

자궁내막암 환자를 위한 예방적 재활운동의 실행가능성과 수용성

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Feasibility and Acceptability of Prehabilitation before Surgery for Endometrial Cancer

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Purpose: To investigate the safety of and adherence to a prehabilitation program among patients with endometrial cancer and to provide preliminary evidence of the program's efficacy in terms of health-related fitness (HRF) and patient-reported outcomes.

Methods: Nineteen patients with endometrial cancer were recruited in a 2-week trial for a one-on-one supervised exercise program. All patients participated in an individual exercise program—the Challenge, Overcome, Resolve, and Enhance (CORE) program—which consisted of 60 minutes of moderate-to-vigorous intensity resistance, core stability, and aerobic exercise, supervised five times within 2 weeks before surgery.

Results: Seventeen (89.5%) of the 19 participants completed the CORE program, and no adverse events occurred. All participants accomplished the daily mean step counts and sustained the prescribed target heart rate (reserve 50%–60%) during the CORE program sessions. Participants who completed the exercise program exhibited significantly improved HRF (cardiorespiratory fitness, 30-second chair stand, hand grip strength, curl-ups, sit and reach, single-leg standing with closed eyes; $p < 0.001$ for all) without changes in the body mass index ($p = 0.113$). Their quality of life (general, $p = 0.001$; function, $p = 0.001$; symptom, $p = 0.003$), symptom clusters ($p = 0.006$), anxiety ($p < 0.001$), and depression ($p < 0.001$) were significantly improved.

Conclusion: The 2-week prehabilitation CORE program is safe and feasible for patients scheduled to undergo surgery for early-stage endometrial cancer and may improve their physical and psychological health status.

Keywords: Endometrial neoplasms, Exercise, Physical fitness, Prehabilitation, Quality of life

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Introduction

The Korea Central Cancer Registry (KCCR), launched 1980 as a nationwide hospital based cancer registry by the Ministry of Health and Welfare, was escalated in 1999 to cover the whole population¹. The KCCR currently provides the nationwide cancer incidence, survival, and prevalence statistics annually. The age standardized rates (ASRs) for gynecologic cancer was 23.7 per 100,000 in 1999 and decreased to 21.0 in 2010. The incidence of cervical cancer has decreased from 16.3 to 10.6 per 100,000 females between 1999 and 2010 according to the KCCR and the Gynecologic Oncology Committee of Korean Society of Obstetrics and Gynecology. However, the ASRs incidence of endometrial cancer has increased steadily from 2.4 to 4.6 between 1999 and 2010².

The U.S. Physical Activity Guidelines Advisory Committee found strong evidence that physical activity (PA) is associated with a lower risk of endometrial cancer³. Participants who participate in PA for 90th percentile (7.5–15.0 metabolic equivalent of task [MET] hours per week) have 20%–40% decreased risk compared to those who participate in PA for 10th percentile (less than 3 MET hours per week)^{4,5}. Moreover, low level of preoperative PA level and health-related fitness (HRF) are associated with poorer postoperative outcomes⁶. In this regard, it is necessary to consider the preoperative PA and HRF evaluation and intervention, due to the endometrial cancer has a good prognosis with overall 5-year survivor rate of 84.8% in Korea⁷.

The burden of the stress of cancer and surgery is notable during the recovery period, and is characterized by fatigue, pain, reduced mobilization and decrease in psychological health. Poor preoperative physical performance has been shown to increase the number of postoperative complications⁸ and the risk of mortality⁹. PA across the cancer continuum is supported by a growing scientific evidence that demonstrates its potential to improve health status. Cancer prehabilitation has been defined as a process on the cancer continuum of care that occurs between the time of cancer diagnosis and the beginning of acute treatment and includes physical and psychological assessments that establish a baseline functional level, identify impairments, and provide interventions that promote physical and psychological health to reduce the incidence and/or severity of future impairments¹⁰.

However, cancer prehabilitation in different settings require more investigation.

Given this evidence, prehabilitation (exercise interventions) that can improve preoperative HRF and patient reported outcomes (PROs) may have considerable clinical benefit for endometrial cancer patients undergoing surgery. However, to our knowledge to, no reported study has investigated the effects of preoperative exercise intervention in this clinical population. Therefore, the purpose of this study was to investigation the feasibility and potential efficacy of a 2-week supervised prehabilitation program consisting of combined whole body strength and core exercise with walking based aerobic exercise in patients with endometrial cancer scheduled to receive surgery.

