ONLINE APPENDIX

Detailed Methodology

Study Design. The pilot randomized control trial was conducted during pregnancy from 12 weeks gestation to delivery. Data were collected during pregnancy by research midwives and physiotherapists at four time points: 12, 20 28 and 36 weeks gestation. The team delivering the intervention also included exercise physiologists and dietitians. Ethics clearance for the study was obtained from the Royal Brisbane and Women's Hospital (RBWH) Human Research Ethics Committee. The study is registered with the Australian Clinical Trials Registry (ACTRN012606000271505).

Sample Size. Weekly Energy Expenditure (kcal per hour) - Energy expenditure was chosen as the primary outcome for this trial because we have found that both energy expenditure and the exercise intensity are better predictors of the variance in both weight and fat mass loss than the duration of exercise (1). Therefore, if we wanted to prescribe an effective dose of exercise that would produce better maternal outcomes, relying on exercise duration alone would not be sufficient. Thus, the advantages of using energy expenditure is that it takes into account both the duration and intensity of exercise. This also means that activities that are performed for a shorter duration, but at a higher intensity, are still adequately accounted for (2).

This study was fully powered to assess feasibility of the exercise intervention, based on the following assumptions. A weekly exercise energy expenditure of around 1,000 kcal is the recommended target for promoting and maintaining good health (e.g. weight loss, cardiovascular health and preventing premature mortality) week (3). We have shown in a cohort of non-pregnant overweight and obese women (mean BMI = 36.8 $kg.m^{-2}$; mean weight=101.3 kg) that following an exercise intervention with a target of 1,500 kcal per week, participants increased their exercise from 500 kcal per week to 845 kcal per week (4). In this study, assuming that the intervention group achieved an exercise energy expenditure of 900kcal/week (SD = 400kcal/week), we calculated that 10 women per group would be needed to have 90% power to detect this difference, with an alpha of 0.05. To allow for loss to follow-up and withdrawals, we oversampled and enrolled 25 women per group.

Participant Recruitment. The study was conducted at the RBWH, Queensland, Australia, a 986 bed general, tertiary referral teaching hospital. Women receiving antenatal care and delivering at the RBWH over a 12-month period were invited to participate in the study. A letter signed by the medical director inviting the women to participate was inserted into the general printed information pack, which is sent to every woman booking into the antenatal clinic prior to 12 weeks gestation. Local radio and print media also promoted the study. Women were eligible if they met the following criteria: aged 18-45, BMI 30 $kg.m^{-2}$ or greater, pregnancy care at the RBWH, willing and able to be randomized to an exercise intervention, and able to provide informed consent.

Women were excluded if the following criteria were present: non-English speaking, contraindication or inability to exercise, medical or obstetric contraindication to exercise including hemodynamically significant heart disease, restrictive lung disease, incompetent cervix (cerclage), multiple gestation, severe anemia, chronic bronchitis, type 1 diabetes, orthopaedic limitations, poorly controlled seizure disorder, poorly controlled hyperthyroidism, or a heavy smoker (5).

Participant Randomisation. Eligible women were invited to attend an initial face-to-face interview with a research midwife for the collection of baseline information (≈ 12 weeks gestation). Following this, women were randomly assigned to the standard care program

(control) or an exercise intervention arm. Randomisation was by a random number allocation technique conducted by a third party at another location outside the hospital. Women were stratified by BMI (30-40 vs. >40) and parity (children vs. no children).

Pre-intervention Stage. All eligible women were invited to attend a single early group education session at around 12 weeks gestation. Women received written information on exercise (5), nutrition (6), and advice regarding weight gain during pregnancy (7).

Intervention. Women randomized to the intervention received a) an individualised exercise plan b) regular exercise advice and c) paper-based diaries for self-monitoring. A face-to-face interview at ≈12 weeks with a physiotherapist, who had expertise in pregnancy management and exercise physiology, was conducted to develop women's individualized exercise plans; to assess readiness for change, and encourage goal setting. The individualized exercise plan was designed to meet the exercise-specific energy expenditure requirements and suit each woman's lifestyle. Women were reviewed every 4 weeks by physiotherapists, with phone calls between visits from a research midwife to assess their adherence to the program. Modifications were made according to the patient's interest, commitment to particular exercise options and for weather. Women who were not meeting exercise targets had additional face-to-face support, with identification of barriers and modification of the exercise plan.

