 	<ul style="list-style-type: none"> Consumption of nonstarchy vegetables and whole fruits probably lowers risk (WCRF/AICR 2018⁴) 	<ul style="list-style-type: none"> Alcohol consumption increases risk of oral cavity, pharynx, and larynx cancers, and squamous cell carcinoma of the esophagus (WCRF/AICR 2018⁴)

American Cancer Society Guideline for Diet and Physical Activity for Cancer Prevention

- Diverse healthful dietary patterns have unique features however, they share a **foundation** of mostly.....

Plant foods

(non-starchy vegetables, whole fruits, whole grains, legumes, and nuts/seeds)

Healthy protein sources

(higher in legumes and/or fish and/or poultry, lower in processed meats and red meat)

Unsaturated fat

lower in added sugar, saturated and/or trans fats

Weight Management and Exercise for the Cancer Survivor

2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults

- Energy deficit of **500–750 kcal/day**

Women
1200–1500
kcal/day

Men
1500–1800
kcal/day



average **weight loss** of **0.5–0.75 kg/wk**

- Restricts certain food types
 - high carbohydrate foods, low-fiber foods or high fat foods

- **Select** dietary approaches that are associated with weight loss

Higher protein diet
(25% protein, 30% fat, 45% carbohydrate)

Lower-calorie diet with prescribed
energy restriction

Low-glycemic load diet

Low-fat vegan-style diet
(10–25% of total calories from fat)

Low-fat diet
(<20% of total calories from fat)

Mediterranean-style diet

2020 한국인 영양섭취기준

표 41 | 생애주기별 권장식사패턴 B (우유·유제품 1회 권장, B타입)

에너지(kcal)	곡류	고기·생선·달걀·콩류	채소류	과일류	우유·유제품	유지·당류
1,000	1.5	1.5	5	1	1	2
1,100	1.5	2	5	1	1	3
1,200	2	2	5	1	1	3
1,300	2	2	6	1	1	4
1,400	2.5	2	6	1	1	4
1,500	2.5	2.5	6	1	1	4
1,600	3	2.5	6	1	1	4
1,700	3	3.5	6	1	1	4
1,800	3	3.5	7	2	1	4
1,900	3	4	8	2	1	4
2,000	3.5	4	8	2	1	4
2,100	3.5	4.5	8	2	1	5
2,200	3.5	5	8	2	1	6
2,300	4	5	8	2	1	6
2,400	4	5	8	3	1	6
2,500	4	5	8	4	1	7
2,600	4	6	9	4	1	7
2,700	4	6.5	9	4	1	8

100kcal 감소

-> 밥 1/3 공기(밥 70g) 감소 / 우유 1회 분량(125kcal) 감소

50kcal 감소

-> 과일 1회 분량(귤 1개, 사과 1/2개) 감소 / 유지류 1회 분량(45kcal) 감소

식품군 및 기준 영양소 값	식품군	1인 1회 분량					
곡류 (300kcal)	곡류						
고기·생선·달걀·콩류 (100kcal: 단백질 10g)		쌀밥 (210g)	백미 (90g)	국수 (말린 것) (90g)	냉면국수(말린 것) (90g)	가래떡 (150g)	식빵 1쪽* (35g)
채소류 (15kcal)	고기·생선·달걀·콩류						
과일류 (50kcal)		쇠고기 (생 60g)	닭고기 (생 60g)	고등어 (생 70g)	대두 (20g)	두부 (80g)	달걀 (60g)
우유·유제품류 (125kcal)	채소류						
유지·당류 (45kcal)		콩나물 (생 70g)	시금치 (생 70g)	배추김치 (생 40g)	오이소박이 (생 40g)	느타리버섯 (생 30g)	미역(마른 것) (10g)
	과일류						
		사과 (100g)	귤 (100g)	참외 (150g)	포도 (100g)	수박 (150g)	대추(말린 것) (15g)
	우유·유제품류						
		우유 (200ml)	치즈 1장* (20g)	호상요구르트 (100g)	액상요구르트 (150g)	아이스크림/셔벗 (100g)	
	유지·당류						
		콩기름 1작은술 (5g)	버터 1작은술 (5g)	마요네즈 1작은술 (5g)	커피믹스 1회 (12g)	설탕 1큰술 (10g)	꿀 1큰술 (10g)

*표시는 0.3회, †표시는 0.5회

2020 한국인 영양섭취기준

메뉴	분량	아침	점심	저녁	간식
		닭죽 마늘종볶음 브로콜리데침 동치미	잡곡밥 배추국 소고기장조림 시금치나물 열무김치	쌀밥 아욱된장국 고등어구이 미역초무침 배추김치	찐감자 바나나 우유
곡류	2.5회	쌀밥 126g (0.6)	잡곡밥 168g (0.8)	쌀밥 168g (0.8)	감자 140g (0.3)
고기·생선·달걀·콩류	2.5회	닭고기 30g (0.5)	소고기 60g (1)	고등어 60g (1)	
채소류	6회	당근 21g (0.3) 마늘종 35g (0.5) 브로콜리 35g (0.5) 동치미 40g (1)	배추 35g (0.5) 시금치 35g (0.5) 열무김치 40g (1)	아욱 35g (0.5) 미역(마른 것) 2g (0.2) 배추김치 40g (1)	
과일류	1회				바나나 100g (1)
우유·유제품류	1회				우유 200mL (1)
유지·당류	4회	유지 및 당류는 조리 시 가급적 적게 사용 할 것을 권장함			