Methods

1. Study participants

The current study was conducted between November 2016 and October 2017 at three different hospitals: Seoul National University Hospital, CHA Gangnam Medical Center, and Korea University Anam Hospital, Korea. Prior to entry into the study, obtaining approval from the Institutional Review Boards of the three hospitals respectively (IRB No. H1607-147-778; GCI-16-48; 2016AN0288), participants who awaiting surgery were recruited. Written informed consent was obtained from all participants prior to participation. Women who declined to participate in the study or had difficulty of mobility were excluded from this study. The eligibility criteria included age ≥ 20 ; at least 2 weeks between diagnosis of cancer and surgery date to allow time for prehabilitation; absence of any neuromuscular and cognitive disorder for exercising and ability to access PA tracker and application. A total of 23 patients were recruited for the study. Primary reasons for declining to participate were lack of time ($n=2$) and interfere with job ($n=2$). Of these 19 participants, two participants excluded from analyses because the surgery schedule was shortened and they failed to complete the Challenge, Overcome, Resolve, and Enhance (CORE) program intervention. The remaining 17 participants completed assessments undertaken at baseline and after intervention (Fig. 1).

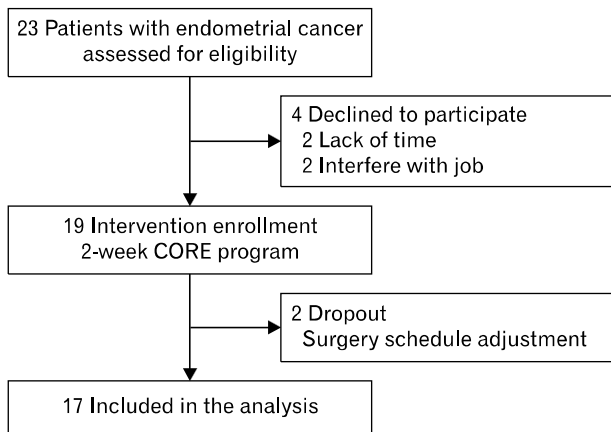


Fig. 1. Challenge, Overcome, Resolve, and Enhance (CORE) program intervention flow diagram.

2. Prehabilitation intervention

The prehabilitation program, Challenge, Overcome, Resolution, Enhancement; CORE (Table 1), was composed of dynamic warm-up, whole body strength exercise, core exercise and cool-down. Five-minute dynamic warm-up consisting of moderate-intensity aerobic exercise and stretching. This was followed by a 30-minute tailored resistance exercise program, total 14 sub-categorical exercise, that targeted the major upper and lower body muscle groups included push-ups, squat, bent over row, lunge, lateral raise, calf raise, and arm curl. Core exercise included core stability exercise (plank, bird, and side plank) and conventional core exercise (crunch, bridge, hip flexor, and hip adduction). Participants performed three sets per exercise at 12 repetition maximum, and core stabilizing exercise performed 30 seconds, with a 120 seconds rest between sets, and the exercise intensity increased progressively. Walking based aerobic exercise was undertaken 10,000 steps per day, and CORE program and half of walking steps targeted for moderate-to-vigorous intensity (50%–60% of maximal heart rate [HR] calculated from the Karvonen formula). Lastly, the 5-minute cool-down session was applied deep core breathing and whole body stretching. Participants conducted one-on-one supervised session from a certified personal trainer who ensured safety and adherence to correct exercise motions and techniques. As well, apart from participants are asked to do extra home based CORE program if they want and able to do. Participants received booklet with written and photographic description of the CORE exercise. CORE program intensity was monitored with rating of perceived exertion and HR by PA tracker

Table 1. CORE program

CORE program		
Dynamic warm-up, 5 min		
Whole-body resistance exercise*	Group	Reps
1. Push up	Upper	12 reps
2. Squat	Lower	12 reps
3. Bent over row	Upper	12 reps
4. Lunge	Lower	12 reps
5. Lateral raise	Upper	12 reps
6. Calf raise	Lower	12 reps
7. Arm curl	Upper	12 reps
8. Rest		120 sec
Core exercise*		
1. Hip Flexor	Core	12 reps
2. Crunch	Core	12 reps
3. Bird	Core	30 sec
4. Plank	Core	30 sec
5. Side plank	Core	30 sec
6. Bridge	Core	12 reps
7. Hip adduction	Core	12 reps
8. Rest		
Cool-down and stretching, 10 min		120 sec

CORE: Challenge, Overcome, Resolve, and Enhance.