Criteria used to terminate the exercise intervention during this study included: persistent 2nd or 3rd trimester bleeding, placenta praevia after 26 weeks gestation, premature labour, ruptured membranes, and pre-eclampsia. Women underwent a medical and obstetric review in this study if they experienced any of the following: unevaluated maternal cardiac arrhythmia, gestational hypertension, intrauterine growth restriction, decreased fetal movement, and new maternal symptoms including dyspnoea prior to exertion, dizziness, headache, chest pain and calf pain or swelling (5).

Primary Outcome Measure. Energy Expenditure - The primary outcome was energy expenditure and is expressed in this paper as 1) Weekly Metabolic Equivalent (MET) hours and 2) kilocalories per week. Energy expenditure was derived from the Pregnancy Physical Activity Questionnaire (PPAQ). Data was collected at 12, 20, 28 and 36 weeks gestation.

Pregnancy physical activity questionnaire (PPAQ) (8). This is a self-report instrument which measures the time spent participating in 32 activities including household/caregiving, occupational, sports/exercise, transportation, and inactivity. The PPAQ is reliable and valid measure of exercise during pregnancy. Specifically, the intraclass correlation coefficient for the sports and exercise activity subscale was 0.83, and scores for the sports and exercise subscale correlate moderately with actigraph data (8).

From the PPAQ, we extracted data for sports and exercise activities only. The types of sports and exercise activities assessed in the PPAQ include walking, jogging, prenatal exercise classes, swimming and dancing. To calculate weekly energy expenditure using the PPAQ, the duration of time spent in these exercise activities was multiplied by specific intensities (i.e. MET values) and scores are expressed as MET-hours per week. It is recommended that an individual achieves between 7.5-12.5 MET-hrs/wk to meet current exercise guidelines for weekly moderate to vigorous intensity activities (1).

In order take into account the women's weight, which can greatly affect energy expenditure, we also calculated the weekly kilocalories (kcals) expended by the women during exercise. Weekly kcals at each time point were derived by multiplying MET-hours per week by weight (kg). Because the data was severely skewed, it was converted into categorical outcome variables at

each time point. At each time point, the data was dichotomised into 1) women who achieved > 900 kcal/wk and 2) women who achieved < 900 kcal/wk.

Insulin Resistance - Following an overnight fast, blood samples were taken to analyse women's glucose and insulin profiles. Biochemical analysis was performed by the RBWH chemical pathology service. Fasting plasma glucose was measured with the oxygen rate method. Inter-assay coefficient of variation (CV) was 3.4% and 2.2% at low and high levels, respectively. Insulin was measured by chemiluminescent immunoassay on the DxI 800 Immunoassay System, Beckman Coulter (Brea, CA, USA). For insulin, the inter-assay CV was 6.2% at low levels (M = 4.3 mU/L) and 4.2% at high levels (M = 80 mU/L). Insulin resistance was estimated using the "Homeostasis model assessment of insulin resistance" "Homeostasis model" (HOMA-IR), which was calculated using the following formula: (Fasting plasma insulin in mU/mL × Fasting plasma glucose in mmol/mL)/22.5 (9).

Analysis. All analyses were conducted using STATA version 10.0 (StataCorp, Texas, USA). Univariate differences between the groups at baseline (12 weeks gestation) were examined using chi-square tests for independence and Fisher's exact tests for categorical variables, and unpaired t-tests for continuous variables. Because the energy expenditure data was skewed, we used Wilcoxon-Mann-Whitney tests to examine the differences between the groups on MET-hrs/wk and chi-square tests to examine differences between the groups on kcal/wk.