총 에너지(kcal): 1428.2kcal; 탄수화물, 단백질, 지방 섭취비율(%): 탄수화물(56.7%), 단백질(20.1%), 지방(23.2%)

구분	식단	식단사진	
		식사	간식
아침	닭죽 마늘종볶음 브로콜리데침 동치미		찐감자 바나나 우유
점심	잡곡밥 배추국 소고기장조림 시금치나물 열무김치		
저녁	쌀밥 아욱된장국 고등어구이 미역초무침 배추김치		

Drug therapy

ASCO Guideline

Exercise, Diet, and Weight management during cancer treatment

- The most important of these are glucagon-like peptide-1 (GLP-1) analogue liraglutide and semaglutide.
- Although there is paucity of research of the long-term safety of GLP-1 analogues in cancer survivors, it is a reasonable option in **diabetic cancer survivors with excess body weight or those who are normoglycemic but failed other weight reduction measures.**
- Other drugs: orlistat, the phentermine–topiramine combination, the bupropion–naltrexone combination, benzphetamine, phendimetrazine, and diethylpropion.
-> they have more side effects, drug interactions, and several contraindications.

ASCO Guideline

Exercise, Diet, and Weight management during cancer treatment

Drug [28,156]	Mechanism of Action	Dose	Weight Change Relative to Placebo	Side Effects
Semaglutide	glucagon-like peptide 1 receptor (GLP1R) agonists, decreases appetite and delays gastric emptying and gut motility	2.4 mg once per week subcutaneous injection	2.4% to 14.9%	abdominal pain, constipation, diarrhea, nausea, vomiting, and pancreatitis (rare)
Liraglutide	GLP1R agonists, decreases appetite and delays gastric emptying and gut motility	3.0 mg per day subcutaneous injection	2.6% to 8%	diarrhea, nausea, vomiting, constipation, dyspepsia, abdominal pain, pancreatitis, and gallstones
Naltrexone SR/bupropion SR	Opioid receptor antagonist/dopamine and noradrenaline reuptake inhibitor causing appetite suppression	32 mg/360 mg oral twice daily	dose dependent 1.3% to 6.1%	headaches, hypertension, sleep disorders, nausea, constipation, vomiting, diarrhea, palpitation, dizziness, tremor, and others
Orlistat	Pancreatic lipase inhibitor causing excretion of 30% of ingested triglycerides in stool	120 mg 3 times daily	6.1% to 10.2%	nausea, diarrhea, steatorrhea, abdominal bloating, and hepatitis
Phentermine/topiramate	Sympathomimetics/anticonvulsant causing appetite suppression	15 mg/92 mg once daily oral	dose depending 1.2% to 7.8%	tachycardia, xerostomia, constipation, headache, sleep disorder, anxiety, depression, suicidal ideation, and cardiovascular event
Phendimetrazine	Sympathomimetics causing appetite suppression	Short-term (≤ 12 weeks) 17.5 to 35 mg 2 or 3 times daily	Not available	hypertension, ischemic events, palpitations, tachycardia, headache, insomnia, overstimulation, psychosis, and others

ASCO Guideline

Exercise, Diet, and Weight management during cancer treatment

- A systemic review and meta-analysis : **bariatric surgery was associated with a 55% reduction in cancer risk.**
- The advantages of bariatric surgery might only apply to malignancies linked to obesity, such as those of the breast and endometrium, where the average risk reduction is 38% ($p = 0.0001$).
- In contrast, the benefits of bariatric surgery are significantly more moderate (9%) among malignancies unrelated to obesity, such as those of the lung and bladder; this level of risk reduction is comparable to that of individuals who do not undergo bariatric surgery ($p = 0.37$).

American Cancer Society Guideline for Diet and Physical Activity for Cancer Prevention

- All cancer survivors are advised to adhere to the World Cancer Research Funds/AICR recommendations.

maintain a healthy weight

be physically active

eat a diet rich in fruits, vegetables, and whole grains

limit consumption of red and processed meats; sugar-sweetened beverages; fast foods high in fat, starches, or sugars; and alcohol

do not rely on dietary supplements for cancer prevention

TABLE 2. American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Survivors

Achieve and maintain a healthy weight.

- If overweight or obese, limit consumption of high-calorie foods and beverages and increase physical activity to promote weight loss.

Engage in regular physical activity.

- Avoid inactivity and return to normal daily activities as soon as possible following diagnosis.
- Aim to exercise at least 150 minutes per week.
- Include strength training exercises at least 2 days per week.

Achieve a dietary pattern that is high in vegetables, fruits, and whole grains.

- Follow the American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention.

감사합니다.