*1 SET (5 min)×3 sets=15 min.

(Fitbit HR, San Fransisco, CA, USA).

3. Measurements

1) Adherence and compliance

Participants returned their completed CORE program and PA tracker step-count logs at weeks 2. Participants were considered to be participating adequately if they performed prehabilitation program five times or more during 2 weeks, logged step counts five times or more per week. CORE program adherence was defined by participation in $\geq 80\%$ of prescribed exercise sessions. In addition to assessing adherence, we also investigated about adverse events (musculoskeletal injuries, falls).

2) CORE program satisfaction

Acceptability of CORE program was assessed response on a general satisfaction survey completed at the end of the 2-week intervention. Participants were asked to rate their satisfaction with the CORE program using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Consistently was found to be acceptable at end of CORE program ($\alpha=0.82$).

3) Health-related fitness

Cardiorespiratory fitness (CRF) was assessed using the Astrand submaximal cycle ergometer test. The Astrand rhyming protocol is a single stage cycle ergometer test designed to elicit a steady state HR for a 6-minute period. The initial workload was adjusted individual capacity, pedaling speed maintained constantly 50 revolutions per minute and HR was recorded end of the 6-minute work stage. The workload was set during the 2–3 minutes warm-up to acquainted the participants with the cycle ergometer and maintained throughout the test. HR was noted at the end of each minute, with a target goal of obtaining two consecutive HR values between 125 and 170 beats per minute (bpm), within 5 bpm of each other, during the 5th and 6th minute of test. Estimating maximal oxygen consumption (VO_{2max}) was using the calculation based formula¹¹. HR was recorded with PA tracker.

Lower body strength was assessed using the 30-second chair stand test. Participants sat in the middle of the chair with hands on the opposite shoulder crossed. Participants performed to full standing position, then sit back down again as soon as possible. 30-second chair stand was defined as number of times the participants comes to a full standing position in 30 seconds.

Upper body strength was assessed using the hand grip strength (HGS). HGS was measured two times bilaterally with a digital dynamometer (TKK 5401; Takei Scientific Instruments, Tokyo, Japan) in the second handle position. HGS was measured in a standing position with the forearm away from the body at the level of thigh. Participants were asked to apply the maximum grip strength each hand. Between repeat the measure, at least 30 seconds of resting interval was allowed. HGS was defined as the maximally grip strength¹².

Abdominal muscle endurance was assessed using the curl-up test. Participants laid supine position on a mat with their arms resting beside their body, knees flexed to 90°, and feet flat on the mat. Participants elevated their upper trunk to advance their third fingertip forward on the mat to touch a piece of masking tape placed 10 cm caudal to their resting fingertip position; they then returned to the starting position. Participants were asked to perform curl-up motion as many times as possible in 60 seconds with the metronome at 50 beats per minute. One 60 seconds trial was performed and total successful curl-ups were recorded.

Flexibility was assessed using the sit and reach test. Sit-and-reach test was assessed as an indicator of trunk flexibility with a trunk flexion meter (TKK 5112; Takei Scientific Instruments). Participants sat on the floor with legs stretched out straight in front of the body and put both hands on the trunk flexion meter flexed forward slowly as far as possible with end position held for at least 2 seconds. The task was repeated two times and the best of two trials were recorded.

Balance was assessed using the single-leg standing with closed eyes. Participants were instructed to stand upright and maintain single-legged stance and both hands with closed eyes on the waist while flexing the other knee to 90°. The holding time was measured until the flexed leg touched the ground surface. The task was repeated two times and the best of two trials were recorded.

4) Patient reported outcomes

Quality of life (QOL) was assessed using the European Organization for Research and Treatment of Cancer Quality of Life-Core30 (EORTC QLQ-C30). The well-validated EORTC QLQ-C30 includes a global quality of life scale, five functional scales (physical, role, cognitive, emotional, and social), three symptom scales (fatigue, pain, and nausea/vomiting), and several single-item symptom measures (dyspnea, loss of appetite, sleep disturbance, constipation, diarrhea, and financial difficulty). Apart from two items of the global quality of life scale scored on a 7-point scale rating from 1 (very poor) to 7 (excellent), all items were scored on a 4-point scale ranging from 1 (not at all) to 4 (very much). The questionnaire was officially translated into the Korean language¹³. According to the EORTC QLQ-C30 scoring manual¹⁴, scores were standardized by linear transformation, resulting in scores in ranging from 0 to 100. Higher scores in global quality of life and functioning scales represent a higher level of functioning, whereas higher scores in symptom scales represent more severe impairment.