References

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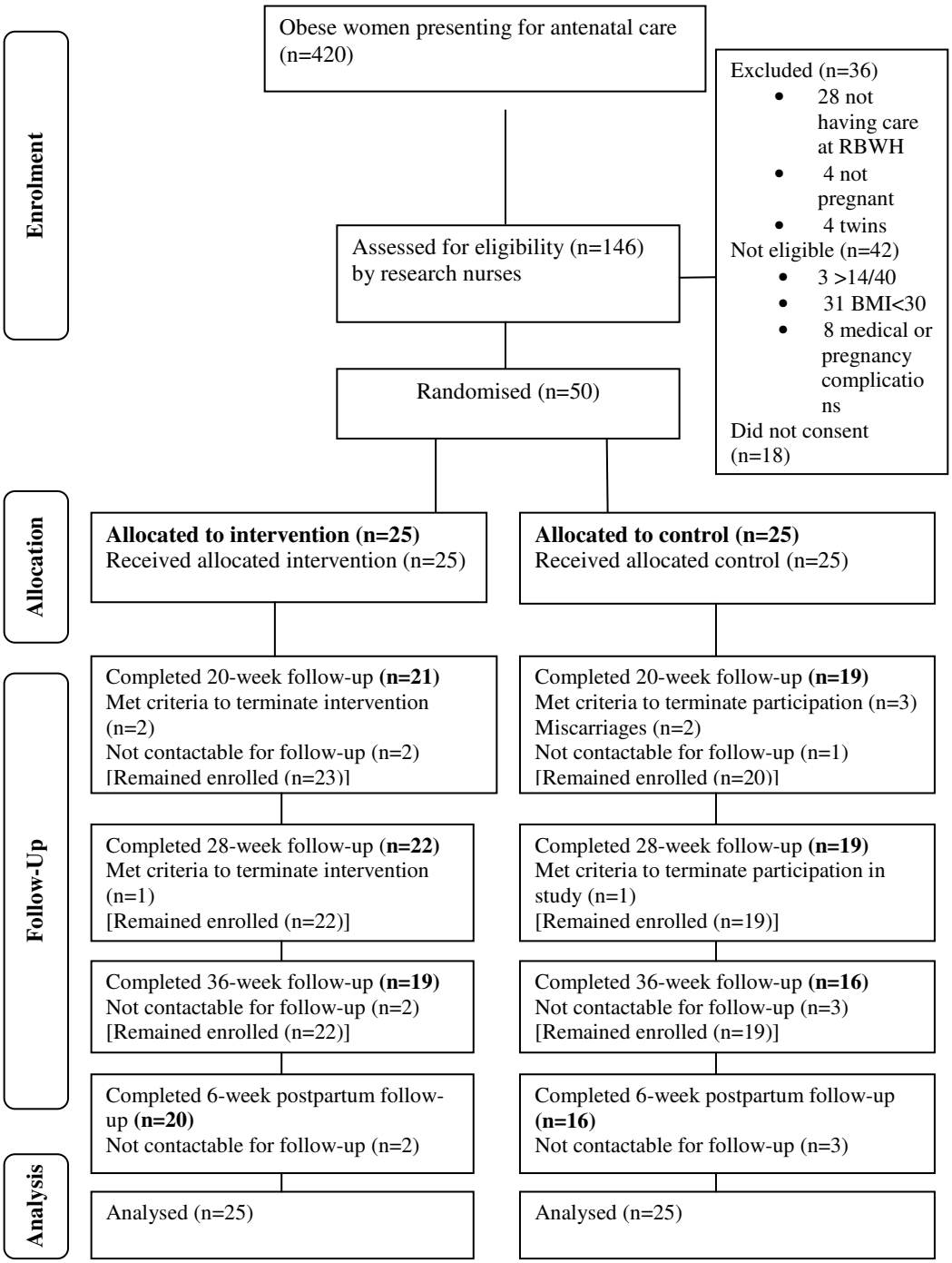
Supplemental Figure 1. Recruitment and retention of pregnant women in the randomized controlled trial.



Supplemental Table 1. Baseline characteristics for the intervention and control group according to selected sociodemographic, obstetric and health-related variables.

	Eligible sample	**Control**	**Intervention**	***p***
	N = 50	***N = 25***	***N = 25***	
Sociodemographic		***M (SD)***	***M (SD)***	
Age(years) mean (SD)	30.2 (5.3)	30.0 (5.9)	30.4 (4.8)	0.75
		n(%)	***n (%)***	
Number Completed Tertiary Education n(%)	15 (30%)	7 (28%)	8 (32%)	0.76
Marital status *Married*	33 (66%)	17 (68%)	16 (64%)	0.77
Employed	37 (74%)	20 (80%)	17 (68%)	0.33
Obstetric		***M (SD)***	***M (SD)***	
Gestational age at 12 weeks (wks)	11.5 (1.6)	11.7 (0.34)	11.4 (0.32)	0.54
		n(%)	***n(%)***	
Previous live birth	30 (60%)	15 (60%)	15 (60%)	1.00
Physical health & health behaviours		***n(%)***	***n(%)***	
BMI (kg/m^2) ≥*35.00*	18 (36%)	9 (36%)	9 (36%)	1.00
Smokers	3 (6%)	2 (8%)	1 (4%)	1.00[1]

Note. [1]Fisher's exact test

Supplemental Table 2. Reasons reported by the women for non-completion of an exercise session. Data are presented for all women who attended a 6 week postpartum appointment.

REASON	***N = 36***
	%
Paid work	97
Household work	83
Illness	78
Not feeling like it	61
Holidays	56
Pain	25
Weather	44
Children	39
Social and family events	36
Hospital appointments	31
Shopping	19
Other	72

Note. Some women reported multiple reasons.