Symptom cluster was assessed using the MD Anderson Symptom Inventory (MDASI). The MDASI is a multi-symptom assessment tool developed for use in the general cancer population. Participants rated the intensity of 13 physical, affective, and cognitive symptoms (pain, fatigue, nausea, vomiting, dry mouth, shortness of breath, lack of appetite, difficulty remembering, drowsiness, disturbed sleep, sadness, distress, and numbness) at

their worst in the past 24 hours, using a 0–10 numeric scale where 0=not present and 10=as bad as you can imagine. Participants also rated how much their symptoms interfere with six daily activities (general activity, mood, work, relations with others, enjoyment of life, and walking), using a 0–10 scale where 0=does not interfere and 10=interferes completely¹⁵.

Anxiety and Depression was assessed using the Hospital depression and anxiety Scale (HADS). We used the validated Korean version of HADS to assess psychological distress¹⁶. The HADS is a well-validated 14-items measure designed for use in medical settings to assess anxiety (HADS-A), and depression (HADS-D). Each subscale consists of 7-items with a 4-point response format. Scores ranges from 0 to 21, with higher scores indicating high levels of anxious or depressive status.

5) Body composition

Height was measured using a stadiometer (Yagami YG-200, Tokyo, Japan). The overall body composition (weight, fat mass, and lean mass) was measured by using Dual-energy X-ray absorptiometry (QDR 4500; Hologic Inc., Bedford, MA, USA) principle in the right supine position after changing in light clothing without metal materials. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared.

6) Sociodemographics and clinical characteristics

Demographic variables such as age, education level, PA, and socioeconomic status were assessed by questionnaire. Participants' stage was obtained from review of medical records.

4. Statistical analysis

Descriptive (results) statistics (mean, median, standard deviation, range, and 95% confidence interval) were presented (used) to compared the measured variables at baseline and post CORE program 2 weeks. Normality of distribution for dependent variables was assessed using the Shapiro-Wilk test. Data were normally distributed, and no outliers were found through assessment of Cook's distance. For comparison between measured secondary outcomes (i.e., body composition, HRF, and PROs) paired t-test was performed. In addition, effect sizes were calculated by dividing the pre-after intervention change over the CORE program by the pooled standard deviation. Tests were two-tailed,

with an α level 5% required for statistical significances. Data were analyzed using the IBM SPSS ver. 23.0 (IBM Corp., Armonk, NY, USA).

Results

1. Characteristics of participants

The participants' sociodemographic and clinical characteristics are described in Table 2^{17,18}. Their mean age was 46.7 years (range, 27–71 years). The mean weight and BMI were 68.1 kg (range, 50.0–92.3 kg), 27.1 kg/m² (range, 19.8–36.9 kg/m²),

Table 2. Sociodemographic and clinical characteristics

Characteristics	Value
Age (yr)	46.7 (27–71)
Height (cm)	158.8 (148.2–171.6)
Weight (kg)	68.1 (50.0–92.3)
Body mass index (kg/m ²)	27.1 (19.8–36.9)
Employment status	
Employed	6 (35.3)
Education	
High school graduate or lower	5 (29.4)
College graduate or higher	12 (70.7)
Cancer stage	
IA/IB	15 (88.2)
II	–
III	2 (11.8)
IV	–
Physical activity (min/wk)*	
Overall physical activity	360 (147–845)
Physical activity at work	30 (0–480)
Active commuting physical activity	30 (7–240)
Leisure time physical activity	0 (0–345)
Vigorous-intensity physical activity	0 (0–12)
Moderate-intensity physical activity	325 (15–675)
Sedentary time (min/day)	420 (240–600)
Strength training guidelines meeting [†]	3 (17.6)

Values are presented as mean (range) or number (%) unless otherwise indicated. Vigorous-intensity physical activities require hard physical effort and cause large increases in breathing or heart rate; moderate-intensity physical activities require moderate physical effort and cause small increases in breathing or heart rate¹⁷.

*Median (Q1–Q3); [†]Strength training guidelines refer to ≥ 2 days per week of strength training¹⁸.

respectively. The majority of participants had stage I disease (88.2%), and two participants (11.8%) had stage III disease. Their median PA including, overall, at work, form travel, at leisure, and sedentary time were 360 min/wk (range, 147–845), 30 min/wk (range, 0–600 min/wk), 30 min/wk (range, 7–240 min/wk), 0 min/wk (range, 0–345 min/wk), and 420 min/day (range, 240–600 min/wk), respectively.

2. Feasibility

1) Adherence and CORE program compliance

Seventeen (89.5%) of the 19 participants completed the CORE program intervention and met the requirements for CORE program. Two participants did not complete due to schedule adjusted for surgery. Fig. 2 illustrates the participants' mean daily step counts and the mean HR of CORE program sessions performed during 2 weeks, respectively. All Participants completed the CORE program and accomplished daily mean step counts over 10,000. As well, participants were sustained prescribed target HR (HR

reserve, 50%–60%) during the CORE program sessions. There was no adverse event occurred during and within times of conducting the CORE program or walking.

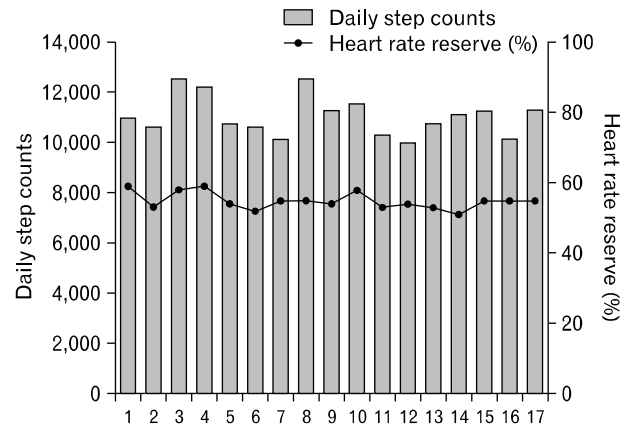


Fig. 2. Compliance among the participants during the Challenge, Overcome, Resolve, and Enhance (CORE) program (mean daily step counts and mean % heart rate reserve during the CORE session that participants logged heart rate).

Table 3. Changes in anthropometrics, health-related fitness, and patient-reported outcomes after 2 weeks of the CORE program

Variable	Baseline	After intervention	p-value	Effect size
Anthropometrics				
Weight (kg)	68.1±12.3	67.7±11.9	0.234	0.30
Body mass index (kg/m ²)	27.1±5.4	26.9±5.3	0.113	0.41
Fat mass (kg)	26.5±7.0	26.3±7.4	0.750	0.08
Lean mass (kg)	37.7±5.4	37.7±5.4	0.969	0.01
Health-related fitness				
Cardiorespiratory fitness (mL/kg/min)	25.3±4.2	27.9±4.2	<0.001	1.90
30-Second chair stand (times)	23.8±4.6	28.8±4.1	<0.001	2.06
Hand grip strength (kg)	26.4±3.9	28.3±3.7	<0.001	1.98
Curl-up (times/min)	1.7±2.4	3.8±3.2	<0.001	1.48
Sit and reach (cm)	7.0±10.4	9.9±10.2	<0.001	1.64
Single-leg standing with closed eyes (sec)	14.8±11.8	18.5±14.3	<0.001	1.19
Patient-reported outcomes				
Quality of life (EORTC QLQ-C30)				
General	54.9±22.6	76.4±16.4	0.001	0.97
Function	82.3±7.3	89.2±7.0	0.001	0.93
Symptom	19.3±10.7	12.1±7.1	0.003	0.85
MD Anderson Symptom Inventory	21.1±14.8	12.5±12.4	0.006	0.78
Hospital Anxiety Depression Scale				
Anxiety	6.8±1.7	3.3±2.1	<0.001	1.79
Depression	6.1±2.2	3.1±1.7	<0.001	1.25

Values are presented as mean±standard deviation.

CORE: Challenge, Overcome, Resolve, and Enhance, EORTC QLQ-C30: European Organization for Research and Treatment of Cancer Quality of Life-Core30.

Table 4. Survey questions and responses of participants of the CORE program (n=17)

Question	Response (%)				
	Strongly agree	Agree	Some-what agree	Disagree	Strongly disagree
1. How satisfied are you with your overall expectation of the CORE program?	64.7	35.3	–	–	–
2. Do you feel that your health is improving after your participation in the CORE program?	35.3	64.7	–	–	–
3. Do you consider yourself an enthusiastic participant of the CORE program?	17.6	53.0	23.5	5.9	–
4. Are you willing to participate in an exercise program after the surgery?	52.9	47.1	–	–	–
5. Would you recommend the CORE program to your friends and family (or others)?	70.6	29.4	–	–	–
6. What do you think is the most important aspect when you participate in the CORE program? Doctor's recommendation (64.7%), exercise program (35.3%)					

CORE: Challenge, Overcome, Resolve, and Enhance.

2) Secondary outcomes

Table 3 summarizes changes in anthropometrics, HRF, and PROs in response to 2 weeks of CORE program. Anthropometrics variables, such as weight ($p=0.234$), BMI ($p=0.113$), fat mass ($p=0.750$), and lean mass ($p=0.969$) were no significant changes. Although there was no significant time effect for body composition, it should be noted that weight and fat mass has decreased, whereas lean mass has sustained. There were statistically significant improved in CRF (25.3–27.9 mL/kg/min, $p<0.001$), 30-second chair stand (23.8–28.8 times, $p<0.001$), HGS (26.4–28.3 kg, $p<0.001$), curl-ups (1.7–3.8 times, $p<0.001$), sit and reach (7.0–9.9 cm, $p<0.001$), single-leg standing with closed eyes (14.8–18.5 seconds, $p<0.001$), respectively. For the PROs variables, there were statistically significant improved in EORTC QLQ-C30 general (54.9–76.4, $p=0.001$), function (82.3–89.2, $p=0.001$), and symptom (19.3–12.1, $p=0.003$), respectively. As well, MDASI (21.1–12.5, $p=0.006$), HADS-A (6.8–3.3, $p<0.001$), and HADS-D (6.1–3.1, $p<0.001$) were significantly improved after CORE program.

3) Participants satisfaction survey

Table 4 presents the participants' satisfaction of CORE program. Most of participants (64.7%) took part in CORE program by doctor's recommendation. All participants (100%) satisfied overall CORE program from "agree" to "strongly agree" and felt actually

that their health was improving after participated in CORE program (100%). The majority considered oneself an enthusiastic participant in the CORE program (70.6%).

Discussion

The primary aims of this study were to identify whether the CORE program intervention would be feasible and safety in patients with endometrial cancer schedule to surgery, and secondly exploratory the CORE program intervention would lead to improvement in physical and psychological health status. The CORE program with whole body and core strength exercise performed in a controlled setting (i.e., correct instruction and highly supervised) were safety and did not appeared the severity of symptom in endometrial cancer patients. In addition, participants were well tolerated with moderate-to-vigorous intensity strength exercise sessions. Despite 2-week acute duration, there were positive changes in the acute response to the CORE program involving both HRF and PROs.

Adherence in this study, defined as participation in 80% over of the prescribed exercise sessions, was 89.5% and there was no adverse event during the CORE program. This is in the line with adherence rate between 68%–83% of sessions from a recent other cancer type of studies^{19,20}. Regarding of the compliance, participants achieved daily step counts goal (10,000 steps/day) and conducted to prescribed target HR reserve 50%–60% during

the CORE program.

To date, meta-analysis has been conducted to epidemiologic evidence on the relationship between PA and endometrial cancer risk and reported 20%–30% significantly reduced risk of endometrial cancer for the most active women compared with the least activity women²¹. Additionally, leisure time PA of vigorous-intensity was significantly associated with a decreased risk of endometrial cancer, whereas moderate intensity PA was not²². According to Korea Health Statistics 2016: Korea National Health and Nutrition Examination Survey (KNHANES VII), many people do not regularly aerobic PA, only 44.3% of women met World Health Organization Guidelines on PA in Korea (data available at <https://knhanes.cdc.go.kr>). In this study was similar result. Although participants' PA met the guidelines, leisure time PA and vigorous-intensity PA was low at baseline. However, our results indicating that there seemed to be no problem with moderate to vigorous-intensity exercise. There are possible reasons for the high adherence rate in our study. First, most of our participants were novice, instruction of the CORE program and intensities of exercise were adapted to the participants' baseline individual health and fitness level, and exercise log and step counts and HR monitoring was performed to reinforce significance of the exercises. As well, second, a potentially selection bias by gynecologic oncologists may have influences the results. Participants took part in the recommendation of the doctor, and it may have influence motivation highly to perform exercise. Additionally, Third, an important finding of the current study in the context of CORE program feasibility was the high level of satisfaction. Our CORE program consisted of whole-body strength and core strength exercises with weight bearing. The emphasis of Exercise program should be convenience and enjoyment and small group exercise program would support promoting adherence and compliance²³. All training sessions were conducted by one exercise specialist, who paid special attention to the exercise in terms of execution, pace and movement. However, a total of 29.4% of participants in this study reported that they were not considered oneself an enthusiastic participant in the CORE program. Participants were provided with a written form about the CORE program and were encouraged to keep doing the exercises that they learned between sessions. This negative self-evaluation seems to be due to the relatively difficulty of

conducting same intensity exercise as supervised session. In this regard, the CORE program was highly feasible in terms of adherence to the exercise sessions and the exercise itself.

Another important aspect was that the CORE program had beneficial effect on preoperative HRF. HRF is associated with cancer. In particular, CRF is a vital independent predictor of all-cause mortality in cancer patients²⁴. Fitness improves rapidly in the first 3 weeks of the intervention, overshoot baseline at week 6, but fitness thereafter declined²⁵. Of note, in a prior study, the same authors tried to randomize patients to 4 weeks of prehabilitation or usual care before lung resection, but neither providers nor patients were willing to wait the 4 weeks before the potentially curative surgery. While, Benzo et al.²⁶ recommended the shorter-duration prehabilitation program, tailored to meet the surgery date. Although the timing of cancer treatments remains of utmost importance, even short duration prehabilitation may provide significant benefit. Rehabilitation can potentially affect mortality as functional capacity may predict survival in patients with non-small cell lung cancer. In addition, growing evidence suggests that as little as 2- to 4-week prehabilitation program led to improvement preoperative oxygen uptake²⁶, muscle power²⁷, functional walking capacity²⁸. Therefore, prehabilitation program positively influence HRF, and the current study support the notion that acute preoperative exercise may improvement HRF among endometrial cancer.

Most of the improvement in QOL was the result of improvements in psychological health, particularly symptom, social functioning, and depression, in concordance with other studies of exercise in cancer²⁹. However, it is interesting that a 2-week CORE program of just five supervised sessions was able to achieve similar improvements to program typically of much longer duration³⁰. The improvement of QOL are probably related to participation in the CORE program as well as improved physical function (HRF). Together, the large effect size of CORE program on HRF and PROs values provide an important foundation for examining the efficacy of exercise as a treatment in this population and suggest a CORE program participation itself seemed to be key.

This study is one of the first studies to investigate the feasibility of exercise program in patients with endometrial cancer awaiting to receive surgery. The PA and HR during the CORE program by objective device is a strength of this data and made it possible

investigate the effect of the CORE program on HRF and PROs outcomes. There are limitations associated with this investigation worthy of comment. First, this is a single-arm pilot study with a small sample size and no control group with which to compare the efficacy. However, we were able to identify compliance, evaluate the feasibility of the CORE program and monitor potential adverse reactions. Second, our participants were well-functioning but low fitness level individuals. Thus, the CORE program delivered one-on-one highly supervised by certified staff, and participants might be better achieved from attributes of more attention and reinforcement. However, the CORE program has a high intensity exercise, it cannot guarantee the effect of long-term application to beginners and elderly people. Third, our results have limited generalization as our participants were diagnosed most commonly stage I (88.2%) endometrial cancer. It is unclear what magnitude of effect is clinically significant when examining acute changes in HRF and PROs, so the results should be interpreted with caution. Despite these limitations, our results provide a preliminary indication that the CORE program may be feasible and safe, and moderate-to-vigorous intensity exercise efficacious to HRF and quality of life in endometrial cancer.

This feasibility, acute study suggests that when appropriately prescribed and supervised, women with endometrial cancer can perform moderate-to-vigorous intensity whole body and core strength exercise without fear of exacerbating their physical and psychological condition. Furthermore, this type of exercise was well tolerated by a sample of women with endometrial cancer, and we report no adverse events. These initial findings have important clinical significance, given the clear potential for prehabilitation program to aid in the long-term management of endometrial cancer through enhanced HRF, QOL, as well as improved functional ability.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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